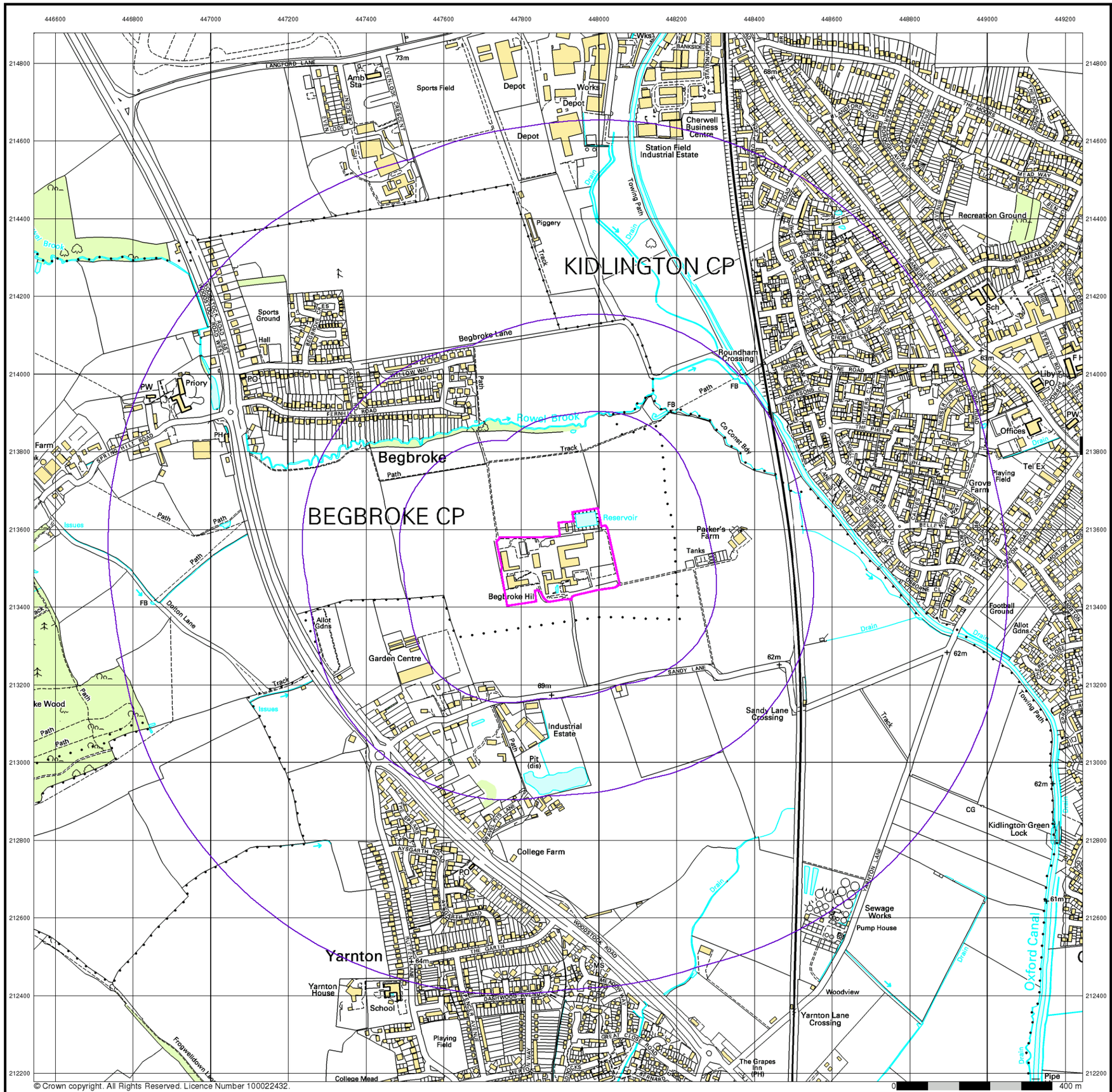


CONSULTING ENGINEERS LIMITED

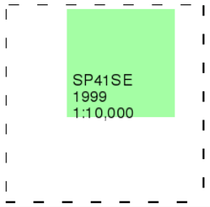
10k Raster Mapping

Published 1999

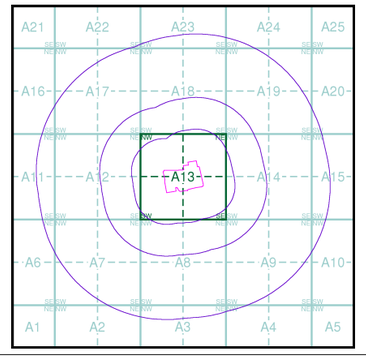
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)



Historical Map - Slice A



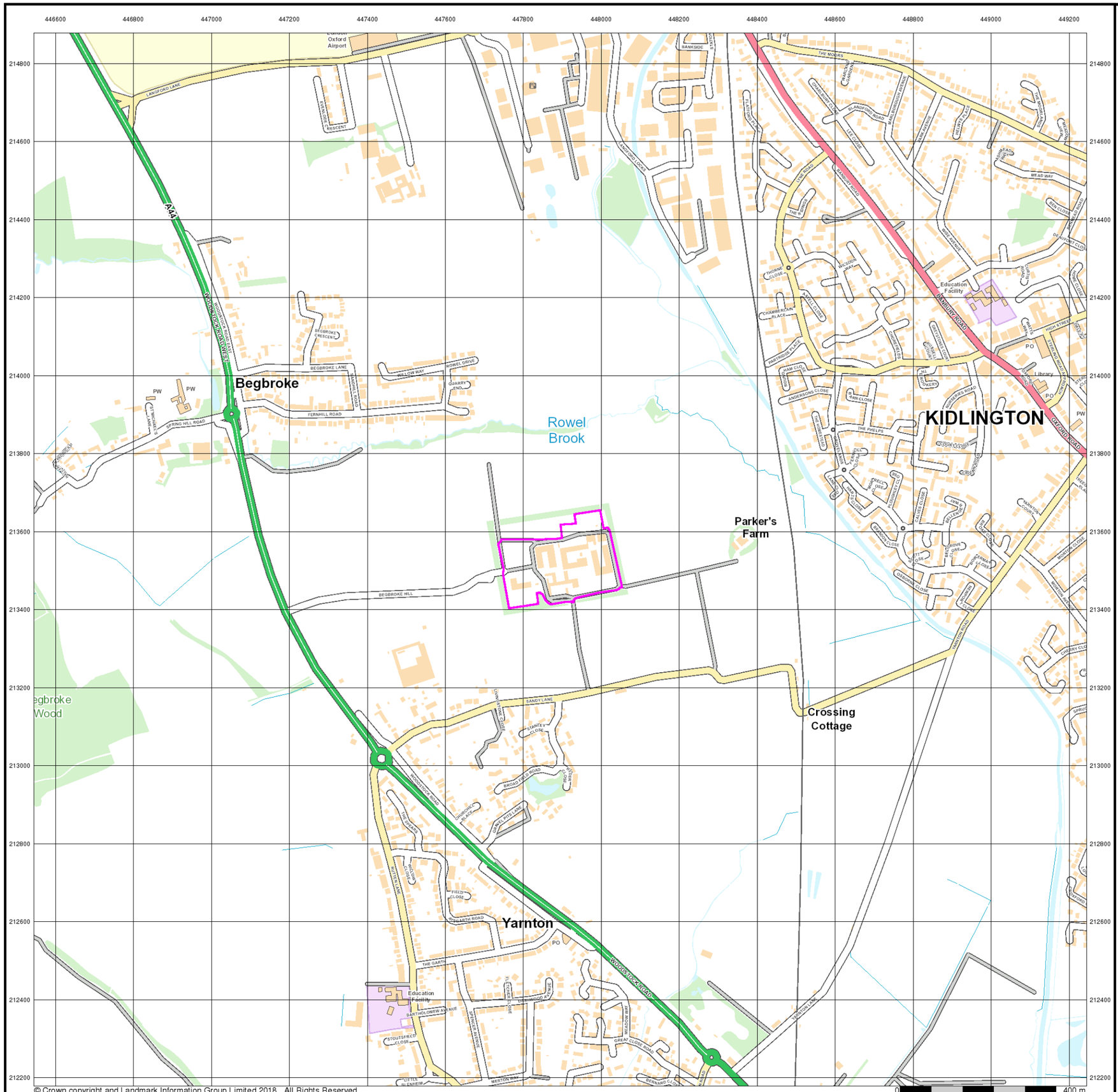
Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	1000

Site Details

Site at, Begbroke, Oxfordshire

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



CONSULTING ENGINEERS LIMITED

Street View

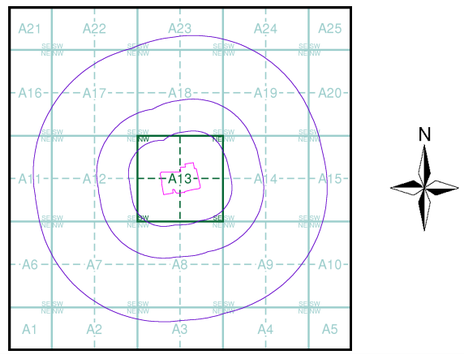
Published 2018

Source map scale - 1:10,000

Street View is a street-level map for the whole of Great Britain produced by the Ordnance Survey. These maps are provided at a nominal scale of 1:10,000

Map Name(s) and Date(s)

Street View Map - Slice A



Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	1000

Site Details

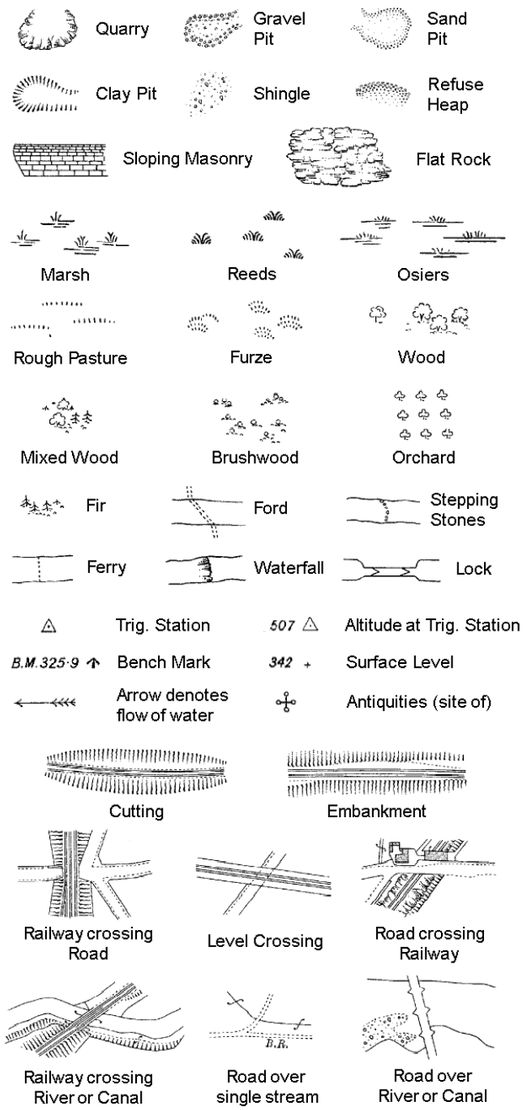
Site at, Begbroke, Oxfordshire

Landmark INFORMATION GROUP

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

Historical Mapping Legends

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



County Boundary (Geographical)

County & Civil Parish Boundary

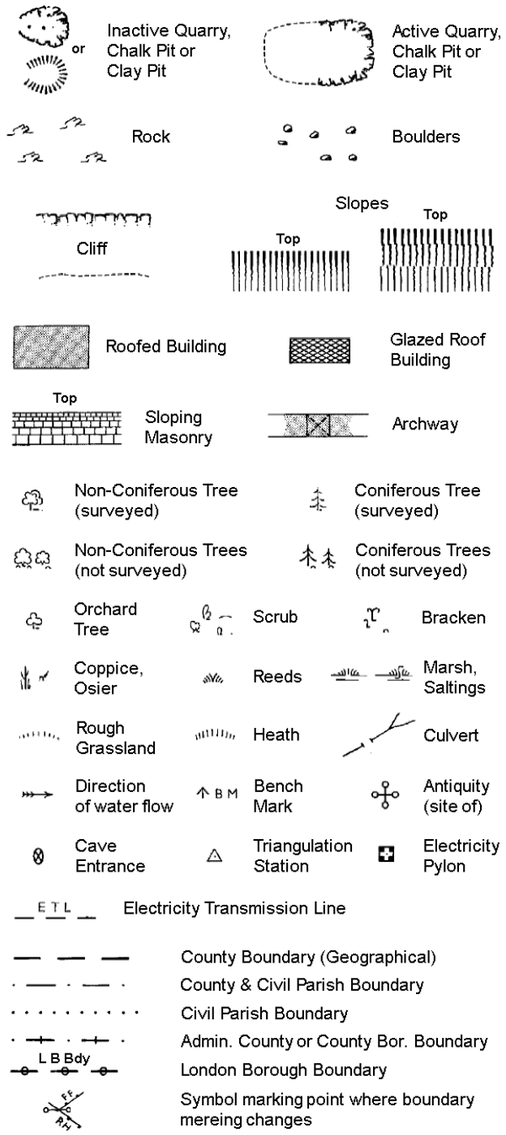
Administrative County & Civil Parish Boundary

Co. Boro. Bdy. County Borough Boundary (England)

Co. Burgh Bdy. County Burgh Boundary (Scotland)

B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

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



County Boundary (Geographical)

County & Civil Parish Boundary

Civil Parish Boundary

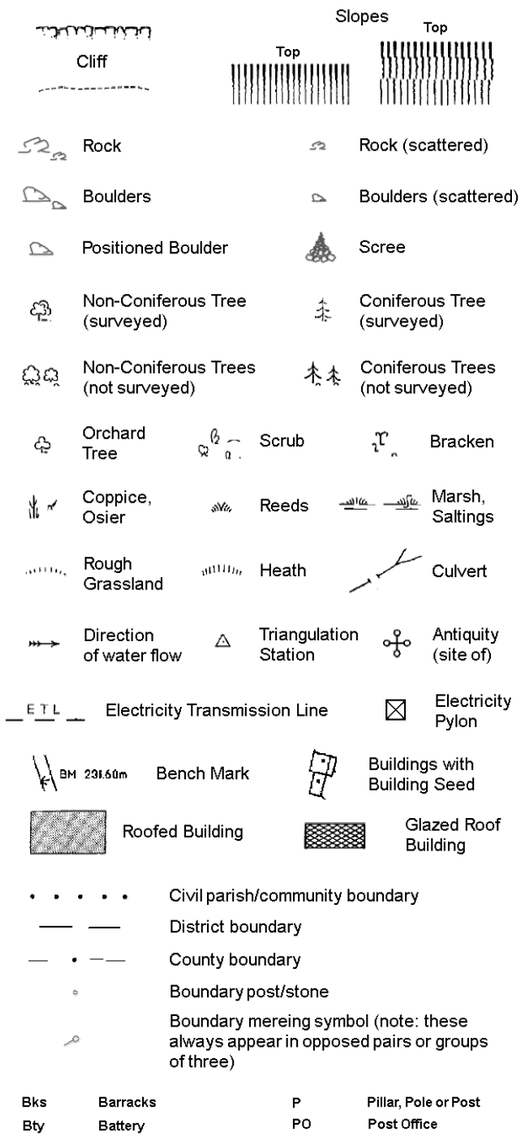
Admin. County or County Bor. Boundary

L B Bdy London Borough Boundary

Symbol marking point where boundary mereing changes

BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

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



Civil parish/community boundary

District boundary

County boundary

Boundary post/stone

Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

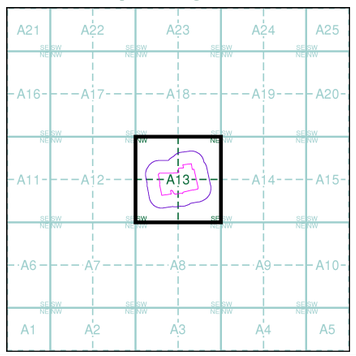
Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

CONSULTING ENGINEERS LIMITED

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Oxfordshire	1:2,500	1876	2
Oxfordshire	1:2,500	1899	3
Oxfordshire	1:2,500	1922	4
Oxfordshire	1:2,500	1936	5
Ordnance Survey Plan	1:2,500	1971 - 1974	6
Ordnance Survey Plan	1:2,500	1978	7
Additional SIMs	1:2,500	1980 - 1987	8
Ordnance Survey Plan	1:2,500	1982	9
Additional SIMs	1:2,500	1983 - 1991	10
Ordnance Survey Plan	1:2,500	1988	11
Large-Scale National Grid Data	1:2,500	1994	12

Historical Map - Segment A13



Order Details

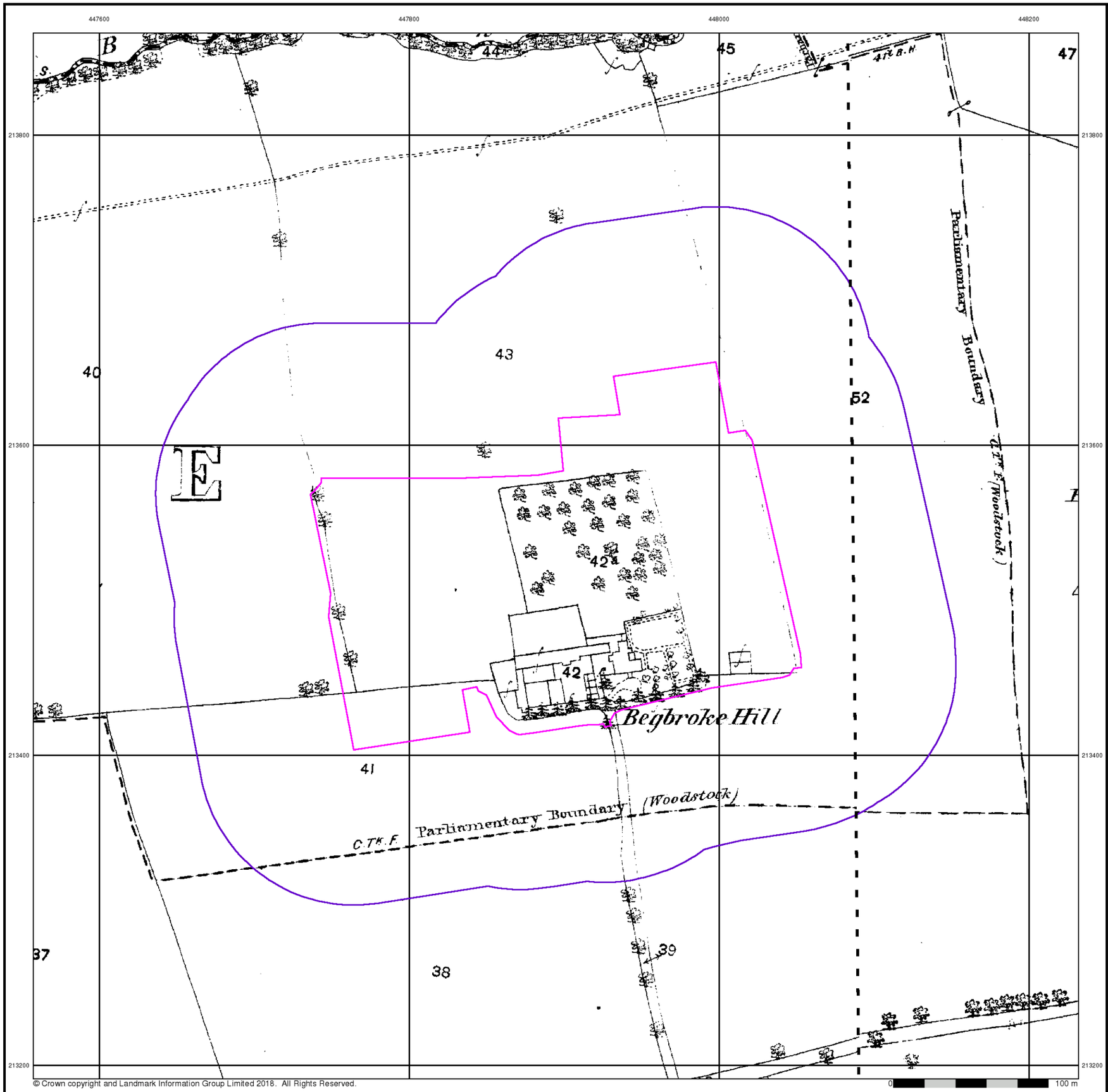
Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

Landmark INFORMATION GROUP

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



CONSULTING ENGINEERS LIMITED

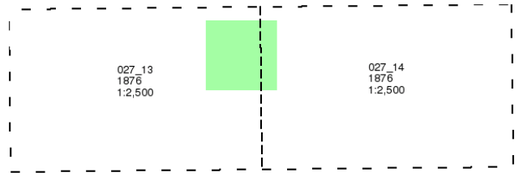
Oxfordshire

Published 1876

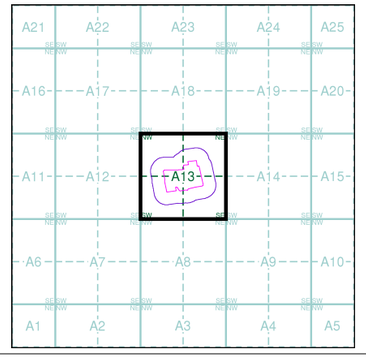
Source map scale - 1:2,500

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



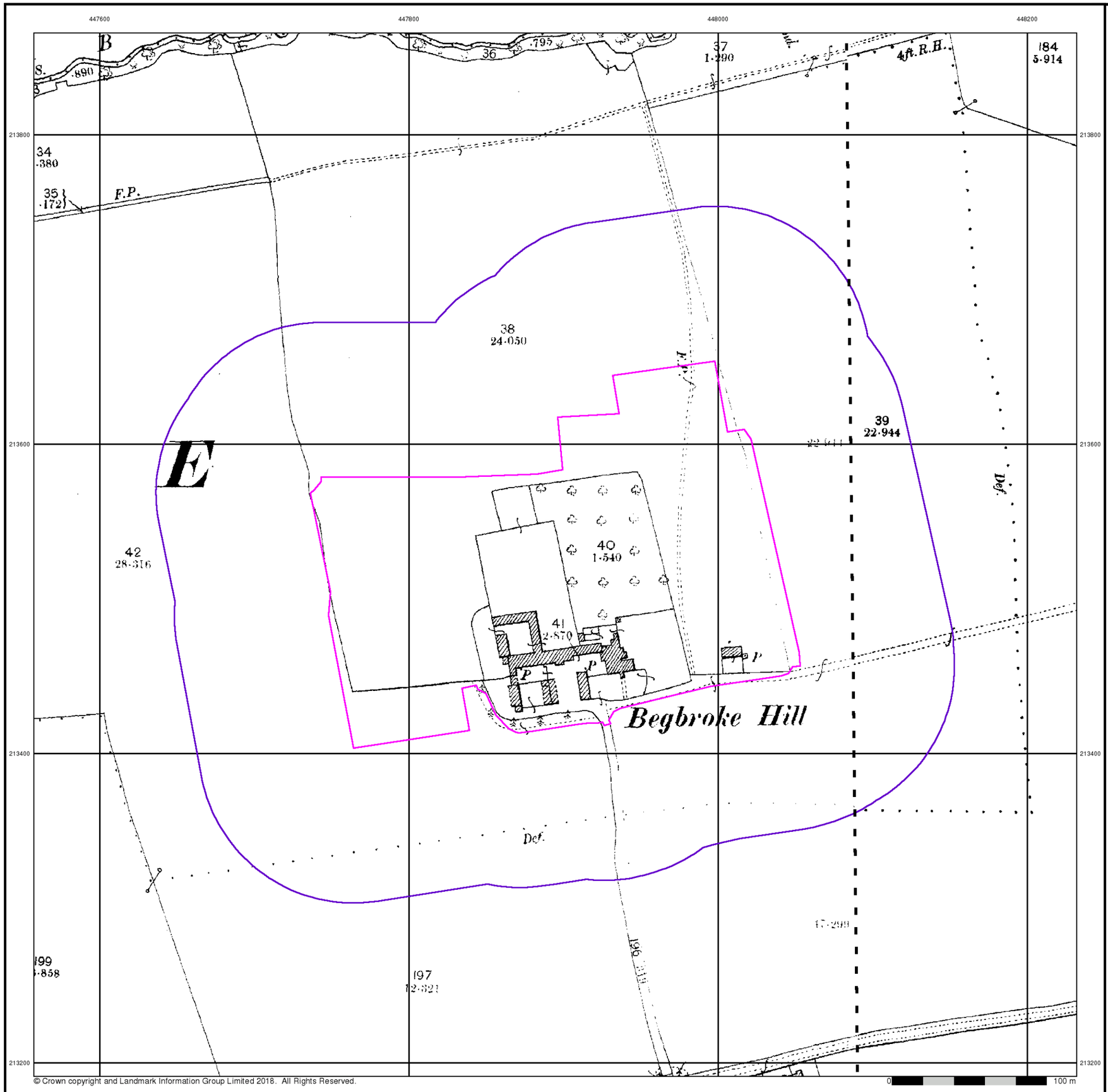
Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

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



CONSULTING ENGINEERS LIMITED

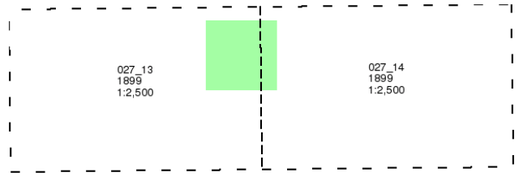
Oxfordshire

Published 1899

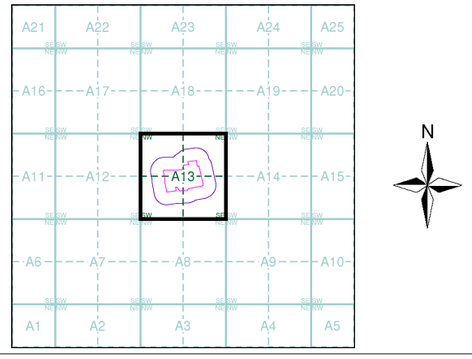
Source map scale - 1:2,500

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



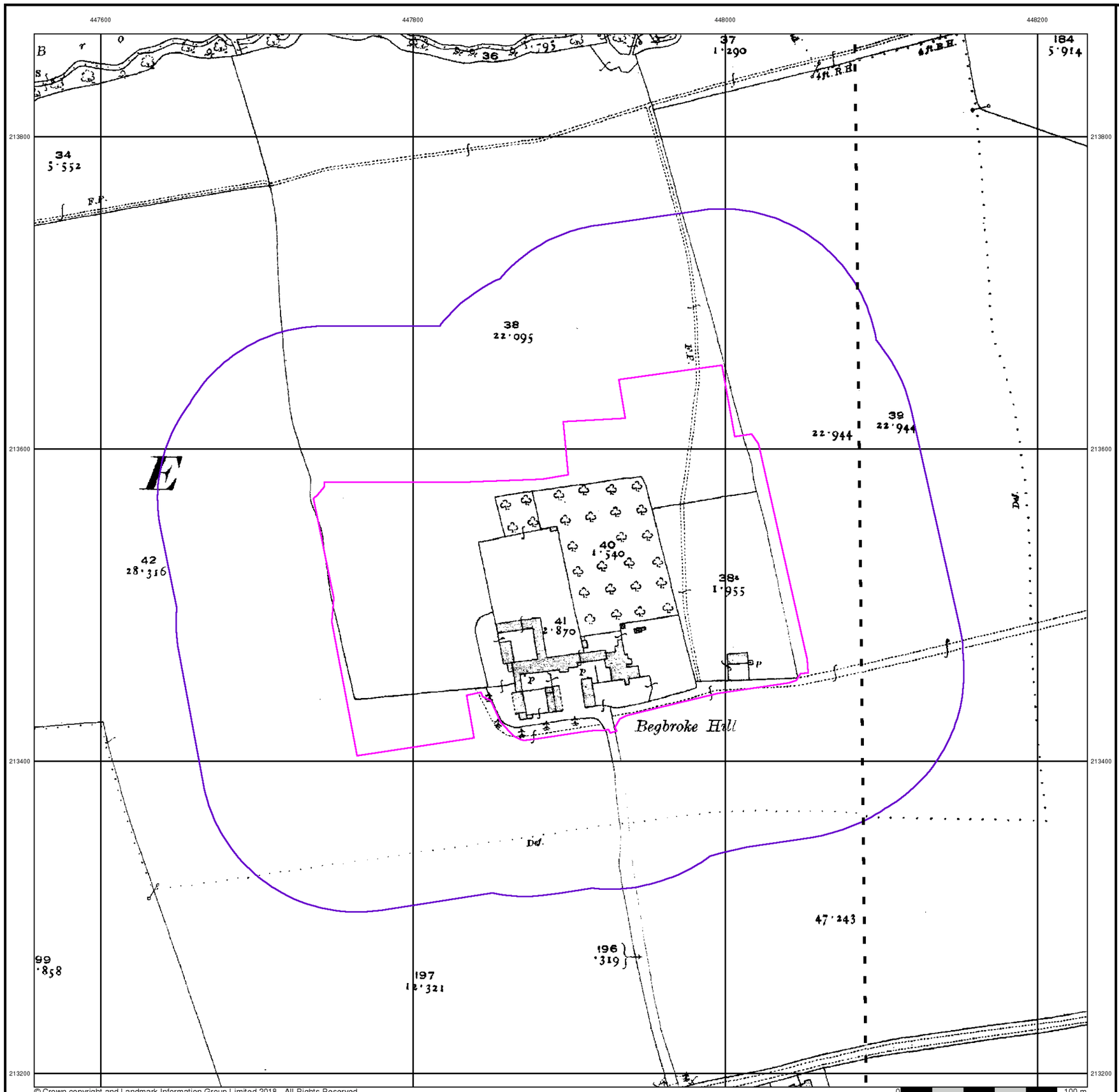
Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

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



CONSULTING ENGINEERS LIMITED

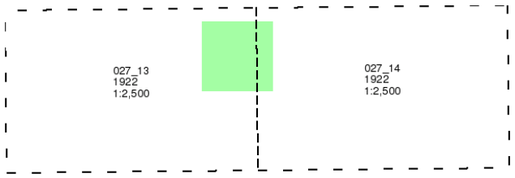
Oxfordshire

Published 1922

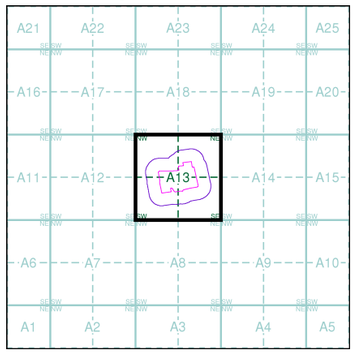
Source map scale - 1:2,500

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



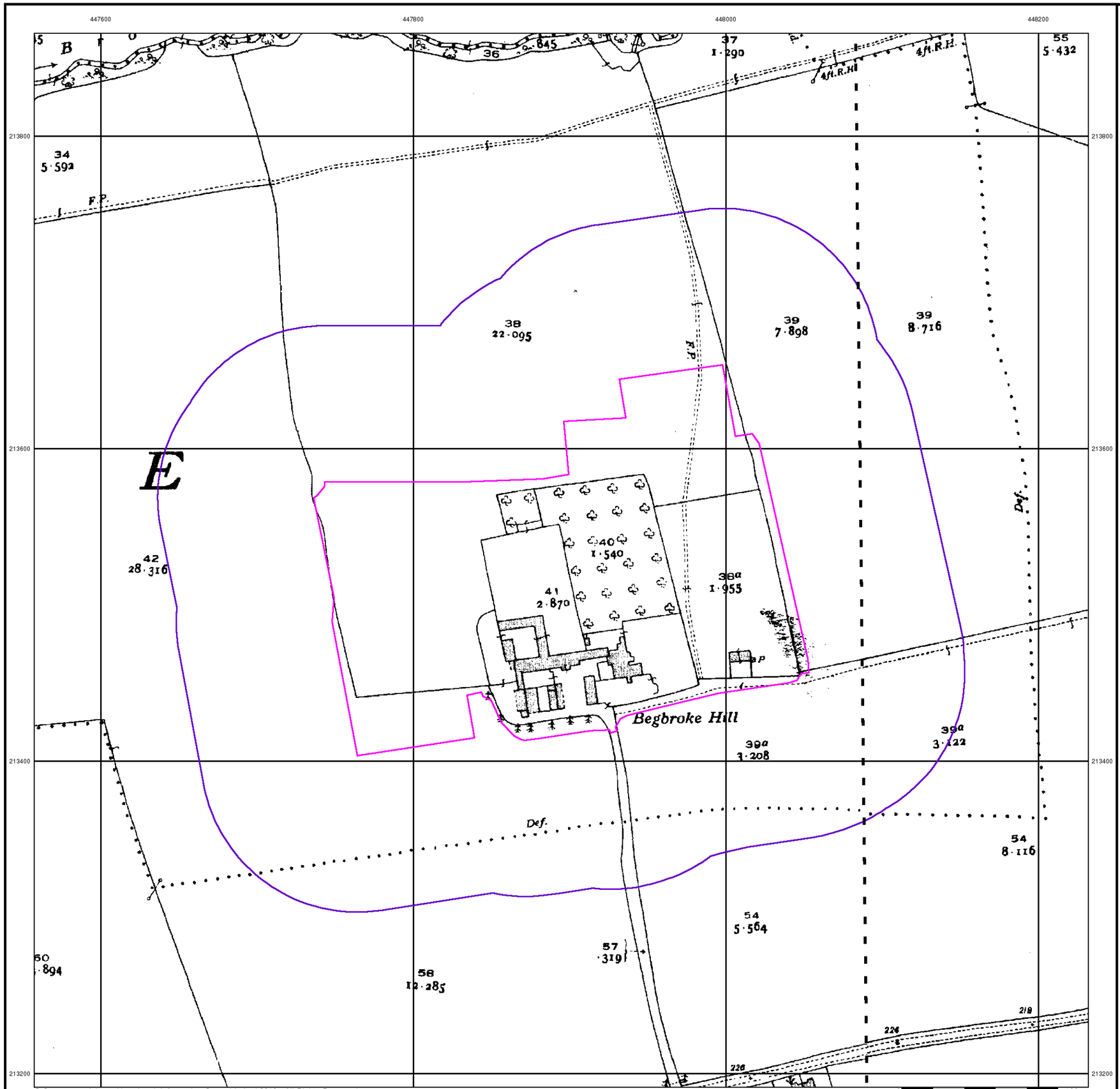
Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

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



CONSULTING ENGINEERS LIMITED

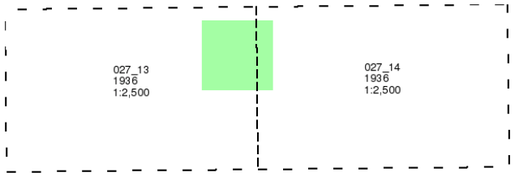
Oxfordshire

Published 1936

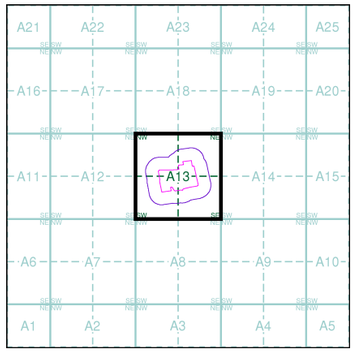
Source map scale - 1:2,500

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



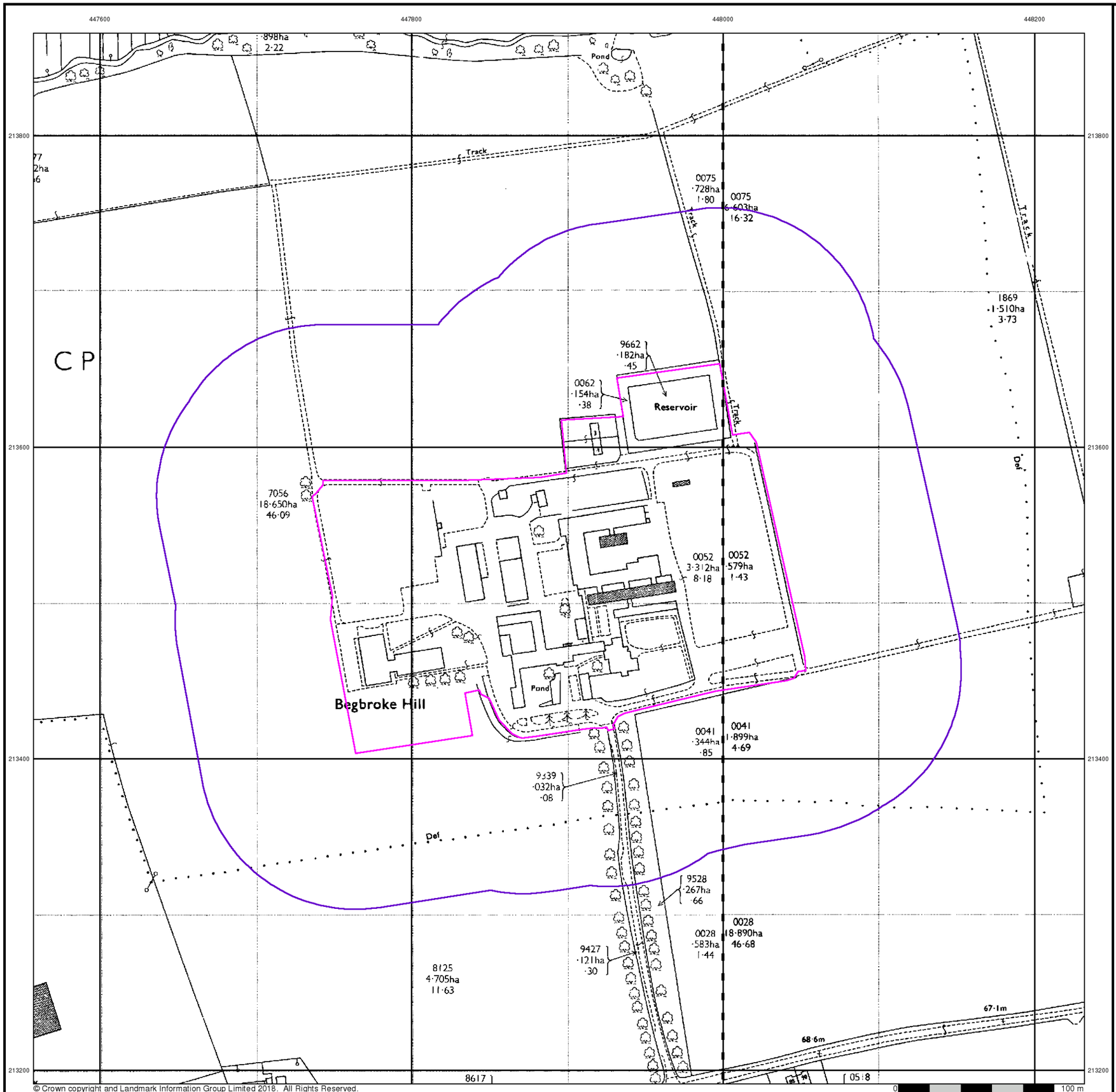
Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

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



CONSULTING ENGINEERS LIMITED

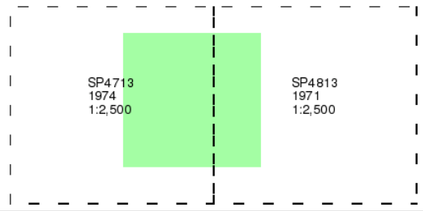
Ordnance Survey Plan

Published 1971 - 1974

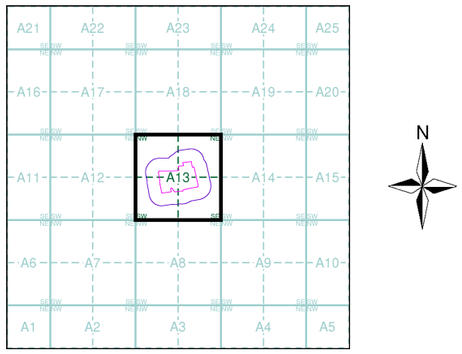
Source map scale - 1:2,500

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



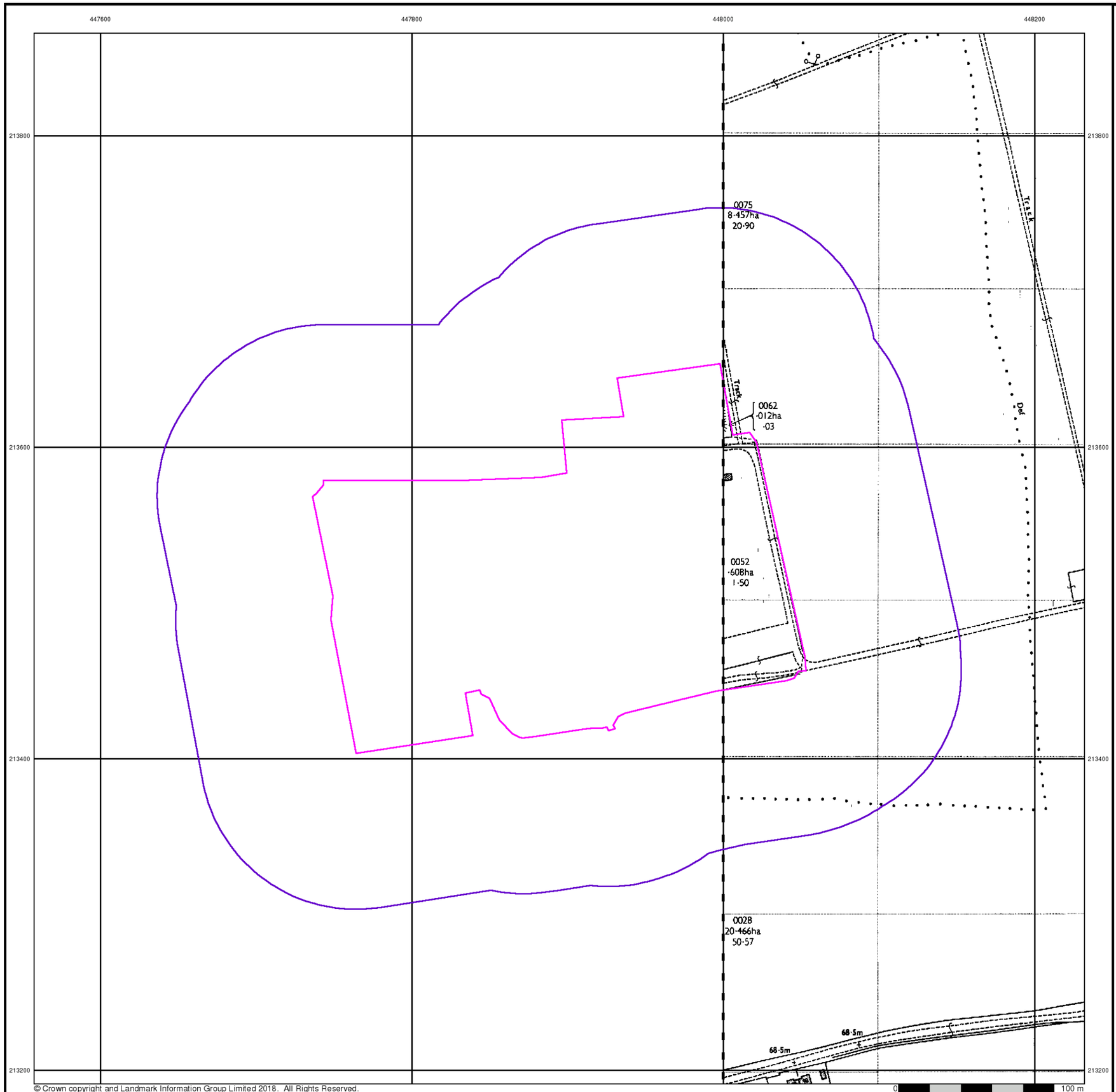
Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

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



CONSULTING ENGINEERS LIMITED

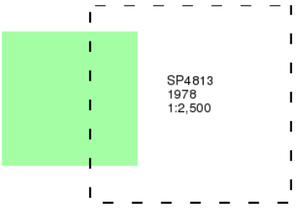
Ordnance Survey Plan

Published 1978

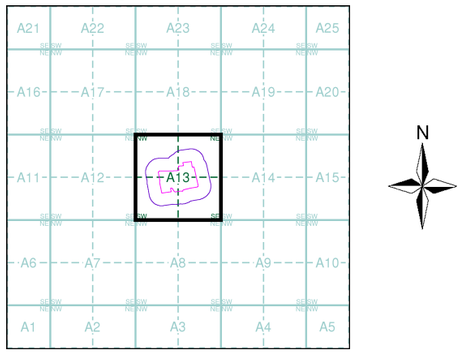
Source map scale - 1:2,500

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



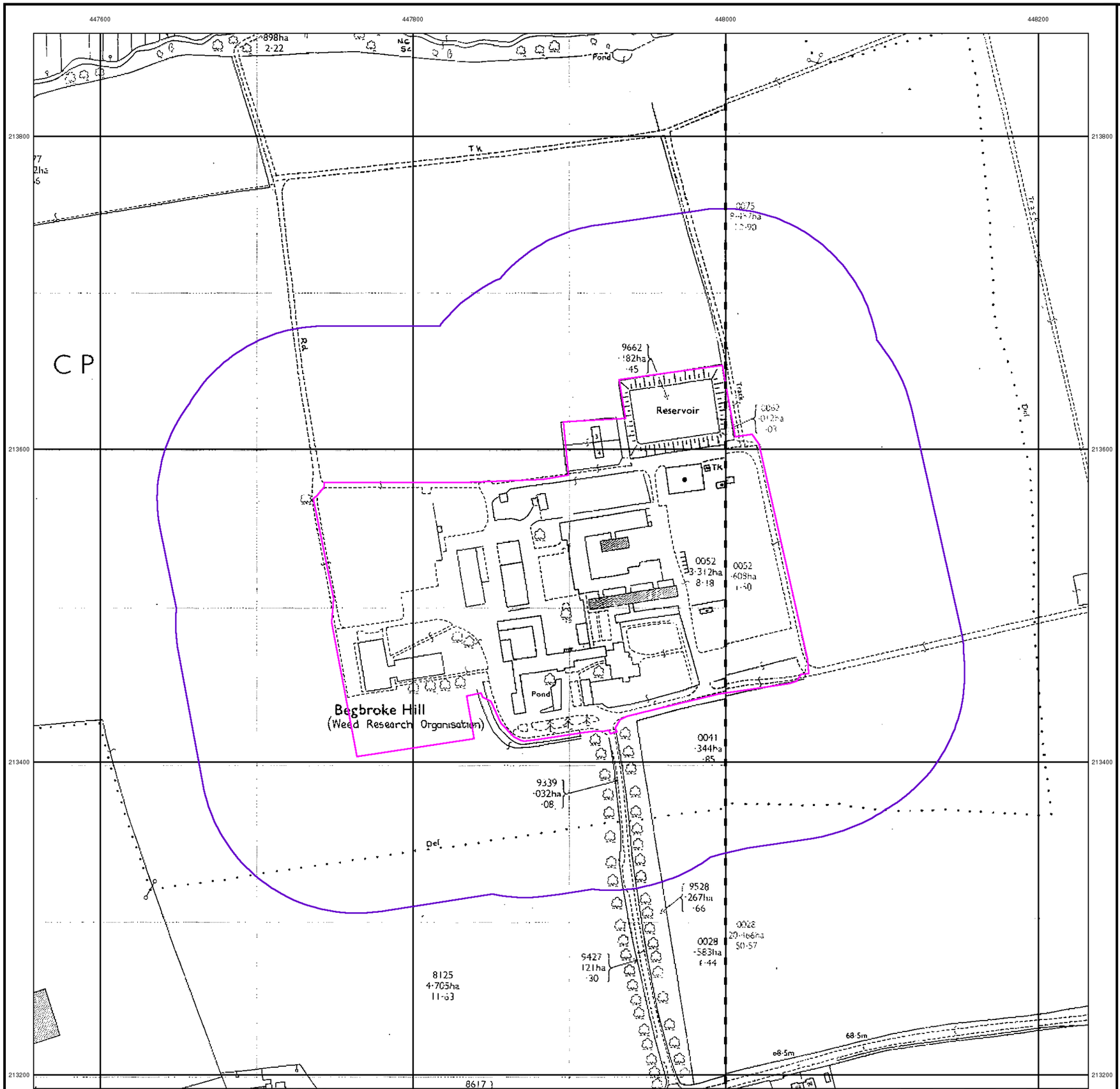
Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

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



CONSULTING ENGINEERS LIMITED

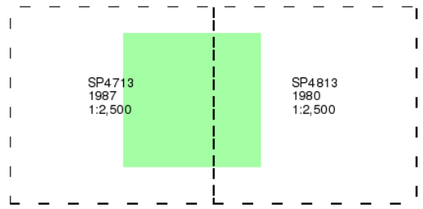
Additional SIMs

Published 1980 - 1987

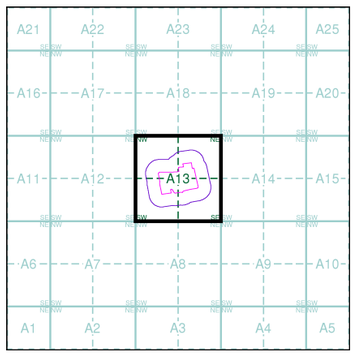
Source map scale - 1:2,500

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

Map Name(s) and Date(s)



Historical Map - Segment A13



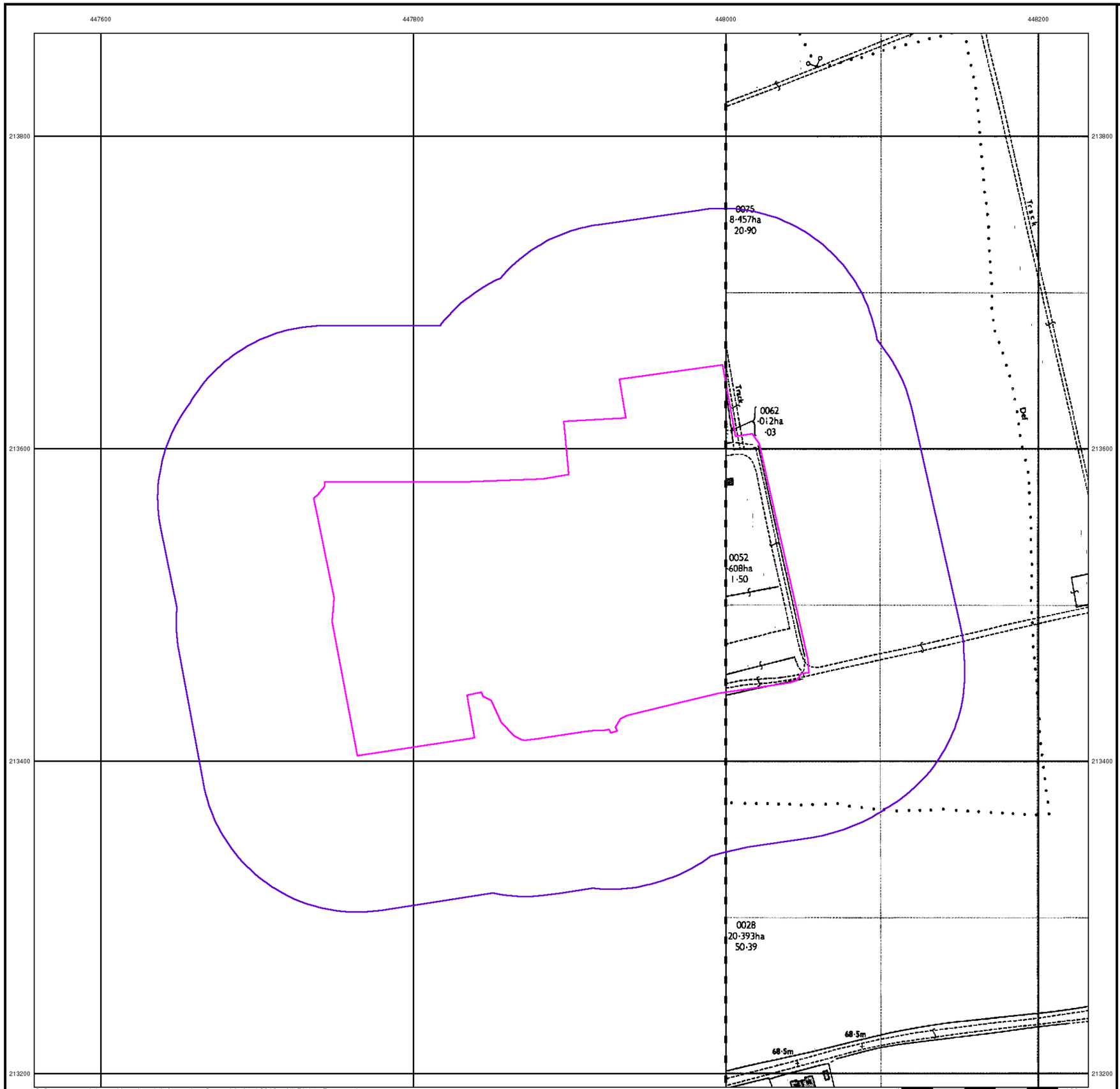
Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

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



CONSULTING ENGINEERS LIMITED

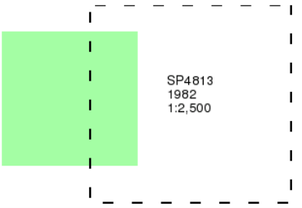
Ordnance Survey Plan

Published 1982

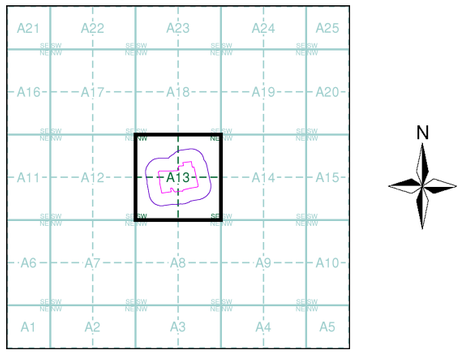
Source map scale - 1:2,500

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

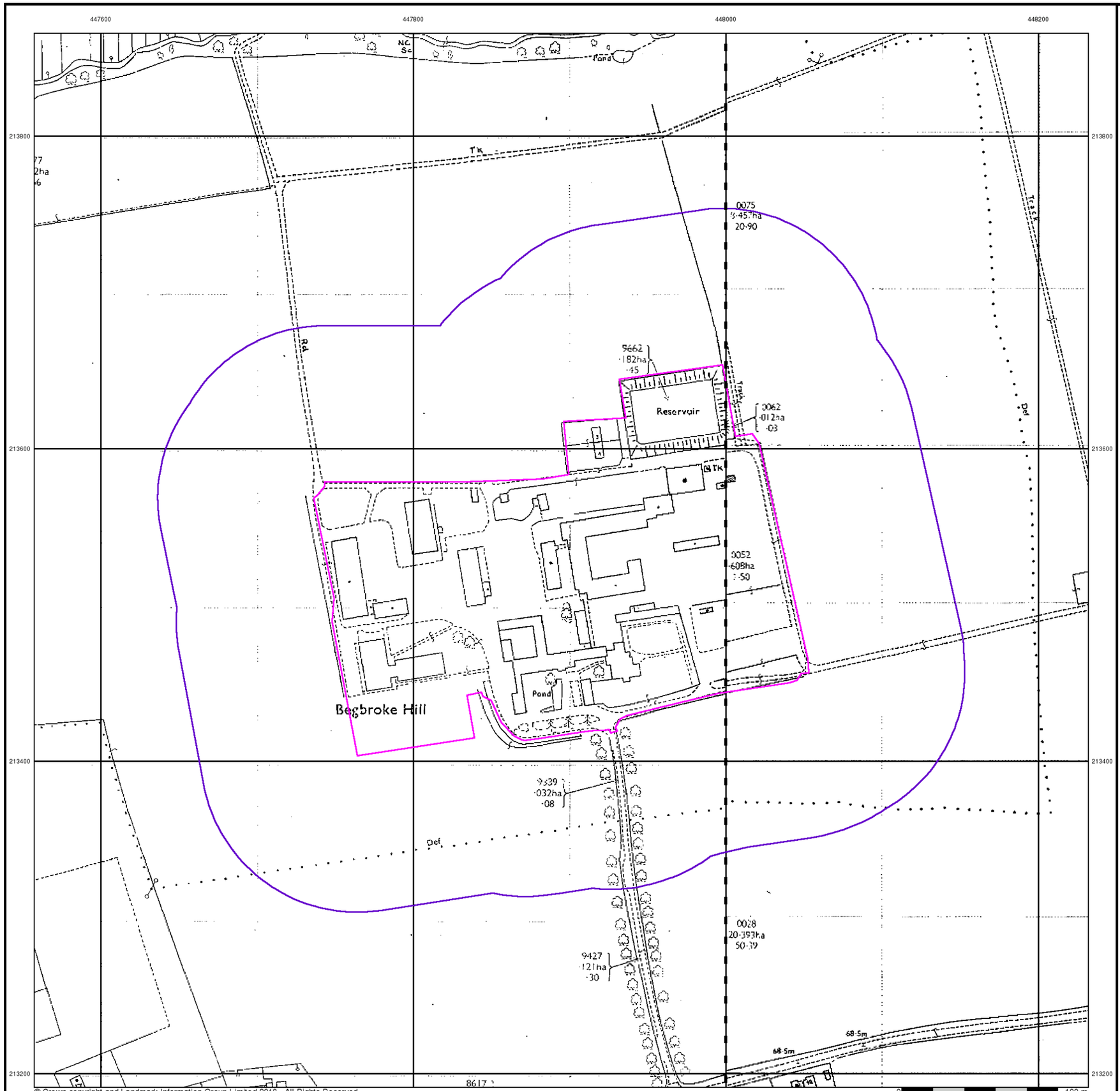


Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire



CONSULTING ENGINEERS LIMITED

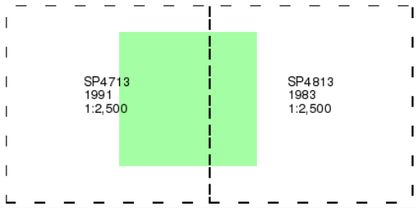
Additional SIMs

Published 1983 - 1991

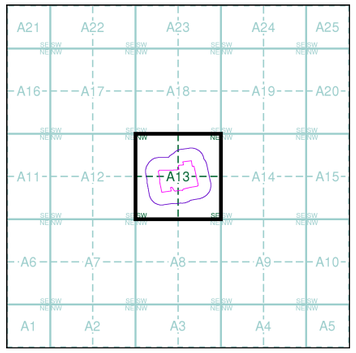
Source map scale - 1:2,500

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

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

CONSULTING ENGINEERS LIMITED

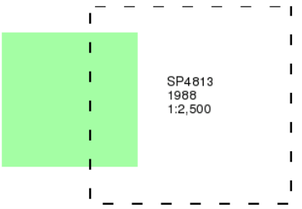
Ordnance Survey Plan

Published 1988

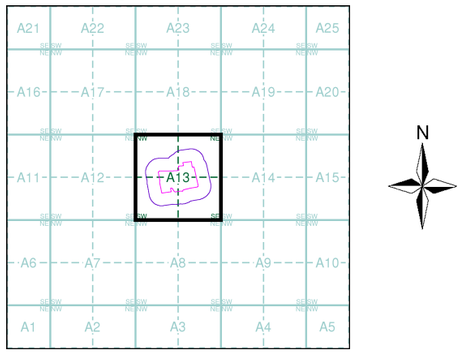
Source map scale - 1:2,500

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:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

Landmark INFORMATION GROUP

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

CONSULTING ENGINEERS LIMITED

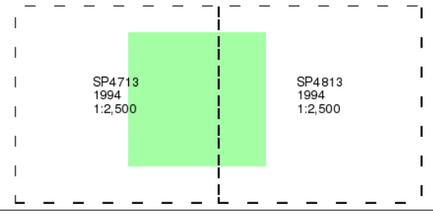
Large-Scale National Grid Data

Published 1994

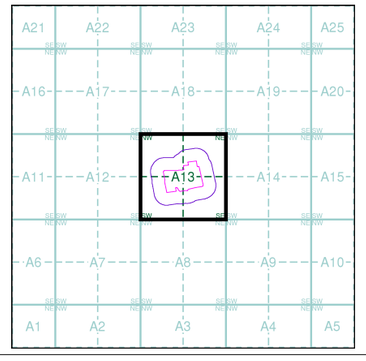
Source map scale - 1:2,500

'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)



Historical Map - Segment A13



Order Details

Order Number:	158805416_1_1
Customer Ref:	18143
National Grid Reference:	447890, 213520
Slice:	A
Site Area (Ha):	5.19
Search Buffer (m):	100

Site Details

Site at, Begbroke, Oxfordshire

Landmark INFORMATION GROUP

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

APPENDIX F – GEOTECHNICAL RISK REGISTER

Title	Begbroke Science Park	**Date**	22/03/2018
Job no.	18143	**Revision**	A

Section	Applicable	Details	Risk Rating	Constraints	Opportunities
1. Scoping	☐				
1.1 Proposed Development	☑	Extension of existing science park	Low		
1.2 Client/Developer	☐				
1.3 Principal Contractor	☐				
1.4 Principal Designer	☐				
1.5 Appraisal objectives	☐				
2. Data Sources	☑	Publically available information			
2.1 Phase 1 Desk Study (PSSR)	☑	Envirocheck Report			
2.2 Phase 2 Ground Investigation Report (GIR)	☐				
2.3 Additional GIR	☐				
2.4 Geotechnical Design Report (GDR)	☐				
2.5 Detailed Design	☐				
2.5.1 Analysis	☐				
2.5.2 Drawings	☐				
2.5.3 Specification	☐				
2.5.4 Design Risk Assessment	☐				
3. Published Geology	☐				
3.1 Solid Geology	☑	Oxford Clay and West Walton Formation (Undifferentiated)	Low		Likely suitable for shallow foundations
3.2 Drift	☑	Summertown Radley sand and gravel member	Low		Potential for soakaways drainage
3.3 Made Ground	☑	Site has been developed previously	Medium	Potential source of contamination	

Title	Begbroke Science Park	**Date**	22/03/2018
Job no.	18143	**Revision**	A

Section	Applicable	Details	Risk Rating	Constraints	Opportunities
4. Geomorphology	☐				
4.1 Geomorphological Setting	☐				
4.1.1 Mountains	☐				
4.1.2 Hill Side	☐				
4.1.3 Valley Side	☐				
4.1.4 Fluvial	☐				
4.1.5 Low Lying/flood plain	☐				
4.1.6 Estuarine	☐				
4.1.7 Coastal/Littoral	☐				
4.1.8 Marine	☐				
4.1.9 Plateau	☐				
4.1.10 Karstic/Halite	☐				
4.2 Slopes	☐				
4.2.1 Aspect	☐				
4.2.2 Average Slope Angle	☐				
4.2.3 Slope Profile	☐				
4.2.4 Terraced/Stepped Profile	☐				
4.3 Groundwater	☐				
4.3.1 Catchment	☐				
4.3.2 Aquifer Status	☑	Bedrock is unproductive stratum. Superficial deposits are Secondary A Aquifer.	Medium		Potential for soakaways drainage if thickness of granular deposits is sufficient.
4.3.3 Surface Water	☑	Rowel Brook 400m north of the site	Low		
4.4 Geohazards	☐				

Title	Begbroke Science Park	**Date**	22/03/2018
Job no.	18143	**Revision**	A

Section	Applicable	Details	Risk Rating	Constraints	Opportunities
4.4.1 Rock Mass Stability	☐				
4.4.2 Rockfall	☐				
4.4.3 Landslide	☐				
4.4.4 Cambering	☐				
4.4.5 Gullying	☐				
4.4.6 Debris and earth flow	☐				
4.4.7 Rotational Slips	☐				
4.4.8 Translational Slips	☐				
4.4.9 Slope Creep	☐				
4.4.10 Seismic	☐				
4.4.11 Faulting	☐				
4.4.12 Flooding	☐				
4.4.13 Subsidence	☐				
4.4.14 Heave	☐				
4.4.15 Collapsible Ground	☐				
4.4.16 Springs	☐				
4.4.17 Artesian Water	☐				
4.4.18 Scour/washout	☐				
4.5 Anthropogenic hazards	☐				
4.5.1 Mine Workings	☐				
4.5.2 Shafts	☐				
4.5.3 Adits/Level/issues	☐				
4.5.4 Mineral extraction	☐				
4.5.5 Contaminated land	☑	Potential for contamiantion in existing made ground and from history of hazardous substances used on site	Medium		

Title	Begbroke Science Park	**Date**	22/03/2018
Job no.	18143	**Revision**	A

Section	Applicable	Details	Risk Rating	Constraints	Opportunities
4.5.6 Climate Change	☐				
4.6 Vegetation	☐				
4.6.1 Woodland	☐				
4.6.2 Scrub	☐				
4.6.3 Grassed/pasture	☐				
4.6.4 Arable	☐				
4.6.5 Hydrophyllic	☐				
5. Land Use	☐				
5.1 Classification	☐				
5.1.1 Greenfield	☐				
5.1.2 Brownfield	☑	UoO Science Park	Medium	Potential contamiantion	
5.1.3 Contaminated	☐				
5.2 Category	☐				
5.2.1 Urban	☐				
5.2.2 Suburban	☐				
5.2.3 Rural	☑	Site is located in an area of primarily open fields			
5.2.4 Wilderness	☐				
5.3 Historic and Current Land use	☐				
5.3.1 Industrial	☐				
5.3.2 Residential	☐				
5.3.3 Commercial	☐				
5.3.4 Agricultural	☑	Formerly a farm	Low		
5.3.5 Public Utility	☐				
5.3.6 Other	☐	University science park			
5.4 Proposed Development	☐				

Title	Begbroke Science Park	**Date**	22/03/2018
Job no.	18143	**Revision**	A

Section	Applicable	Details	Risk Rating	Constraints	Opportunities
5.4.1 Heavy/Industrial	☐				
5.4.2 Light/Commercial	☑	Additional research facilities	Low		
5.4.3 Residential	☐				
5.4.4 Civil Engineering Structures	☐				
5.4.5 Roads/Pavements	☐				
5.4.6 Reclamation	☐				
6. Ground Investigation Findings	☐				
6.1 Superficial (drift) soils	☐				
Granular	☐				
Cohesive	☐				
Mixed (e.g. Till)	☐				
Plasticity	☐				
Undrained Shear Strength	☐				
Effective Stress Parameters	☐				
Elastic Modulus	☐				
Compressive Strength	☐				
Settlement	☐				
6.2 Rock	☐				
Unit/Formation	☐				
Compressive Strength	☐				
Elastic Modulus	☐				
Angle of Internal Friction	☐				
Settlement	☐				
RMR/Q/Geological Strength Index	☐				
6.3 Groundwater	☐				

Title	Begbroke Science Park	**Date**	22/03/2018
Job no.	18143	**Revision**	A

Section	Applicable	Details	Risk Rating	Constraints	Opportunities
6.4 Report Recommendations	☐				
6.4.1 Shallow Foundations	☑	Shallow foundations anticipated to be viable	Low		Ground ivnestigation to confirm depth and strength of suitable founding stratum
6.4.2 Deep Foundations	☐				
6.4.2.1 Floor Slabs	☐				
6.4.3 Frost Action	☐				
6.4.4 Temporary excavation stability	☐				
6.4.5 Rippability	☐				
6.4.6 Permanent slope angle of repose	☐				
6.4.7 Groundwater	☐				
6.4.8 Earthworks	☐				
6.4.9 Ground Improvement	☐				
6.4.10 Geotechnical process works	☐				
6.4.11 Retaining Walls	☐				
6.4.12 Pavements	☐				
6.4.13 Other Structures	☐				
6.4.14 Basements	☐				
6.4.15 SUDS Infiltration testing	☐				
6.4.16 Concrete Durability	☐				
6.4.17 NHBC Trees	☐				

APPENDIX G: - CONTAMINATION RISK ASSESSMENT METHODOLOGY AND DEFINITIONS

CONTAMINATION ASSESSMENT METHODOLOGY

The DEFRA and Environment Agency Contaminated Land Report 11 (CLR11) 'Model Procedures for the Management of Land Contamination' provides a technical framework for structured decision making about land contamination.

A1. Definition of Risk

CLR11 defines risk as "a combination of probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence".

A2. The Concept of the 'Pollutant Linkage'

In the context of contaminated land, there are three essential elements to any risk:

- a **contaminant (or source)** – a substance that is in, on or under land and has the potential to cause harm or cause pollution of controlled waters.
- a **receptor** - humans, ecological system, water body or property.
- a **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist separately; however, they create a risk only where they are linked together forming a **pollutant linkage**.

A3. Conceptual Site Models

A conceptual site model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

For all potential pollutant linkages identified, the *consequence* and *probability* of occurrence is qualitatively assessed, and a *risk* assigned.

A4. The Tiered Risk Assessment Approach

CLR11 presents a tiered approach to risk:

Tier 1 *Preliminary risk assessment (PRA)*
The purpose of the preliminary risk assessment is to develop an initial conceptual model of the site and to establish whether or not there are potentially unacceptable risks. If potential risks are identified the initial conceptual model is developed in subsequent tiers of the risk assessment process.

Tier 2 *Generic quantitative risk assessment (GQRA)*
The purpose of the generic quantitative risk assessment is to establish whether generic assessment criteria and assumptions are appropriate for assessing the risks and, if so, to apply them to establish whether there are actual or potential unacceptable risks. It also determines whether further detailed quantitative risk assessment is required.

Tier 3 *Detailed quantitative risk assessment (DQRA)*
The purpose of the detailed quantitative risk assessment is to establish and use more detailed site specific information and criteria to decide whether there are unacceptable risks. It may be used as the sole method of quantitative assessments of risks, or it may be used to refine earlier assessments using generic assessment criteria.

B. RISK ASSESSMENT DEFINITIONS

B1. General

The following classification and definition of risk assessment has been based on that set out in NHBC and EA Publication R&D 66 – Guidance on the Safe Development of Housing on Land Affected by Contamination (2008).

The key to the classification is that the designation of risk is based upon the consideration of both:

a) **the magnitude of the potential consequence (i.e. severity)**, which considers both the potential severity of the hazard, and the sensitivity of the receptor**.**

b) **the magnitude of probability (i.e. likelihood)**, which considers both the presence of the hazard, the receptor, and the integrity of the pathway.

B2. Classification of Consequence

Classification	Definition	Examples
Severe	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Catastrophic damage to crops, buildings or property.	Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of List I and II substances present in groundwater close to small potable abstraction (high sensitivity). Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).
Medium	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.	Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.
Mild	Exposure to human health unlikely to lead to "significant harm". Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce. Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population. Minor damage to crops, buildings or property.	Exposure could lead to slight short-term effects (e.g. mild skin rash). Surface spalling of concrete.
Minor	No measurable effect on humans. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	The loss of plants in a landscaping scheme. Discoloration of concrete.

** For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.*

B3. Classification of Probability

Only applies if there is a possibility of a pollutant linkage being present.

Classification	Definition	Examples
High likelihood	There is pollutant linkage and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.	*a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden.* *b) Ground/groundwater contamination could be present from chemical works, containing a number of USTs, having been in operation on the same site for over 50*
Likely	There is pollutant linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.	*a) Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden, or the top 0.5m in public open space.* *b) Ground/groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.*
Low likelihood	There is pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place, and is less likely in the shorter term.	*a) Elevated concentrations of toxic contaminants are present in soils at depths >1m in a residential garden, or 0.5-1.0m in public open space.* *b) Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.*
Unlikely	There is pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.	*a) Elevated concentrations of toxic contaminants are present below hard standing.* *b) Light industrial unit <10 yrs. old containing a double-skinned UST with annual integrity testing results available.*

Note: A pollution linkage must first be established before probability is classified. If there is no pollution linkage, then there is no potential risk. If there is no pollution linkage, then there is no need to apply tests for probability and consequence.

For example, if there is surface contamination and a major aquifer is present at depth, but this major aquifer is overlain by an aquiclude of significant thickness then there is no pollution linkage and the risks to the major aquifer are not assessed. The report should identify both the source and the receptor but state that because there is no linkage there are no potential risks.

B4. The Classification of Risk

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High likelihood**	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

B5. Description of the Classified Risks

Very high risk
There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action OR there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to be site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.

High risk
Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realisation of the risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term.

Moderate risk
It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term.

Low risk
It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst, that this harm if realised would normally be mild. It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.

Very low risk
It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.

No potential risk
There is no potential risk if no pollution linkage has been established.

B6. Definitions

Term	Definition
Hazard	A property or situation which in certain circumstances could lead to harm. The properties of different hazards must be assessed in relation to their potential to affect the various receptors.
Risk	A combination of the probability or frequency of the occurrences of a defined hazard AND the magnitude of the consequences of that occurrence.
Probability	The mathematical expression of the chance of a particular event in a given period of time [e.g. probability of 0.2 is equivalent to 20% or a 1 in 5 chance].
Impact	The adverse effects (or harm) arising from a defined hazard which impairs the quality of the environment or human health in the short or longer term.
Pollution linkage	An identified pathway is capable of exposing a receptor to a contaminant and that contaminant is capable of harming the receptor.

APPENDIX H - LIMITATIONS AND EXCEPTIONS

Limitations and Exceptions

1. The advice given in this report is based on the guidelines available at the time of writing.

2. This investigation was conducted so as to generally comply with the relevant principles and requirements of BS10175: 2011 "Investigation of potentially contaminated sites - Code of Practice" and BS 5930:2015 “Code of Practice for Site Investigations”.

3. The Client is advised that the conditions observed on site by Jubb Consulting Engineers Ltd (JCE) at the time of the investigation or assessment are subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance or investigation and they may subsequently have become observable. Ground conditions, including geotechnical properties may vary between points of observation, sampling and testing.

4. Certain areas of site had restricted access or were inaccessible due to the presence of in-use buildings, facilities and live services, as identified in this report. These may require further investigation outside the scope of this present investigation.

5. Comments made relating to land gas or groundwater conditions are based on observations made at the time of an investigation unless otherwise stated. Land gas and groundwater conditions may vary as a result of seasonal or other effects.

6. Ground contamination often exists as small discrete areas of contamination and there can be no certainty that any or all such areas have been located, sampled and/or identified.

7. The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from previous site investigations and chemical and geotechnical testing laboratories, and which JCE has assumed are correct. Nevertheless, JCE cannot and does not guarantee the authenticity or reliability of the information it has used or cited. JCE can accept no responsibility for inaccuracies within the data supplied by other parties.

8. This report is written in the context of an agreed scope of work between JCE and the Client and should not be used in a different context. In the light of additional information becoming available, improved practices and changes in legislation, amendment or re-interpretation of the assessment or report in whole or part may be necessary after its original submission.

9. This report is provided for sole use by the Client and is confidential to them. No responsibility whatsoever for the contents of the report will be accepted to anyone other than the Client.

10. This report is not a specification for works.

11. JCE believes that providing information about limitations is essential to help the Client identify and thereby manage risks.

12. JCE does not provide legal advice and the advice of the Clients' legal advisors may also be required.

13. JCE retain the copyright in this report and all drawings reproduced in it.