GEOTECHNICAL &
GEO- ENVIRONMENTAL REPORT
PROPOSED RESIDENTIAL DEVELOPMENT ON LAND OFF CAERLEON ROAD,
DINAS POWYS

Prepared for:
Kier Living Ltd

April 2017

Job No: 12224

terrafirma

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REPORT TITLE	**:**	**Geotechnical and Geo-environmental Report: Proposed Residential Development on Land off Caerleon Road, Dinas Powys**
REPORT STATUS	**:**	**Final**
JOB NUMBER	**:**	**12224**
DATE	**:**	**April 2017**
PREPARED BY	**:**	**……..**
		(Dr. N. Thomas)
REVIEWED BY	**:**	**……..**
		(Miss R. Howells)
APPROVED BY	**:**	**……..**
		(Dr G. C. Lake)

Executive Summary

Kier Living Ltd are proposing the construction of a new residential development on land off Caerleon Road, Dinas Powys.

The site has remained field land since pre 1878 to the present day. Consequently, no contamination is expected on site.

The site is underlain by rocks of the Mercia Mudstone Group of Triassic Age. No superficial deposits are recorded on the site. However, weathered bedrock in the form of clay and clayey gravel is likely to overlie the bedrock.

In order to confirm the ground conditions beneath the site, a geotechnical and geo-environmental site investigation was carried out comprising ten trial pits and three soakaway tests. Ground conditions were found to be topsoil underlain by firm to stiff red brown clay underlying by medium dense gravel occasionally underlain by firm red brown clay or very weak weathered mudstone.

Mass concrete reinforced strip and trench fill foundations founded within the firm in-situ clay and the medium dense clayey gravel should be used. Depending upon the amount of ground treatment floor slabs may be designed as ground bearing or suspended.

During the site investigation samples of the underlying soil were taken and submitted for laboratory screening. No contamination was identified on site and it is therefore concluded that there are no risks to human health or the aquatic environment from site soils.

Soil plasticity tests recorded the soil to have medium volume change potential.

The Radon (RPM) Site Report from the British Geological Survey confirms that no radon protection measures are required for the site.

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SECTION 1 Introduction and Proposed Development

Kier Living Ltd are proposing the construction of a new residential development on undeveloped land off Caerleon Road, Dinas Powys. The development is largely to consist of detached dwellings with one unit consisting of six flats.

Asbri Planning Limited are the Planning Consultants for the proposed development.

Terra Firma (Wales) Limited has been commissioned by Kier Living Ltd to undertake a geo-environmental assessment and geotechnical investigation of the site.

The main objectives of the geo-environmental assessment programme were to:

- Identify the potential environmental liabilities at the site associated with any soil and groundwater contamination from past site uses.
- Provide a summary of the environmental conditions at the site, together with any necessary remediation works to render the site fit for its intended use.
- Provide recommendations with regard to any other geo-environmental aspects pertaining to the development such as radon emissions.

The main objectives of the geotechnical site investigation were to:

- Determine the type, strength and bearing characteristics of the shallow superficial deposits and underlying solid geology.
- Provide recommendations for a suitable and economic foundation/floor slab solution for the development.
- Provide recommendations with regard to any other geotechnical aspects pertaining to the development.

In order to achieve the above objectives, Terra Firma (Wales) Limited carried out an assessment programme including a review of existing data, followed by a field investigation to determine the prevailing ground conditions and also to collect and analyse soil samples from selected locations around the site.

1.1 Limitations and Exceptions of Investigation

The geo-environmental and geotechnical investigation was conducted and this report has been prepared for the sole internal reliance of Kier Living Ltd and its design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. 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 report represents the findings and opinions of experienced geo-environmental and geo-technical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may also be required.

The subsurface geological profiles, any contamination and other plots are generalised by necessity and have been based on the information found at the locations of the exploratory holes and depths sampled and tested.

SECTION 2 Review of Existing Data

2.1 Physical Setting, Current Use and Site Conditions

The site is a triangular parcel of land that situates to the north of Caerleon Road, Dinas Powys, CF64 4PU at National Grid Reference: 316460 171760, see **Drawing 01**. The site is currently an undeveloped meadow of level topography which is bounded on all sides by mature bushes and trees. A number of immature trees locate within the site. Reeds were also noted in the north of the site indicating an area of potentially marshy ground. A field locates to the east of the site and a north south trending passenger railway locates adjacent to the western boundary of the site. Houses off Caerleon Road locate to the south of the site. The site layout is presented in **Drawing 02.**

2.2 History

Historical maps of the site have been obtained from the Landmark Information Group. These are supplied in **Annex A** with the most relevant editions summarised below. Distances are approximate.

1878
The site is recorded as field land. A tree lined stream partially locates along the western site boundary then diverts to traverse the northern section of the site. A north east to south west trending stream locates 25m to the east of the site. A stream also follows the southern boundary of the site. The surrounding area is largely rural. A number of small ponds locate within the adjacent fields.

1900
There have been no changes to the site. A north east to south west trending railway has been constructed immediately to the north west of the site. Numerous houses have been constructed adjacent to the railway 50m to the northwest of the site in the village of Dinas Powys. The village of Cogan has undergone residential development 1km to the east of the site.

1920
There have been no changes to the site. Additional houses have been constructed 150m to the south west of the site. The town of Penarth has undergone substantial residential development over 1km to the south east of the site.

1941
The streams appear to be diverted to flow along the north eastern boundary of the site to the northern most corner of the site. A small building locates along the boundary in the extreme south east of the site. The suburb of the town of Penarth has extended to within 500m of the south east of site.

1971
By 1971 the building on the south eastern boundary of the site is no longer recorded. A housing estate including Chamberlain Row and Castle Drive have been constructed 60m to the south west of the site.

1977
No changes have occurred to the site. Additional residential development has occurred immediately to the south including Caerleon Road and 100m to the west.

1982
The site and much of the surrounding area remains unchanged.

2.3 Geology

The 1:50,000 -scale geological maps of the area (Sheet 263) was consulted. The site is shown to be underlain by rocks of the Mercia Mudstone Group of Triassic Age. These rocks consist of red brown occasionally green grey mudstone.

Superficial till deposits are not recorded at the site. Weathered bedrock can be expected in the form of Clay and or clayey Gravel. Given the sites innocuous past no made ground is anticipated.

2.4 Radon

A Radon Report obtained from the British Geological Survey concludes that **no radon** protection is required. The radon report is presented in **Annex B**.

2.5 Hydrogeology

The Mercia Mudstone Group has been classed by the Environment Agency as a secondary B aquifer. Secondary B aquifers are described as predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localized features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

2.6 Hydrology

The 1:25000 scale Ordnance Survey map indicates that perched groundwater flows will be primarily in a south-westerly direction towards the River Cadoxton.

As described a stream previously flowed across the northern section of the site in a westerly direction, this stream was later diverted to the north along the eastern boundary of the site.

Cardiff Bay situates approximately 2.6km to the east. Significant residential developments locate around the site and between the site and Cardiff Bay where much surface runoff will be collected by manmade shallow subsurface drainage.

Deeper groundwater flow, within the underlying bedrock, will be controlled by the dip and any fractures or bedding planes within the rock unit. However, that the bedrock has been classed as a Secondary B aquifer would indicate low permeability levels and hence low groundwater flow through the bedrock.

2.7 Environmental

The Environment Agency online ‘What’s in Your Back Yard’ database was consulted. The relevant information is summarised below.

2.7.1 Pollution

The EA regulate the amount and type of pollution that business and industry produce under the EC Integrated Pollution Prevention and Control Directive (IPPC) and EP OPRA (Environmental Protection Operator and Pollution Risk Appraisal scores). There are no such sites listed within 250m of the site.

2.7.2 Landfills

There are no current or historical landfill sites recorded within a 250m radius of the site.

2.7.3 Flooding

The site does not locate in an area shown to be affected by flooding.

2.7.4 Groundwater Source Protection Zones

The site does not situate within a groundwater source protection zone.

SECTION 3 Qualitative Preliminary Human Health and Environmental Risk Assessment

3.1 General

The contaminated land regime is set out in Part IIA of the Environmental Protection Act (EPA) 1990 and was introduced on the 1st April 2000 in England and 1st July 2001 in Wales. A similar regime was introduced in Scotland on 14th July 2000. Part IIA was introduced to achieve two aims:

(1) The identification of contaminated land
(2) The remediation of contaminated land that poses an unacceptable risk to human health and/or the environment

Under Part IIA the statutory definition of 'contaminated land' is:"any land which appears to the local authority in whose area it is situated, to be in such a condition, by reason of substances in, on, or under the land, that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) Pollution of controlled waters is being, or is likely to be, caused."

For land to be classified as 'Contaminated Land' there must be a '**pollutant linkage**'.

For our definitions of pollution linkage and how we define risk please refer to **Annex C** which includes our classifications of consequence and probability and risk assessment matrix.

3.2 Potential Sources of Contamination

Given the sites innocuous past history no made ground and no contamination is expected on site. A minor amount of fly tipping was noted at the rear of the properties of Caerleon Road. No asbestos containing materials were seen.

3.2 Potential Sources of Contamination (Continued)

The qualitative preliminary Human Health and Environmental Risk Assessment is detailed in the **Tables 3.1** on the following pages, based on findings of the desk study and site walk over and includes all potential sources, pathways and receptors of any contamination.

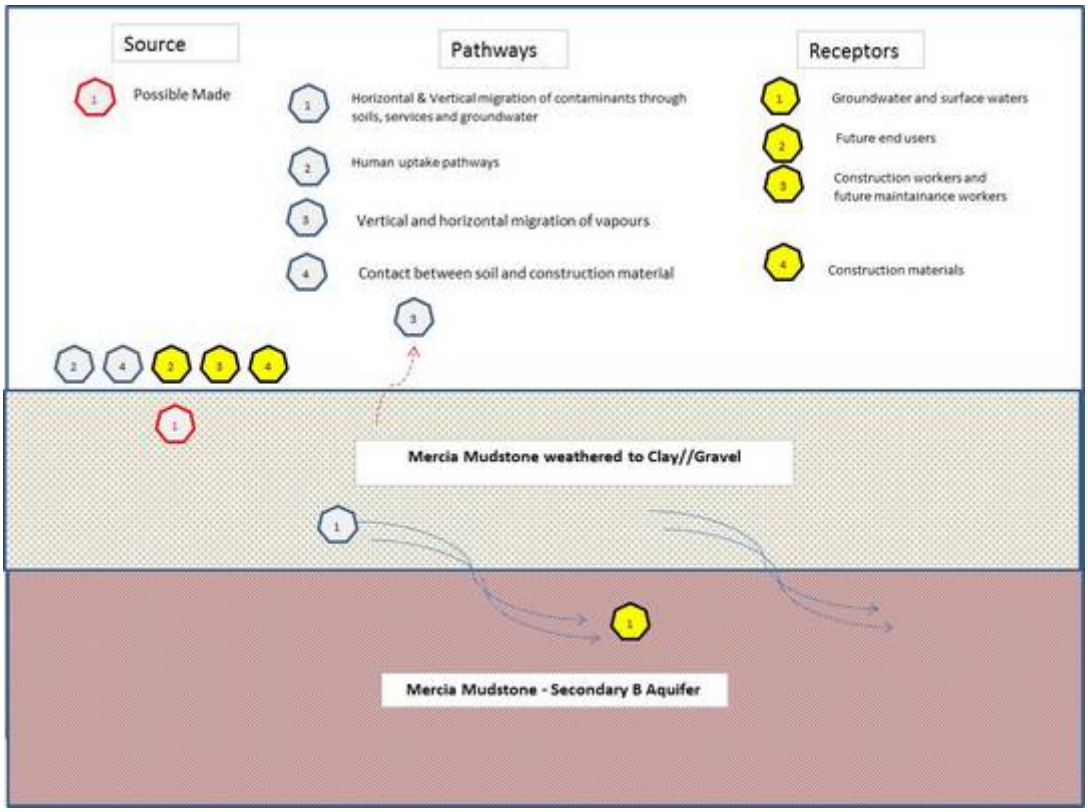
Table 3.1 – Qualitative Preliminary Human Health Risk and Environmental Risk Assessment

Source	Pathway	Receptor During Construction	Level of Risk	Receptor Post Construction	Level of Risk
Made Ground	Ingestion, inhalation and dermal contact with soil and soil dust	Construction Workers Neighbouring Site Users	Low	Residents and visitors	Low
Made Ground	Ingestion of site grown vegetables	N/A	N/A	Residents and visitors	Low
Radon Gas	Inhalation	N/A	Low	Residents and visitors	Low
Drinking water	Ingestion	Construction workers	Low	Residents and visitors	Low
Surface Water	Run-off Accidental spillage	Adjacent Sites	Low	Adjacent Sites River Cadoxton	Low
Groundwater	Leaching and groundwater leaching	Bedrock: Dolomitic Conglomerate classed as a Principal Aquifer	Low	Bedrock: Mercia Mudstone Group; Secondary B Aquifer	Low
Made Ground	Absorption and uptake of contaminated soil	Vegetation	Low	Vegetation	Low
Made Ground	Aggressive Ground Conditions	Building materials	Low	Building materials	Low

3.3 Preliminary Site Conceptual Model

The preceding sections enable a preliminary conceptual model of the site to be drawn up.
Below is a theorised conceptual model of the site. The drawing is generalised and not to scale.

South North



SECTION 4 Field Investigation

4.1 Site Works

A geotechnical and geo-environmental site investigation was carried out in June 2013 comprising ten trial pits, including three soakaway tests.

The trial pits were excavated using a JCB 3cx.

The fieldworks were supervised by Terra Firma (Wales) Limited and the trial pits and boreholes were logged to the requirements of BS5930:1999/EC7.

The detailed trial pit logs are presented in **Annex D**.

Their positions are shown on **Drawing 02.**

4.2 Ground Conditions

The ground conditions encountered can in general be summarised as shown in **Table 4.1.**

Table 4.1 Summary of Ground Conditions

Depth (m)			Thickness (m)	Stratum
GL	-	0.4/0.5	0.4/0.5	**TOPSOIL:** Soft light brown slightly sandy **CLAY,** fine roots
0.4/0.5	-	0.8/1.8	0.3/1.4	Firm occasionally firm to stiff red brown **CLAY**
0.8/1.8	-	1.9/2.8	0.1/2.0	Medium dense red brown occasionally blue grey clayey fine to coarse angular **GRAVEL** of mudstone occasionally friable.
1.9/2.8	-	>3.00	-	Very weak weathered red brown **MUDSTONE** recovered as fine to coarse angular gravel.

TP8 recorded topsoil to 0.20m underlain by stiff red brown CLAY to 0.70m underlain by firm red brown Clay to 2.60m.

4.3 Groundwater

No groundwater was encountered in any of the ten trial holes. The ground in the north of the site was occupied by reeds and is potentially an area where water will pool.

4.4 Laboratory Soil Chemical Testing

4.4.1 Exploratory Strategy and Sampling Regime

During the intrusive investigation, small disturbed soil samples were collected. The sampling regime was conducted in accordance with BS5930: 1999 in order to satisfy the following criteria:

- Identify and confirm suspected sources of contamination
- Determine type and concentration of contamination
- Determine lateral and vertical spread of contaminants
- Ensure representation of the entire site
- Provide sufficient data to determine suitable remedial measures if necessary

The sample locations and depths are listed in the following table.

Table 4.2 Sample Locations and Depths

Sample	Depth (m)	MCerts Sample Description
TP1	0.40	Brown very sandy CLAY with numerous rootlets
TP2	0.30	Brown very sandy CLAY with numerous rootlets
TP5	0.50	Brown very sandy CLAY with numerous rootlets
TP7	0.50	Brown very sandy CLAY with numerous rootlets
TP8	0.40	Brown very sandy CLAY with numerous rootlets
TP10	0.30	Brown very sandy CLAY with numerous rootlets

4.4.2 Laboratory Analysis

4.4.2.1 Standard Screening

The soil samples taken were despatched to the laboratories of Derwentside Environmental Testing Services Limited for laboratory chemical testing. The following chemical tests were undertaken:

Metals and Metalloids	**In-Organics**	**Others**
Lead	Cyanide	pH (acidity)
Arsenic	Sulphate	Organic Matter
Mercury		
Chromium		
Copper		
Nickel		
Zinc		
Selenium		
Cadmium		

Organic Chemicals
Phenol
Total Polycyclic Aromatic Hydrocarbons (PAHs)

The laboratory soil chemical test results are presented in **Annex E.**

SECTION 5 Soil Analytical Results

5.1 Soil Assessment Methodology

Comparison of the analytical results obtained from the site investigation with Soil Guideline Values (SGVs) sourced from The Environment Agency Contaminated Land Exposure Assessment (CLEA) Guidelines has been undertaken. Where SGV values are not available reference has been made to Generic Assessment Criteria (GAC) provided by Land Quality Management Limited and the Chartered Institute of Environmental Health (CIEH).

5.2 Soil Test Results

A summary of the soil chemical test results is given in the following table.

Table 5.1 Summary of Soil Chemical Test Results

Substance	SGV/GAC (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of exceedences
			Minimum	Maximum	
Arsenic	32	CLEA	5.9	9.1	0
Cadmium	10	CLEA	0.8	1.1	0
Chromium III	910	CIEH	26	37	0
Chromium VI	6	CIEH	<1.0	<1.0	0
Copper	2400	CIEH	16	22	0
Lead	200	C4SL	18	29	0
Mercury	170	CLEA	<0.05	<0.05	0
Nickel	180	CIEH	25	33	0
Selenium	350	CLEA	<0.5	3.3	0
Zinc	3700	CIEH	52	94	0
Cyanide	8	CLEA	<0.1	<0.1	0
Organic matter	-	-	0.6	2.3	-
Sulphate	2400	BRE	200	500	0
pH	-	-	8	8.3	-
Phenol	420	CLEA	<0.3	<0.3	0
Total PAH	*	CLEA	<1.6	<1.6	0

Notes:

- CLEA - Soil Guideline Values for residential development
- CIEH - Generic Assessment Criteria for a residential setting
- BRE - British Research Establishment (buried concrete risk assessment only, not human health related)
- A total of 6 samples were tested
- ^ CIEH Chromium, copper and zinc thresholds based on 6% organic matter

*The PAH is made of 16 speciates, each one contributing a maximum of 0.16mg/kg to the total results. As all speciate thresholds are greater than this then there are no exceedences.

SECTION 6 Quantitative Risk Assessment/Mitigation Measures

6.1 Potential Receptors

During Construction

- Construction workers
- Site Workers and visitors
- Neighbouring site users and passers-by
- The aquatic environment - Stream to the east, perched or deep groundwater within Mercia Mudstone

Following Construction

- Site End Users - Site residents and visitors
- Site End Users - Maintenance contractors
- The aquatic environment - Stream to the east, perched or deep groundwater within Mercia Mudstone

6.2 Contaminants

All substances tested for in soil were found to be present at concentrations below their regulatory guidelines or below the limits of laboratory detection.

6.3 Potential Pathways

6.3.1 Construction Workers

As no contamination was identified in site soils there are not considered to be any risks to the health of site construction workers.

However, construction workers should adhere to good site management, COSHH, good standards of hygiene and appropriate health & safety, use of personal protection equipment (PPE) and dust suppression where appropriate.

6.3.3 Neighbouring Site Users and Passers-by

Neighbouring site users and passers-by are not at risk.

6.3.3 Future Site Users

Site end users will not be at risk from exposure to site soils/soil dust through dermal contact, ingestion and inhalation pathways.

No remedial measures are therefore required.

Developers should carry out a risk assessment to determine the most suitable choice of portable water supply pipes.

If during development works any other unexpected ground conditions or evidence of contamination is found, inspection by a geo-environmental engineer should be made, and any required testing or investigation carried out prior to continuation of works.

No radon protection measures are required for the new development.

6.3.3 Future Site Users (Continued)

No risk from vapours has been identified.

Similarly there are no potential risks from ground gas.

6.3.4 Aquatic Environment

No contamination was evident in site soils and therefore there are not considered to be any risks to the aquatic environment.

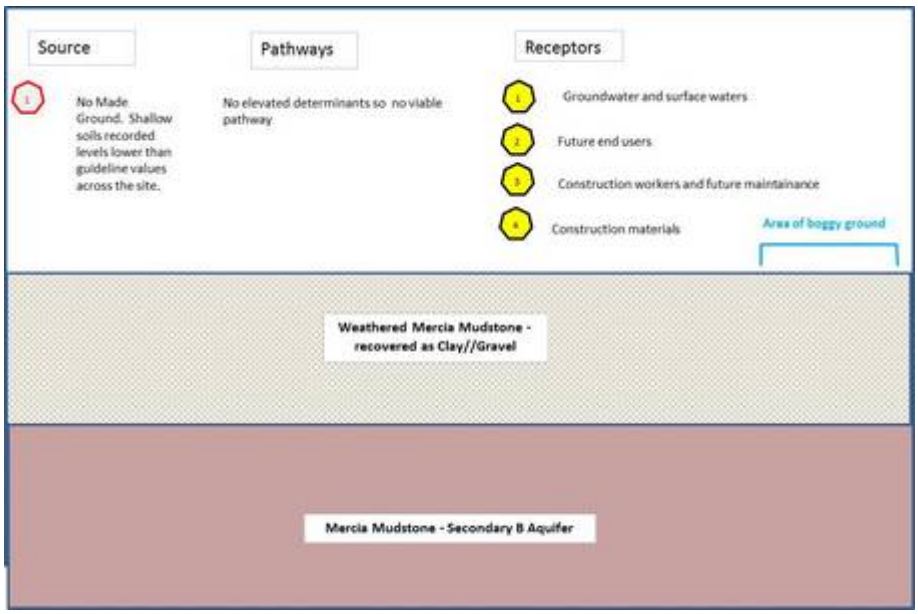
During the construction period, there is a risk to the environment/adjacent sites from de-watering, digging foundations, moving contaminated soil, drainage misconnections, discharges to local surface waters or the ground, runoff from construction materials and/or exposed ground, wheel washings and oil or chemical spills.

The risk is considered to be negligible as any adverse effects will be easily preventable by due diligence to good construction practise and housekeeping in preventing surface runoff and the spillage of materials. The basic measures that should be taken are as follows:

- Prepare a drainage plan and mark the manholes to prevent pollutants accidently reaching the surface water sewers;
- carry out any activities that could cause pollution in a designated, bunded area, away from rivers or boreholes. Where possible it should drain to the foul sewer;
- use settlement ponds to remove silty water;
- store all oils and chemicals in a fully bunded area to prevent leaks or spills;
- get advice on whether you need an environmental permit and apply in good time

6.4 Final Site Conceptual Model

South North



SECTION 7 Engineering Recommendations

7.1 Preparation of Site

All grass and scrub vegetation, as well as trees, including all roots should be grubbed up and removed from beneath the underside of the proposed building, car parking, hard standing areas and access roads.

The reduced levels should be brought up to the required levels with suitable inert mainly granular materials. Department of Transport (DoT) type 2 sub base or similar should be used and should be compacted in layers to the requirements of the Specification for Highway works.

Contingencies should also be made for the protection/diversion any underground services present beneath the site brought about as a result of the proposed works.

Allowances should be made for the excavation of any soft spots and buried obstructions and their replacement with well compacted imported granular materials as previously described.

Allowances should also be made for any unconsolidated or fill material associated with the former stream that traversed the site. Localised groundwater infiltrations may occur along the path of the former stream, and any inflows should be dealt with by suitable pumping techniques. The condition of the diverted stream/culvert should be assessed for damage and repaired appropriately and due consideration should be given to the easement of any culverts.

In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM2 (v. 2.3/2011) soils and other materials destined for off-site disposal should be classified on the basis of their hazard phrases prior to disposal. Soils are classified as a mirror entry waste and should be classified on the basis of their specific chemical properties. Terra Firma Wales Ltd offer this service if required.

7.2 Foundation and Floor Slab Solution

Traditional mass concrete strip/trench foundations are recommended for the properties founded within the underlying medium dense clayey gravel deposits found from 0.80 to 1.8m depth.

An allowable bearing pressure of 125kN/m^2 may be used for design purposes.

For the given foundation solution and bearing pressure, maximum total settlements of 25mm should result with differential movements of the superstructure not exceeding 1:750.

In order to prevent the effects of frost heave and/or thermal shrinkage the foundations should be at a minimum depth of 900mm below the finished ground level.

Provided all topsoil is removed from beneath the proposed buildings and replaced with well compacted imported materials as previously described then the floor slabs can be designed as suspended. However, in order to satisfy the National House Building Council (NHBC) Guidelines then if the fill exceeds 600mm the floor slabs should be designed as suspended.

7.2 Foundation and Floor Slab Solution (Continued)

Allowances should be made for the removal of any 'soft spots' and their replacement with well-compacted granular materials, as previously described.

All foundation formations should be inspected by a suitably qualified Engineer before being concreted.

During the investigation a samples of the in-situ clay were taken and submitted for plasticity testing. The results are given in **Annex F.** In line with the NHBC (Chapter 4.2), the modified plasticity index for the samples was calculated.

Table 7.1 Plasticity Test Results

Sample	Depth (m)	Soil Type	Plasticity Index (%)	Plasticity	Modified Plasticity Index (%)	Volume Change Potential
TP1	1.0	Silty CLAY	25	Intermediate	25	Medium
TP2	1.2	Silty CLAY	22	Intermediate	22	Medium
TP6	1.0	Silty CLAY	28	Intermediate	25.2	Medium

The National House Building Council (NHBC) Chapter 4.2 gives guidelines as to the appropriate depth of foundation based on the type of tree, distance of the foundation from the tree and the plasticity index of the in-situ materials.

All foundation formations should be inspected by a suitably qualified Engineer before being concreted.

7.3 Excavations and Formations

The shallow excavations should not encounter significant perched water/groundwater inflows. Any inflows together with rainwater infiltration should be dealt with by suitable pumping techniques. The northern section of the site had numerous reed plants present which would indicate marshy ground conditions and allowances should be made for seasonal variations in groundwater level.

It is recommended that any soft soils within this marshy area are removed if beneath proposed roads, hardstandings or buildings. In addition it may be required that further drainage is installed within this area.

The sides of any excavations deeper than 1.0m should be supported by planking and strutting or other proprietary means.

The sub-formations/formations will be susceptible to loosening, softening and deterioration by exposure to weather (rain, frost and drying conditions), the action of water (flood water or removal of groundwater) and site traffic.

Formations should never be left unprotected and continuously exposed to rain causing degradation, or left exposed/uncovered overnight, unless permitted by a qualified engineer.

7.3 Excavations and Formations (Continued)

Construction plant and other vehicular traffic should not be operated on unprotected formations. Allowances should be made for special precautions to prevent formation deterioration in addition to the above.

It is recommended that approval be gained from a qualified engineer of the formation condition before covering them with any subsequent construction.

7.4 Storm Drainage

During the investigation three in-situ soakaway tests were undertaken. The test locations are shown on **Drawing 02**.

No movement of water level was recorded in any of the three test holes. Consequently, soakaway drainage is not considered an option for this site.

7.5 Access and Car Parking

The proposed access roads and car parking areas will be within the underlying firm clay soils.

Results show that it is likely that a California Bearing Ratio (CBR) Value of 1-3% may be used for design purposes.

Allowances should be made for the removal of any ‘soft spots/areas’ and their replacement with well compacted granular materials as previously described.

It is recommended that field testing be carried out to confirm the California Bearing Ratio of all new formations.

7.6 Protection of Buried Concrete

Building materials are potentially at risk from sulphates, sulphides, magnesium ions, ammonium ions, carbon dioxide, chloride ions and phenols.

The laboratory soil chemical tests from the made ground revealed total sulphate content of between <200mg/kg and 500mg/kg and pH levels of between 8.0 and 8.3.

When these results are compared with Table C1 of BRE Digest 1:2005, it indicates that all buried concrete should most likely as a minimum conform to Class AC-1.

7.7 CBR Tests

In February 2017, Terra Firma (Wales) Ltd carried out 11 CBR tests across the site using a TRL probe. The CBR's were carried out from ground level to 1.0m. The locations of the tests are shown in **Drawing 03** and the results are presented in **Table 7.2**.

The approximate CBR value at between 0.35m and 0.60m depth is given below and considerable variation in the data can be seen. Additional CBR values are presented in **Annex G**.

Table 7.2 CBR Test Results

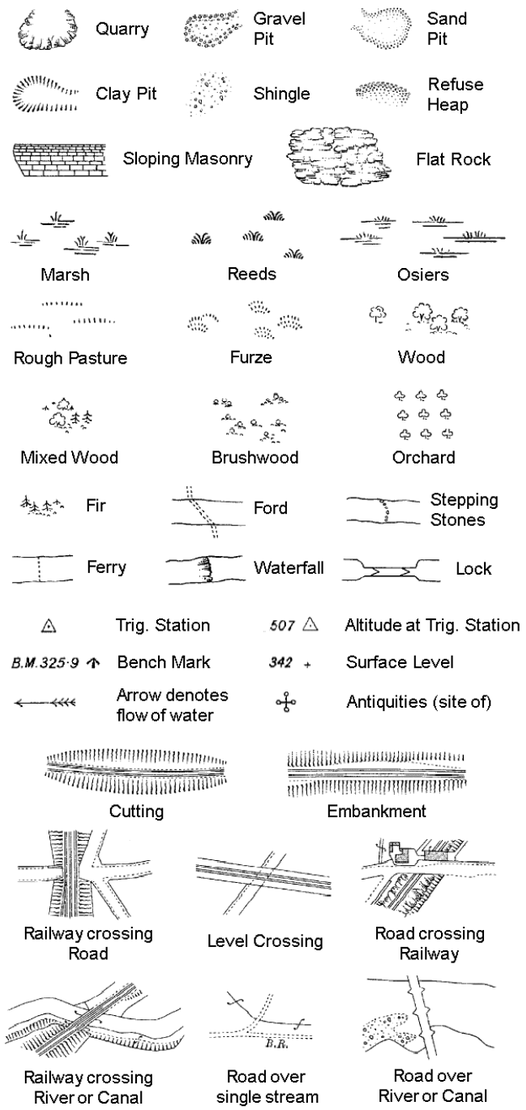
CBR Test ID	Depth to layer bottom (mm)	CBR Value (%)
1	435	7
2	180	7
3	440	5
4	460	5
5	590	6
6	420	6
7	550	5
8	415	5
9	425	6
10	400	5
11	350	5

The TRL probes were carried out following a few days of heavy rain, consequently the top approximately 0.30m was very soft.

ANNEX A
Historical Maps

Historical Mapping Legends

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



County Boundary (Geographical)

County & Civil Parish Boundary

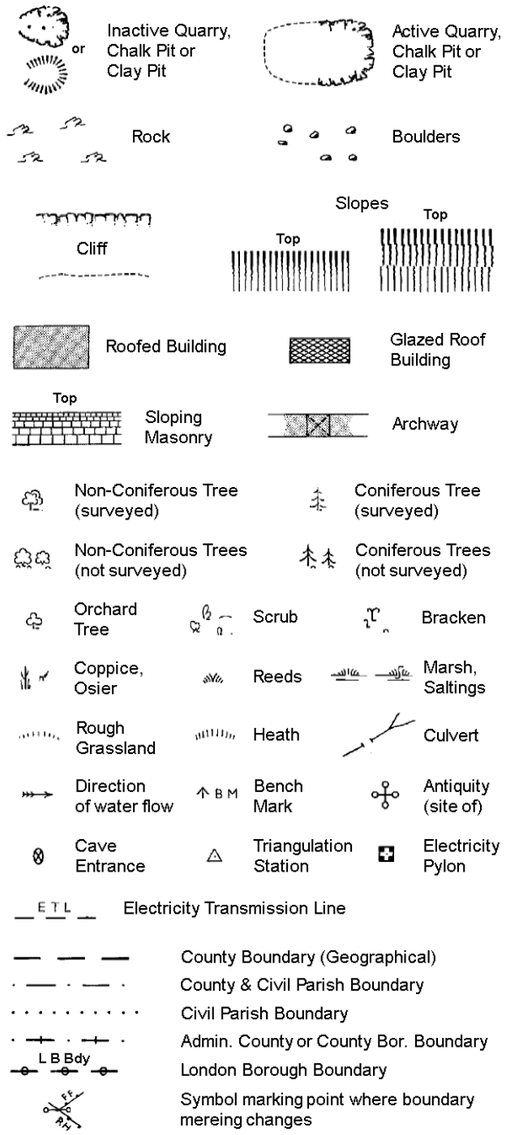
Administrative County & Civil Parish Boundary

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

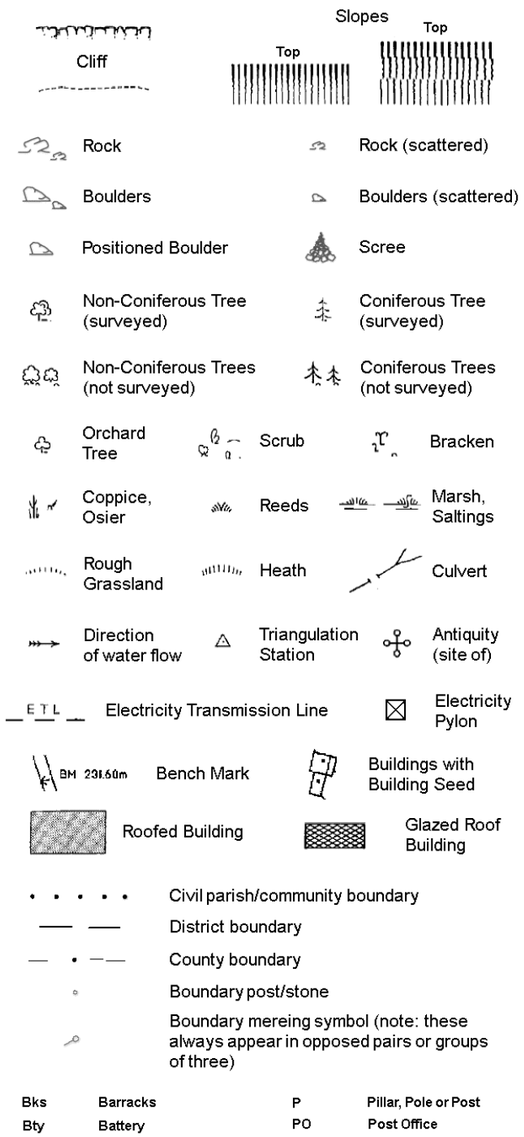
Admin. County or County Bor. Boundary

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

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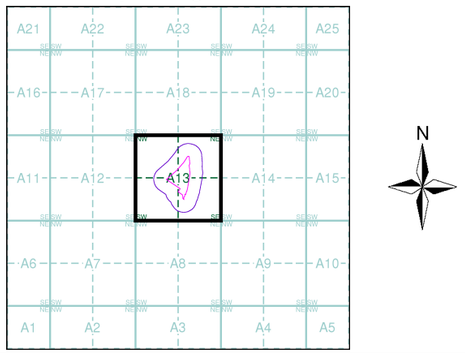
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Glamorganshire	1:2,500	1878 - 1881	2
Glamorganshire	1:2,500	1900	3
Glamorganshire	1:2,500	1920	4
Glamorganshire	1:2,500	1941 - 1942	5
Ordnance Survey Plan	1:2,500	1971	6
Additional SIMs	1:2,500	1977	7
Additional SIMs	1:2,500	1977 - 1988	8
Ordnance Survey Plan	1:2,500	1982 - 1991	9
Additional SIMs	1:2,500	1987	10
Large-Scale National Grid Data	1:2,500	1992	11
Large-Scale National Grid Data	1:2,500	1997	12

Historical Map - Segment A13



Order Details

Order Number: 46777449_1_1
Customer Ref: 12224
National Grid Reference: 316460, 171750
Slice: A
Site Area (Ha): 2.79
Search Buffer (m): 100

Site Details

Land off Caerleon Road, Dinas Powys, CF64 4PW

Landmark® Information Group

Tel: 0844 844 9952
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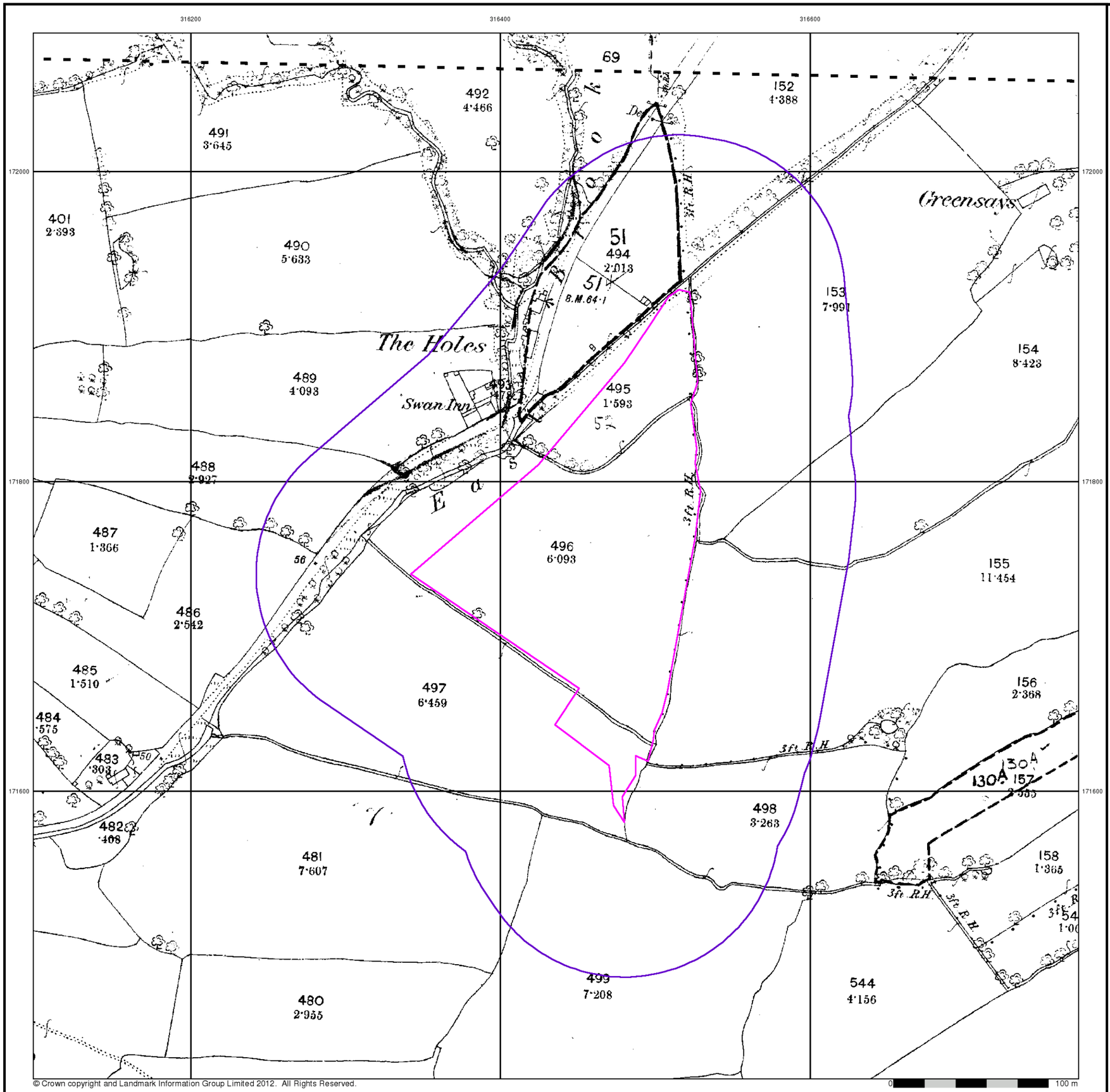

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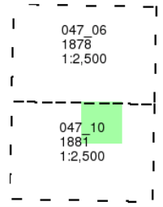
Glamorganshire

Published 1878 - 1881

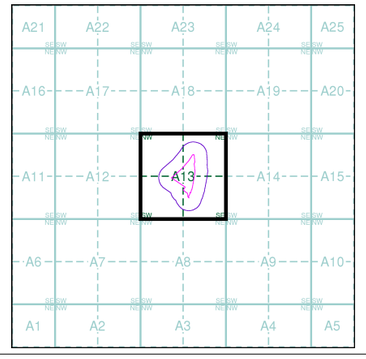
Source map scale - 1:2,500

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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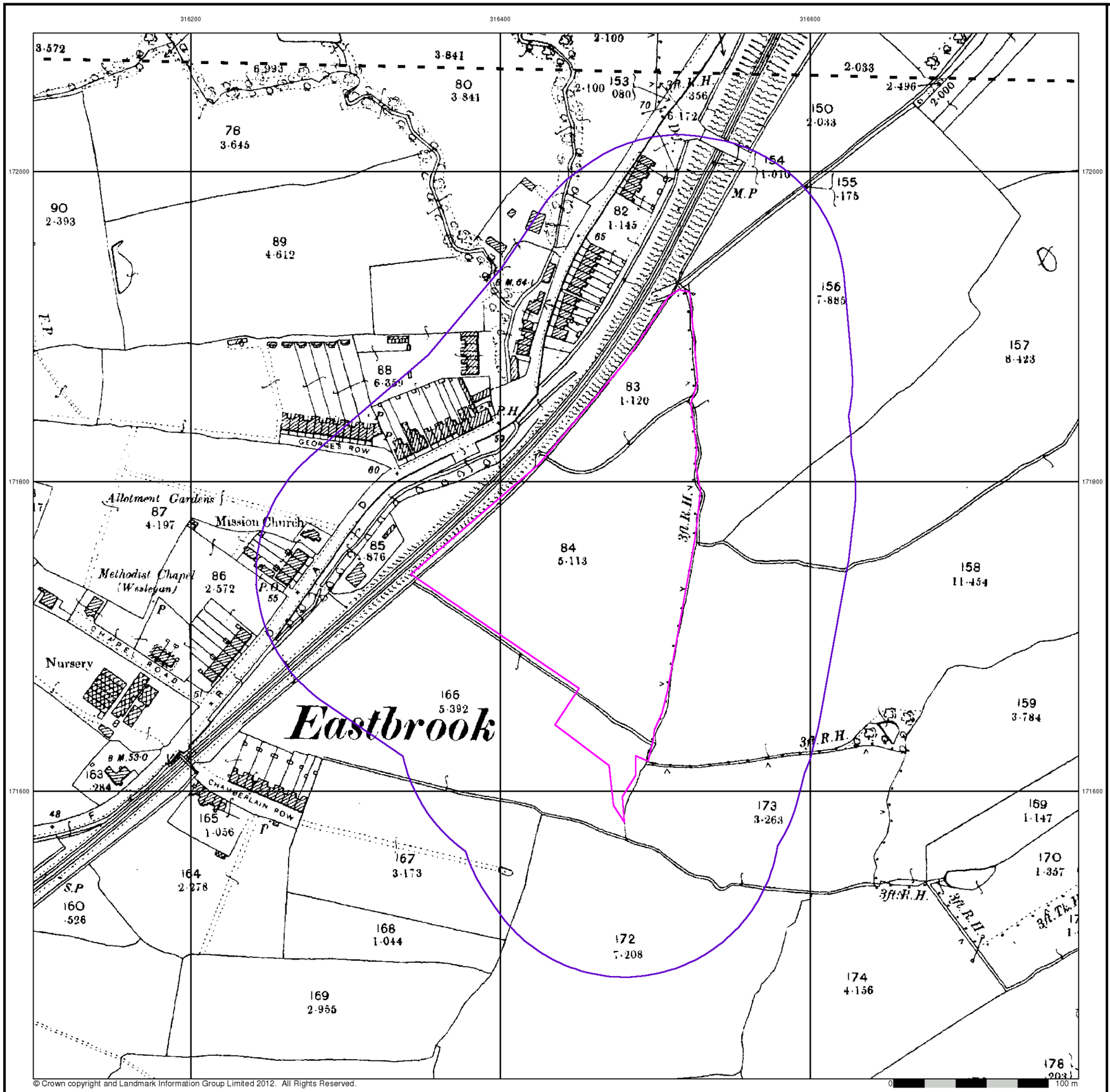

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Glamorganshire

Published 1900

Source map scale - 1:2,500

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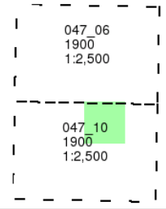
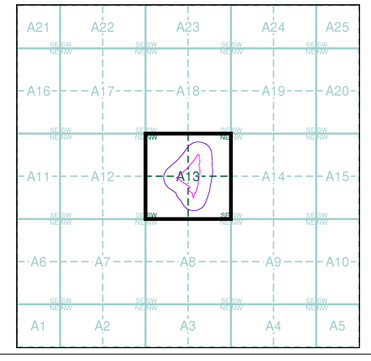


Historical Map - Segment A13



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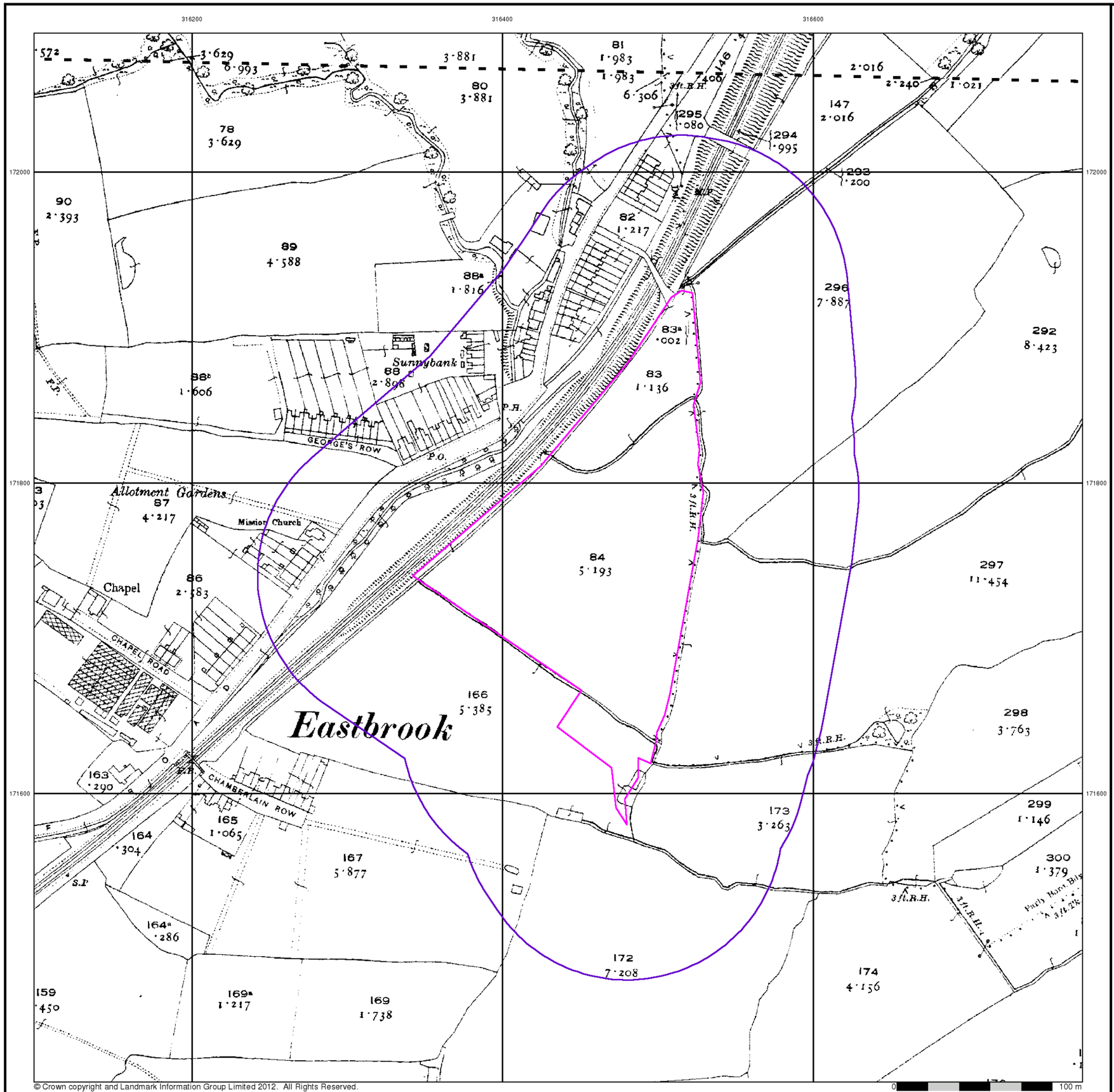

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Glamorganshire

Published 1920

Source map scale - 1:2,500

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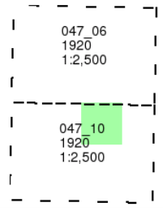
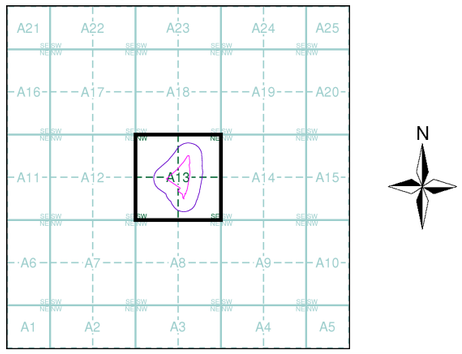
Map Name(s) and Date(s)



Historical Map - Segment A13



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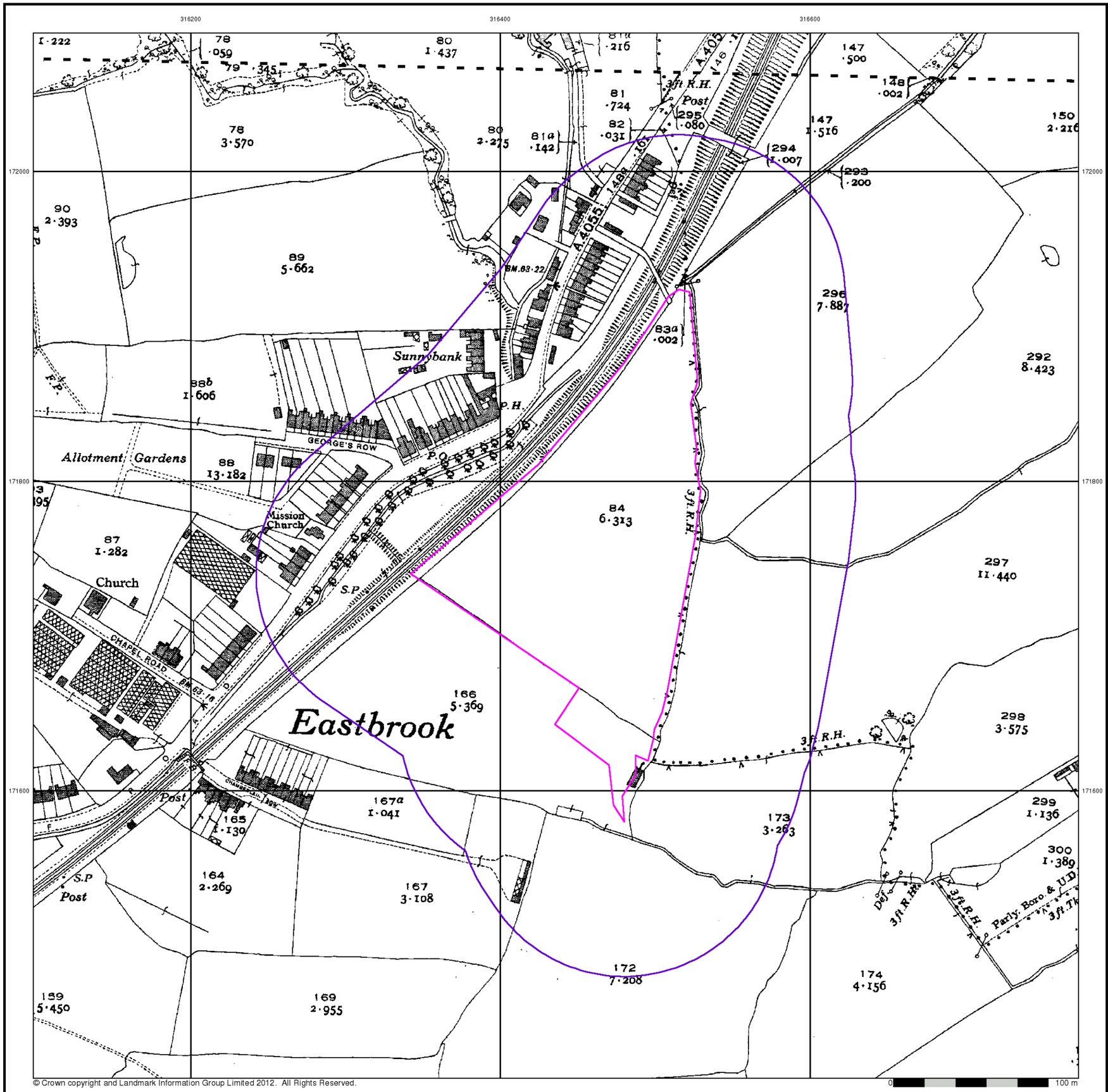
Site Details

Land off Caerleon Road, Dinas Powys, CF64 4PW



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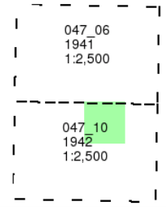
Glamorganshire

Published 1941 - 1942

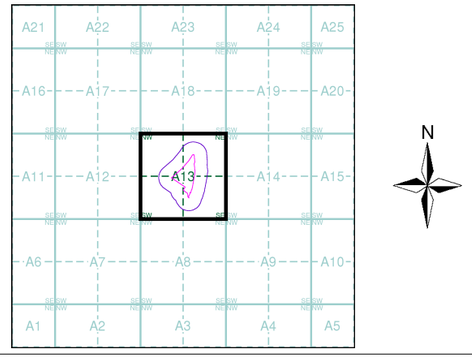
Source map scale - 1:2,500

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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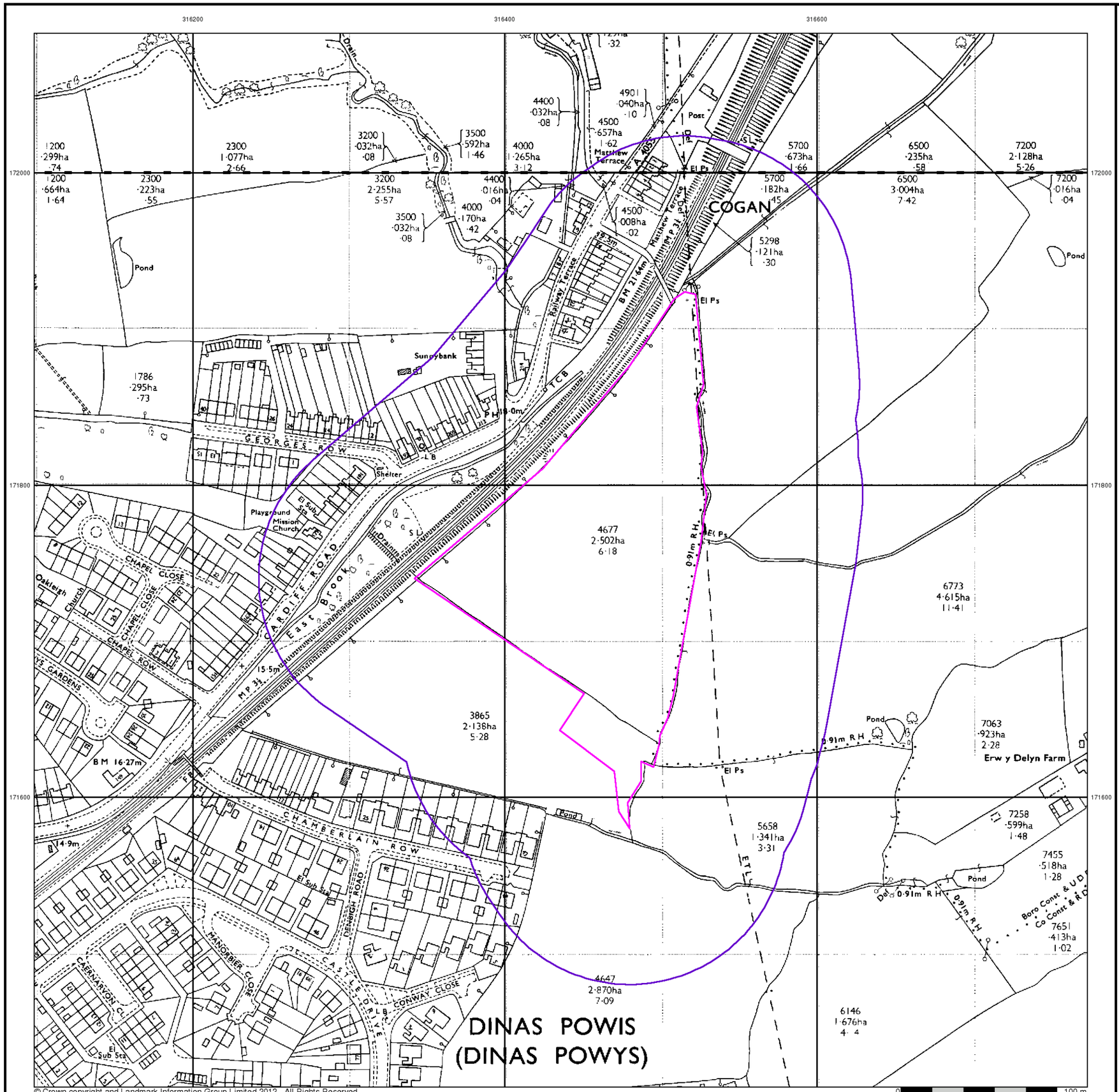

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Ordnance Survey Plan

Published 1971

Source map scale - 1:2,500

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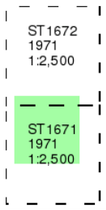
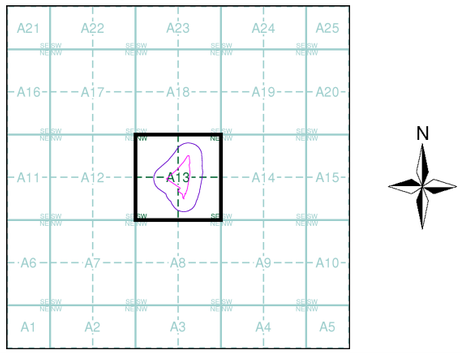
Map Name(s) and Date(s)



Historical Map - Segment A13



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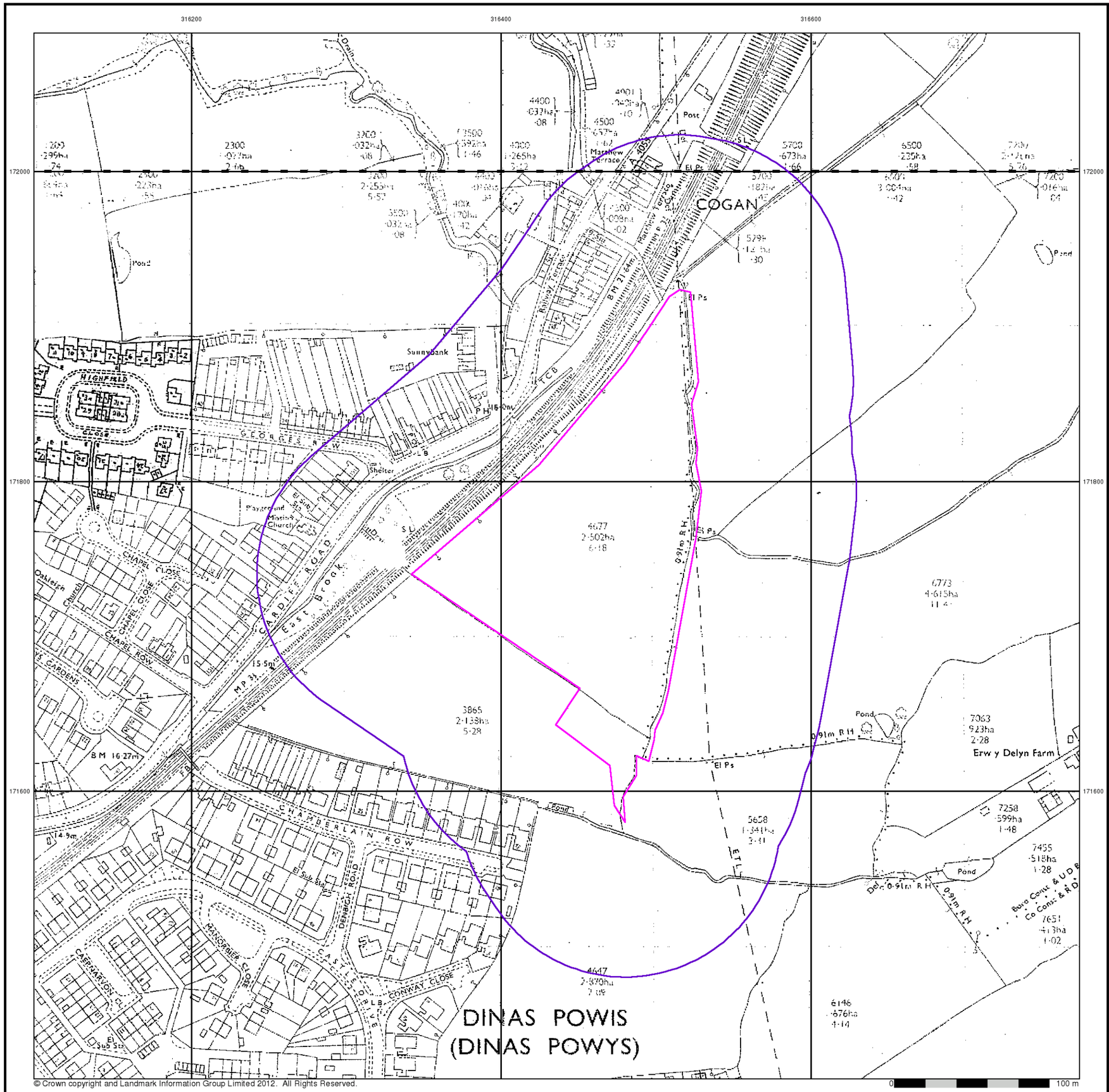


terrafirma

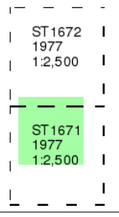
Additional SIMs

Published 1977

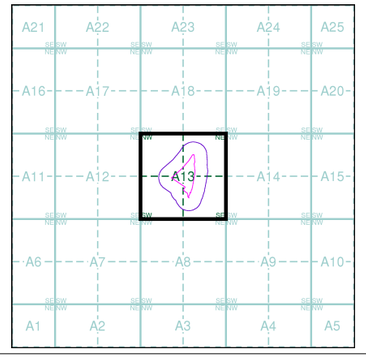
Source map scale - 1:2,500

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



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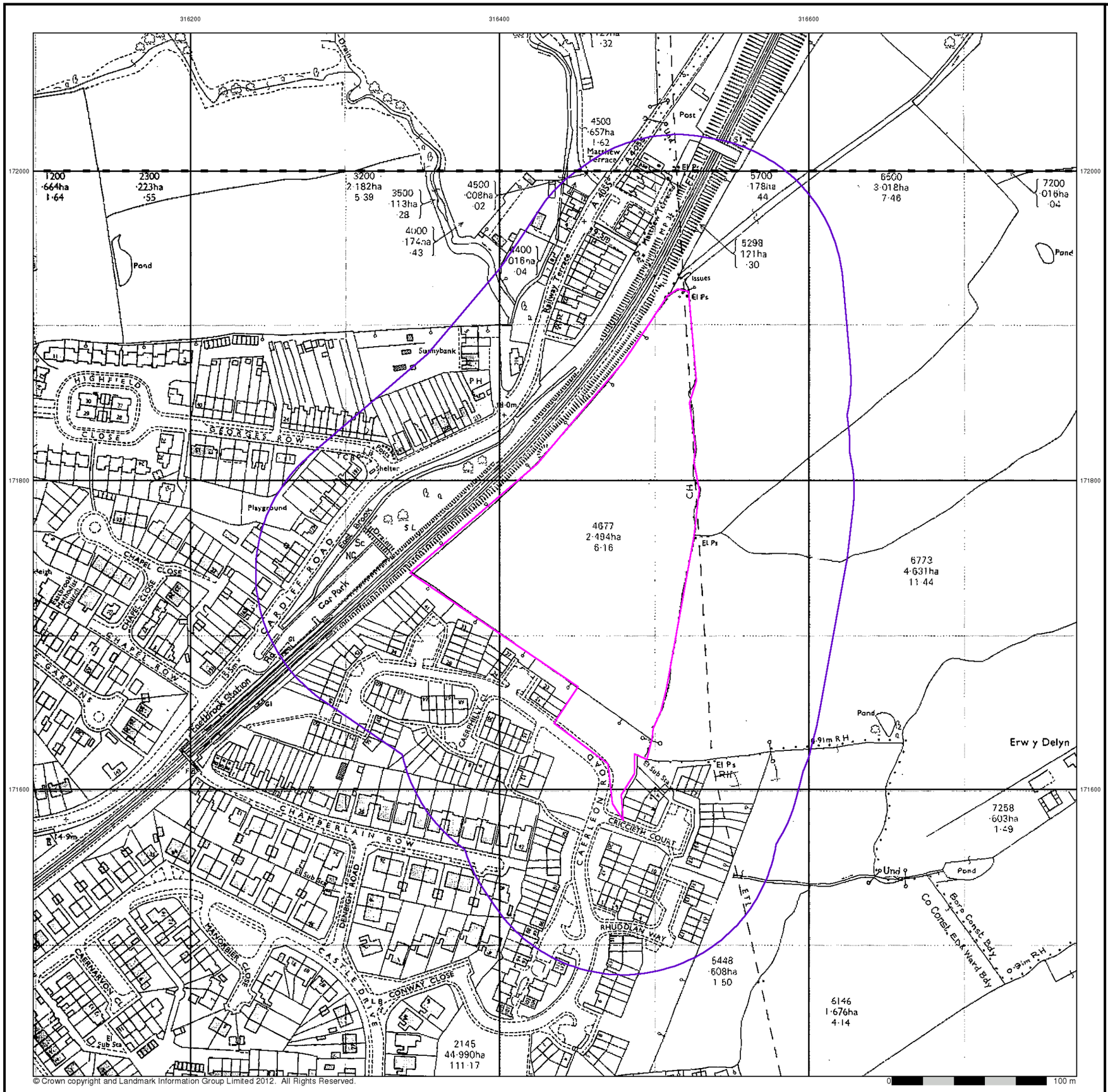


terrafirma

Additional SIMs

Published 1977 - 1988

Source map scale - 1:2,500

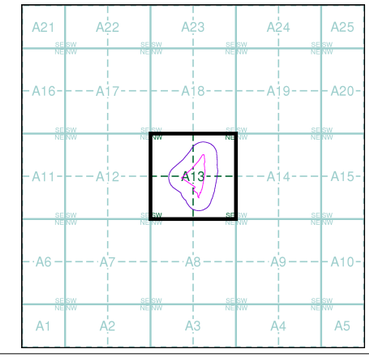
The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps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

Map Name(s) and Date(s)

ST1672
1977
1:2,500

ST1671
1988
1:2,500

Historical Map - Segment A13



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Slice:	A
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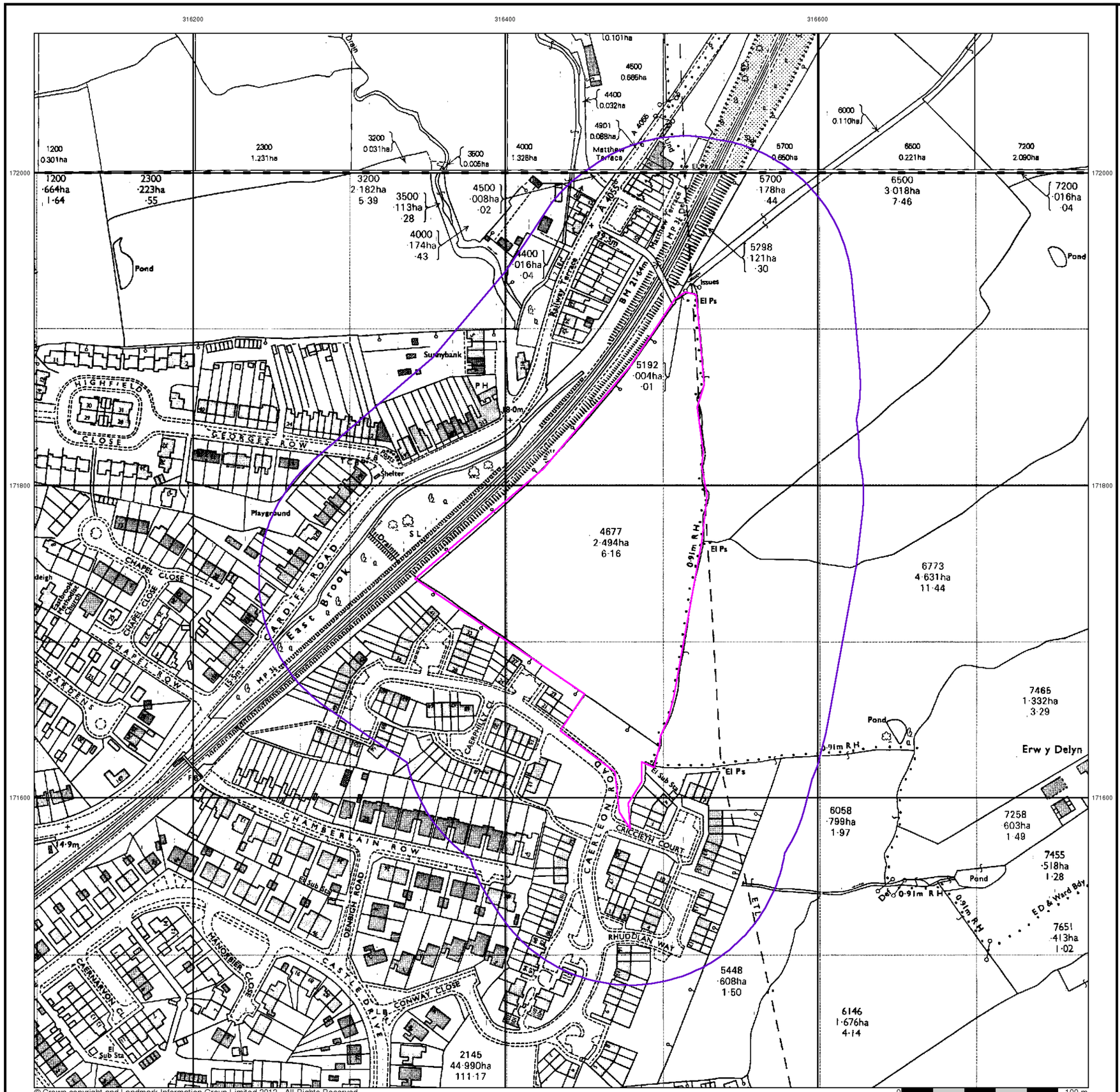

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Ordnance Survey Plan

Published 1982 - 1991

Source map scale - 1:2,500

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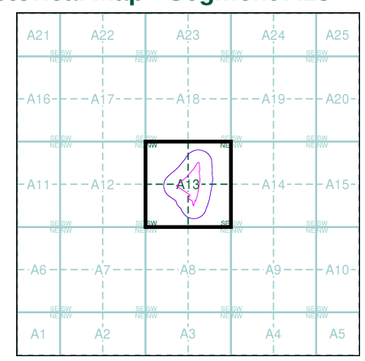
Map Name(s) and Date(s)

ST1672
1991
1:2,500

ST1671
1982
1:2,500

Historical Map - Segment A13



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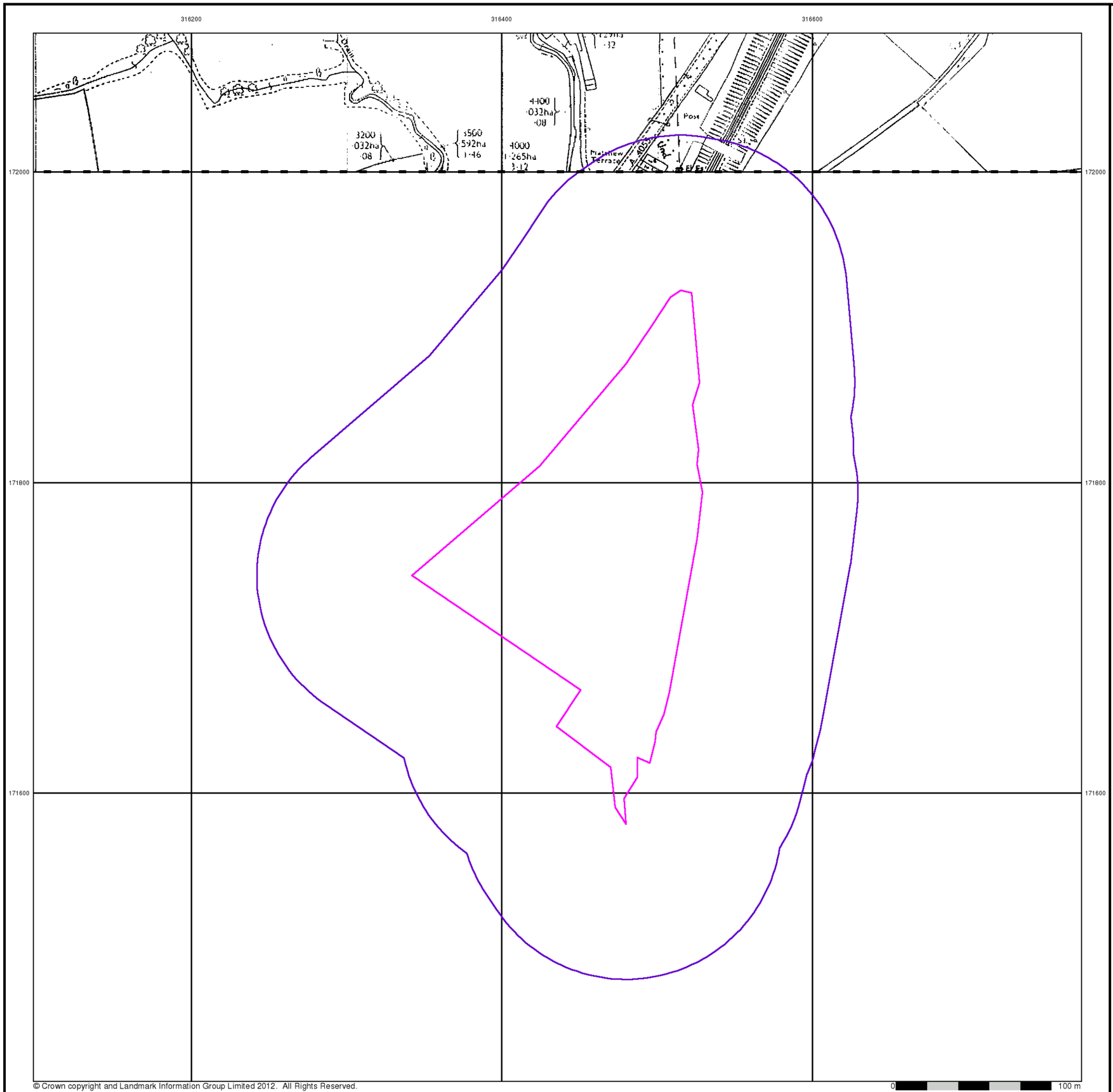


terrafirma

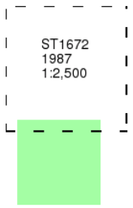
Additional SIMs

Published 1987

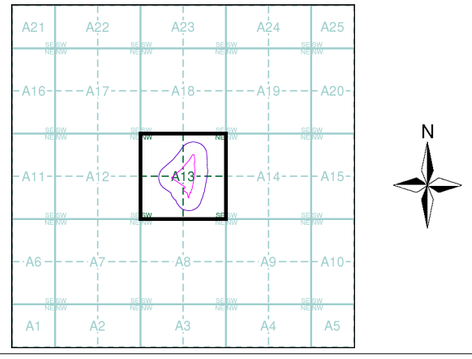
Source map scale - 1:2,500

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



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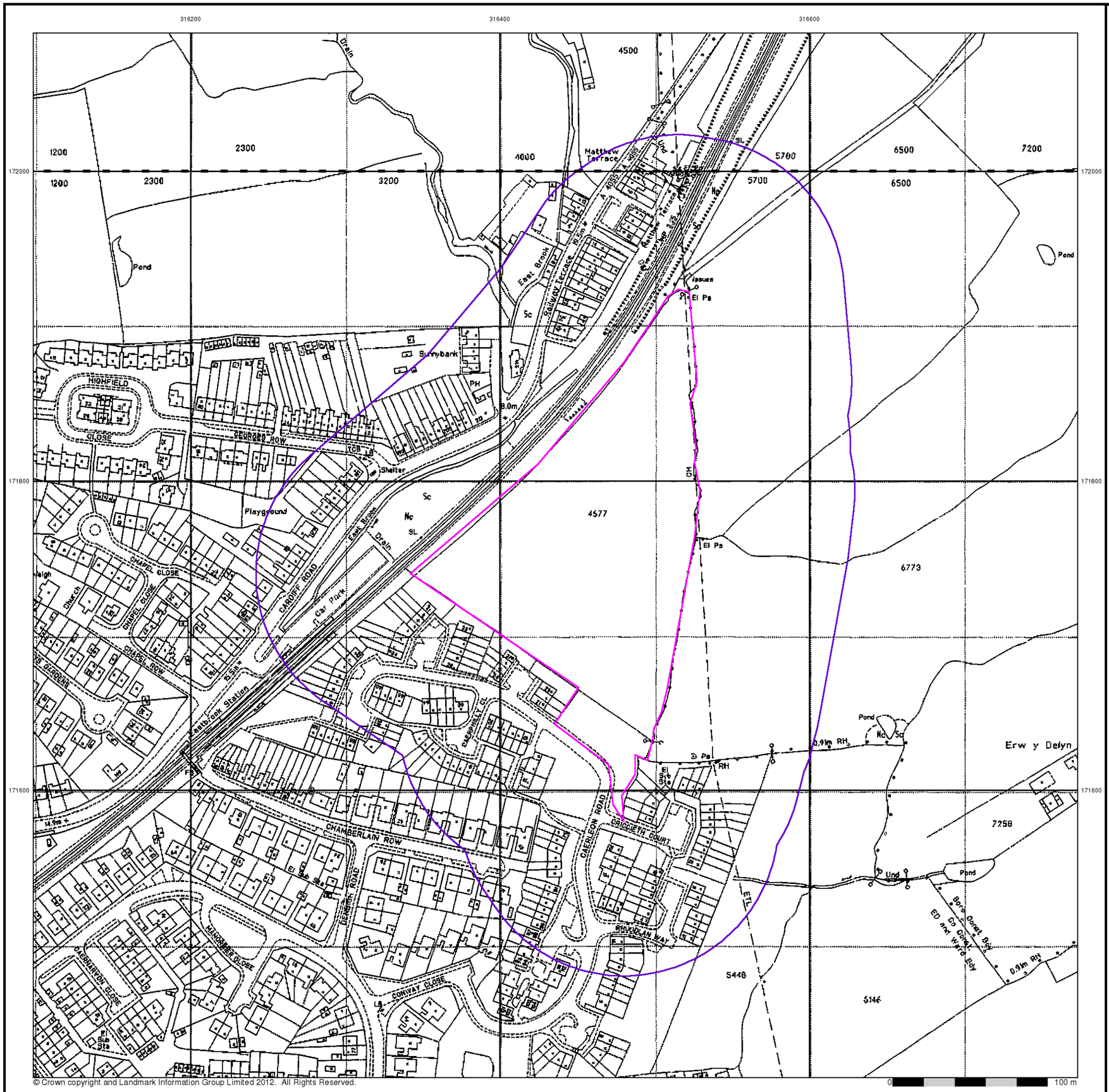


terrafirma

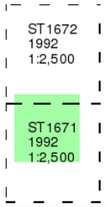
Large-Scale National Grid Data

Published 1992

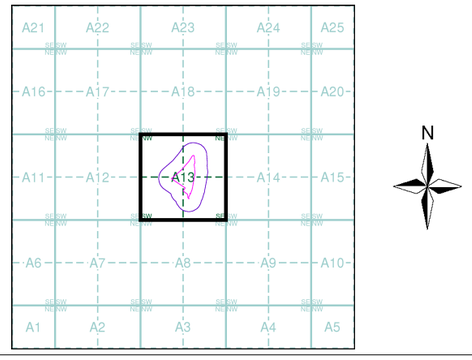
Source map scale - 1:2,500

'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:	46777449_1_1
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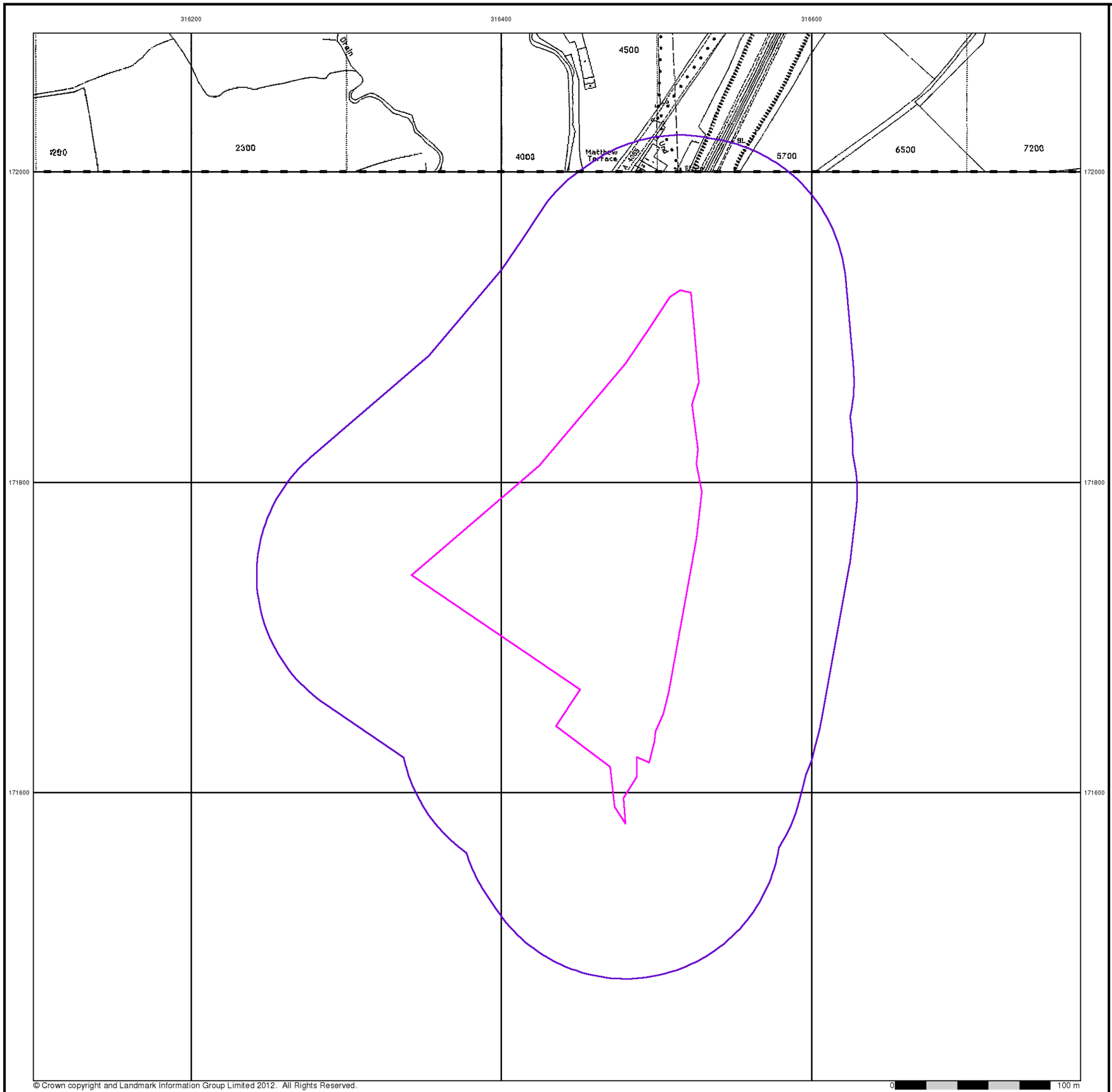


terrafirma

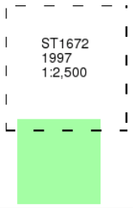
Large-Scale National Grid Data

Published 1997

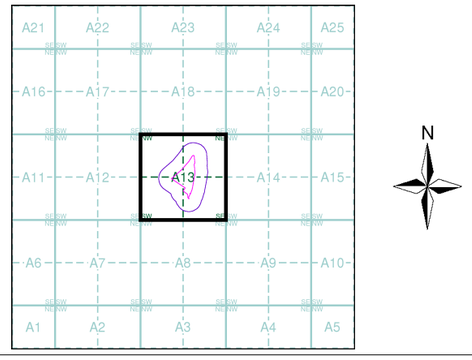
Source map scale - 1:2,500

'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



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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
Fenced
Un-Fenced
Minor Roads
Fenced
Un-Fenced
Sunken Road
Raised Road
Road over Railway
Railway over River
Railway over Road
Level Crossing
Road over River or Canal
Road over Stream
Road over Stream
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)
R.D. Bdy. 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
Coppice
Bracken
Heath
Rough Grassland
Marsh
Reeds
Saltings
Building
Direction of Flow of Water
Shingle
Sand
Glasshouse
Pylon
Electricity Transmission Line
Pylon
Sloping Masonry
Pole
Cutting
Embankment
Standard Gauge Multiple Track
Road Under
Road Over
Level Crossing
Foot Bridge
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
Shown only when not coincident with other boundaries
Civil Parish
Shown alternately when coincidence of boundaries occurs

BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Convenience
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Call Box
MP	Mile Post	TCP	Telephone Call Post
MS	Mile Stone	W	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
MHW(S) Mean high water (springs)
MLW(S) Mean low water (springs)
Telephone line (where shown)
Electricity transmission line (with poles)
BM 123.45 m 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

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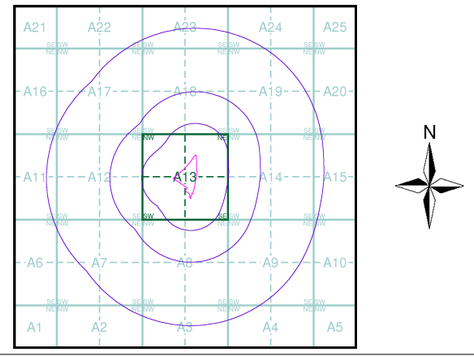
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Glamorganshire	1:10,560	1885	3
Glamorganshire	1:10,560	1901	4
Glamorganshire	1:10,560	1922	5
Glamorganshire	1:10,560	1922	6
Glamorganshire	1:10,560	1922	7
Glamorganshire	1:10,560	1938 - 1947	8
Glamorganshire	1:10,560	1947 - 1950	9
Historical Aerial Photography	1:10,560	1947	10
Historical Aerial Photography	1:10,560	1947	11
Ordnance Survey Plan	1:10,000	1965	12
Ordnance Survey Plan	1:10,000	1974	13
Cardiff	1:10,000	1982	14
Ordnance Survey Plan	1:10,000	1984	15
Ordnance Survey Plan	1:10,000	1996	16
10K Raster Mapping	1:10,000	2006	17
10K Raster Mapping	1:10,000	2013	18

Historical Map - Slice A



Order Details

Order Number: 46777449_1_1
Customer Ref: 12224
National Grid Reference: 316460, 171750
Slice: A
Site Area (Ha): 2.79
Search Buffer (m): 1000

Site Details

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Russian Military Mapping Legends

1:5,000 and 1:10,000 mapping

a. Not drawn to scale b. Drawn to scale

- Government and Administrative Buildings
- Military and Industrial Buildings
- Military and Communication Areas
- Subway Entrance
- Fireproof Building
- Prominent Fireproof Building
- Non-fireproof Building
- Non-fireproof Building (non-dwelling)
- Factory, mill, and flour mill, with chimneys
- Factory, mill, and flour mill, without chimneys
- Power Station, drawn to scale
- Hydroelectric Power Station
- Radio Station, drawn to scale
- Telephone Station, drawn to scale
- Abandoned Open-pit Mine or Quarry
- Open-pit Salt Mine
- Pit
- Oil Deposit or Well
- Oil Seepage
- Tailings Pile
- Fuel Storage Tanks
- Natural Gas Tank
- Bench Mark
- Drill Hole
- Burial Mound
- Triangulation Point on Burial Mound
- Single-track Railroad
- Double-track Railroad and Station Building
- Coniferous Forest
- Deciduous Forest
- Mixed Forest
- Lawns
- Citrus Orchard
- Wet Ground
- Scattered Vegetation
- 243,8 — Values for prominent elevations
- 186.0 — Numbers for spot elevations, depth soundings, contour lines, etc.
- 0,2 — Velocity of the current, width of river bed, depth of river
- Fractional terms: length and capacity of bridges; depth of fords and condition of the river bottom; height of forest and the diameter of trees

Russian Alphabet (For reference and phonetic interpretation of map text)

А а (A)	З з (Z)	П п (P)	Ч ч (CH)
Б б (B)	И и (I)	Р р (R)	Ш ш (SH)
В в (V)	Й й (Y)	С с (S)	Щ щ (SHCH)
Г г (G)	К к (K)	Т т (T)	ъ (–)
Д д (D)	Л л (L)	У у (U)	ы (Y)
Е е (E)	М м (M)	Ф ф (F)	ь (')
Ё ё (YO)	Н н (N)	Х х (KH)	Э э (E)
Ж ж (ZH)	О о (O)	Ц ц (TS)	Ю ю (YU or IU)
			Я я (YA or IA)

1:25,000 mapping

a. Not drawn to scale b. Drawn to scale

- Government and Administrative Buildings
- Military and Industrial Buildings
- Military and Communication Areas
- Subway Entrance
- Partly Demolished Buildings
- Demolished Buildings
- Built-Up Area with Fireproof Buildings Predominant
- Built-Up Area with Non-Fireproof Buildings Predominant
- Individual Fireproof Building
- Prominent Industrial Building
- Individual Dwelling, Fireproof
- Ruins of an Individual Dwelling
- Factory or Mill Chimney
- Factory or Mill with Chimney
- Factory or Mill without Chimney
- Mine or Open Pit Mine
- Operating Shaft or Mine
- Non-Operating Shaft or Mine
- Salt Mine
- Tailings Pile
- Pit
- Stone Quarry
- Gas Pump or Service Station
- Fuel Storage or Natural Gas Tank
- Oil or Natural Gas Derrick
- Small Hydroelectric Power Station
- Power Station
- Transformer Station
- Cemetery
- Burial Mound (height in metres)
- Triangulation Point on Burial Mound
- Triangulation Point
- Bench Mark
- Bench Mark (monumented)
- Telegraph Office
- Telephone Station
- Radio Station
- Radio Tower
- Airfield or Seaplane Base
- Landing Strip
- Main Highway
- Highway under Construction
- Improved Dirt Road (former truck road)
- Double-track Railroad with First Class Station
- Dismantled Railroad
- Railroad Under Construction
- Shore Embankment
- River or Ditch with Embankment
- Direction and velocity of current
- Well
- Water Reservoir or Rain Water Pit
- Spring
- Isobath with value
- Heavy (Index) Contour Line
- Contour Line and Value
- Half Contour Line
- Spot Elevation Value
- Coniferous
- Deciduous
- Mixed
- Scrub

Key to Numbers on Mapping

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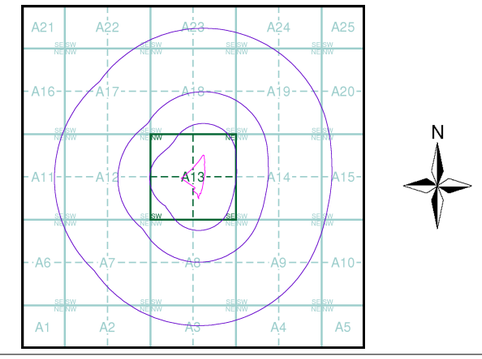
10K Raster Mapping	1:10,000	2006	17
10K Raster Mapping	1:10,000	2013	18

Russian Map - Slice A



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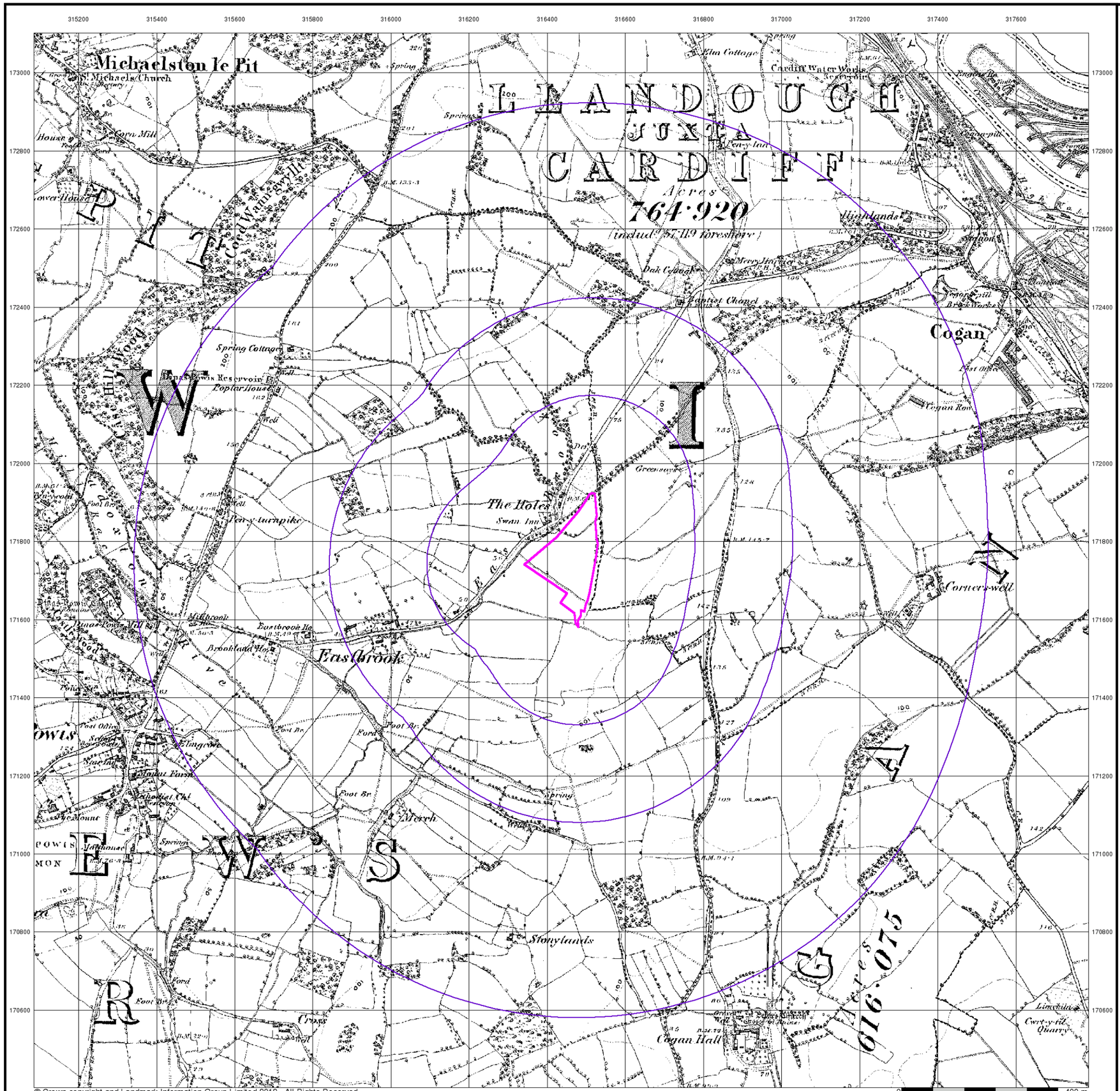

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Glamorganshire

Published 1885

Source map scale - 1:10,560

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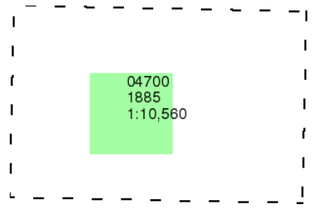
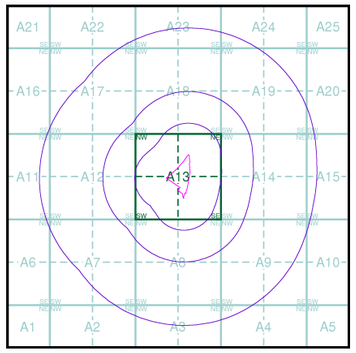
Map Name(s) and Date(s)



Historical Map - Slice A



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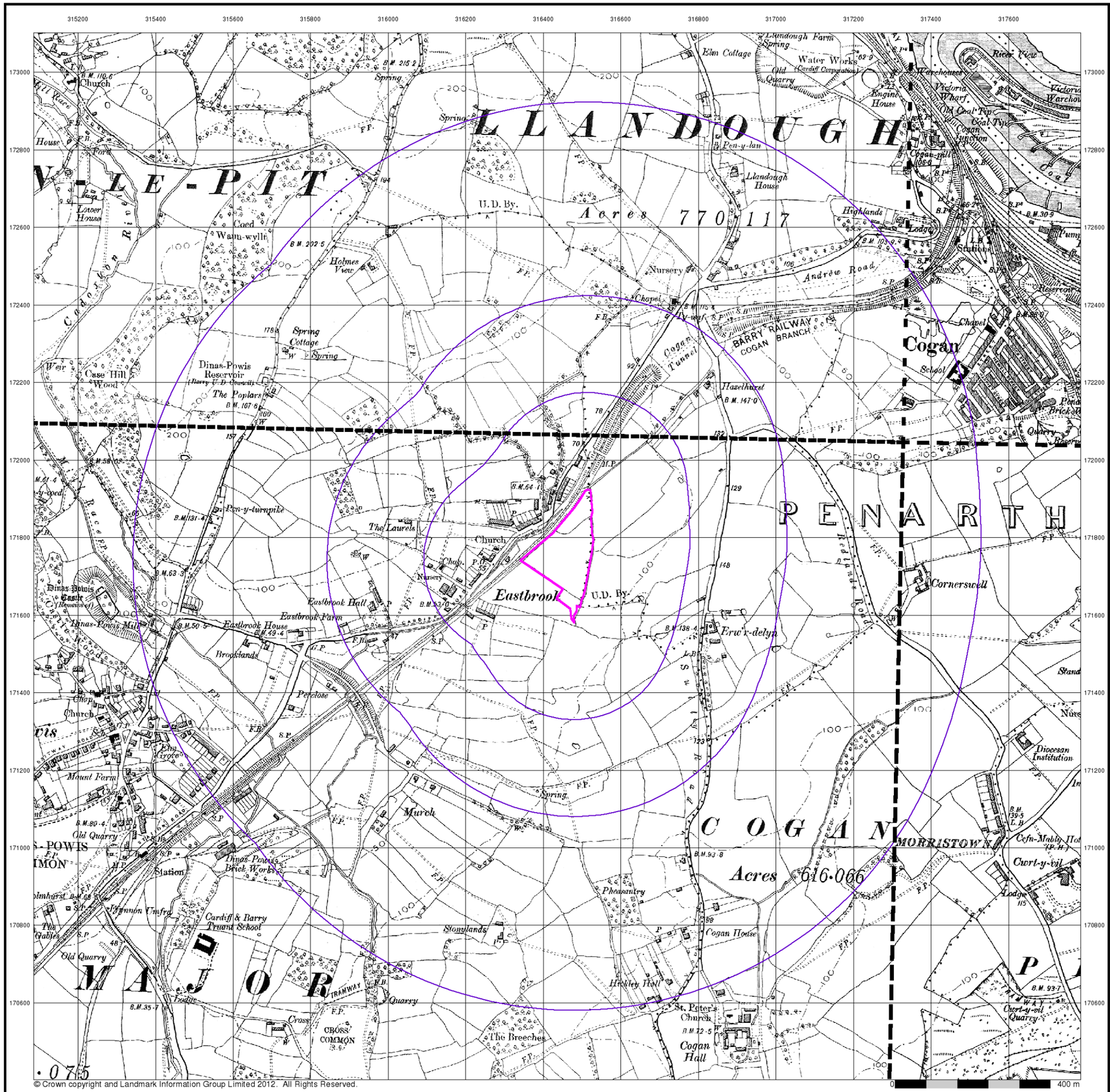

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Glamorganshire

Published 1901

Source map scale - 1:10,560

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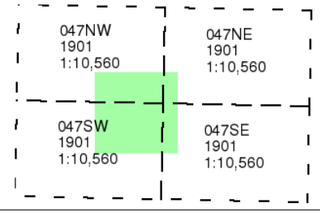
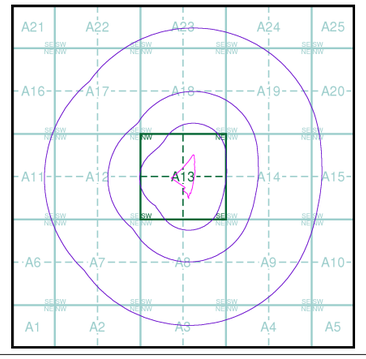


Historical Map - Slice A



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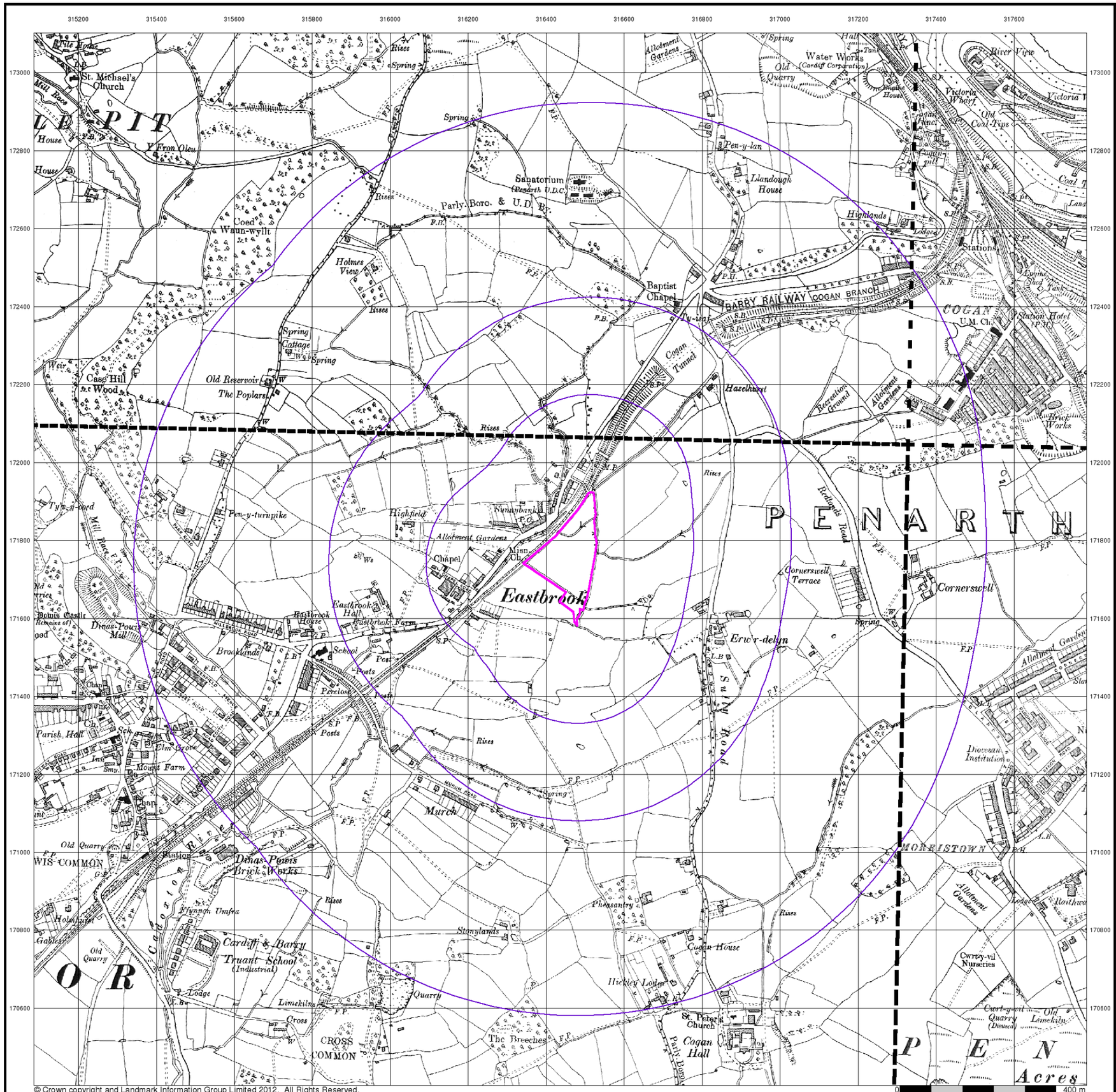

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Glamorganshire

Published 1922

Source map scale - 1:10,560

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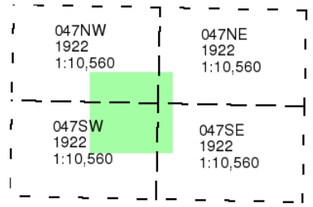
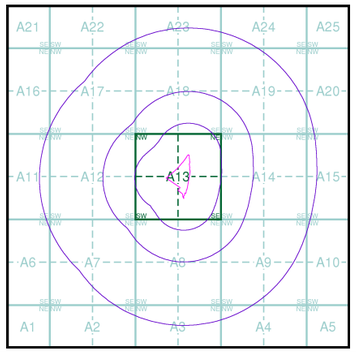
Map Name(s) and Date(s)



Historical Map - Slice A



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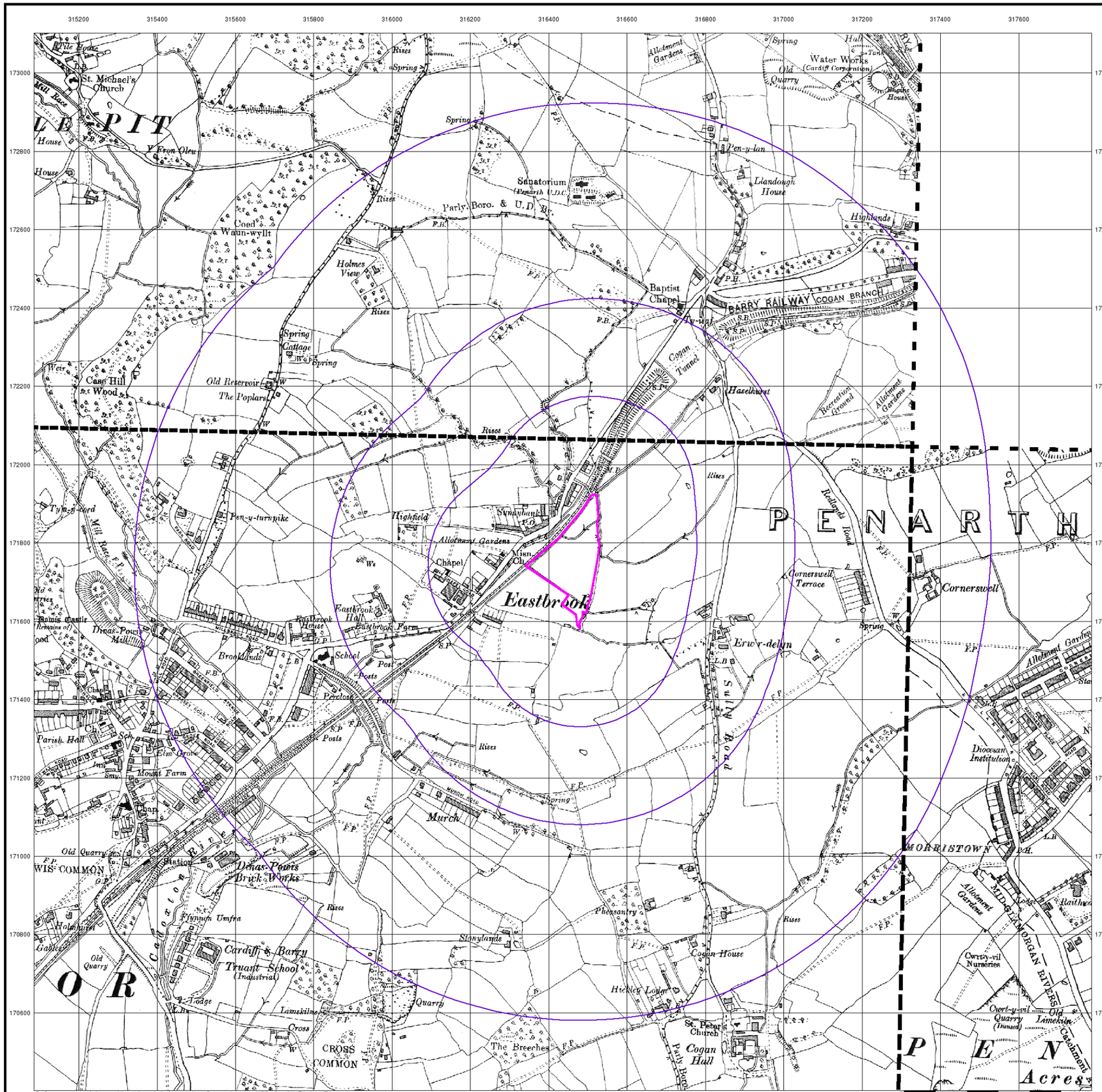

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Glamorganshire

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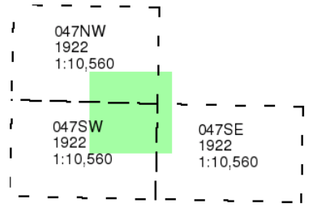
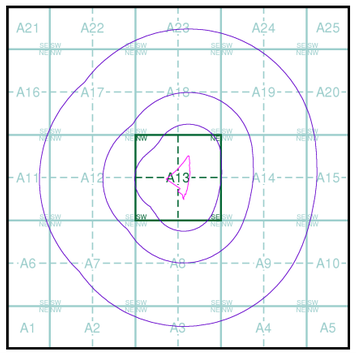


Historical Map - Slice A



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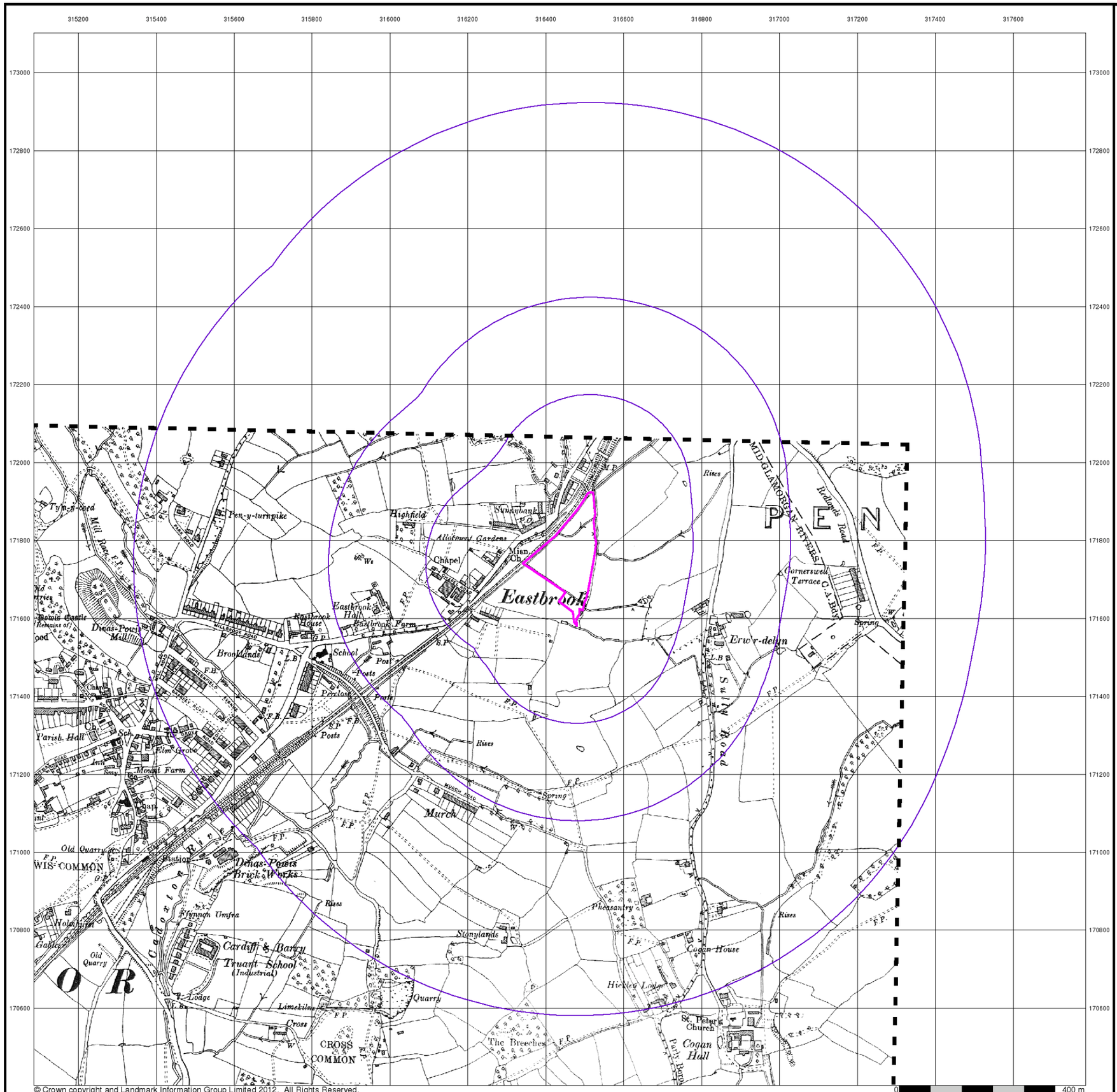

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Glamorganshire

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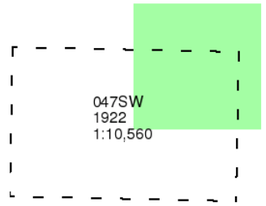
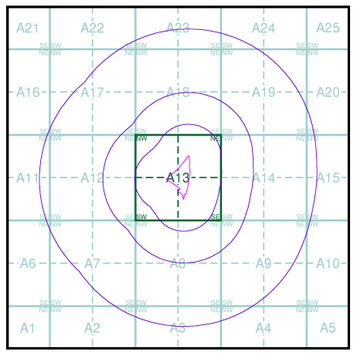


Historical Map - Slice A



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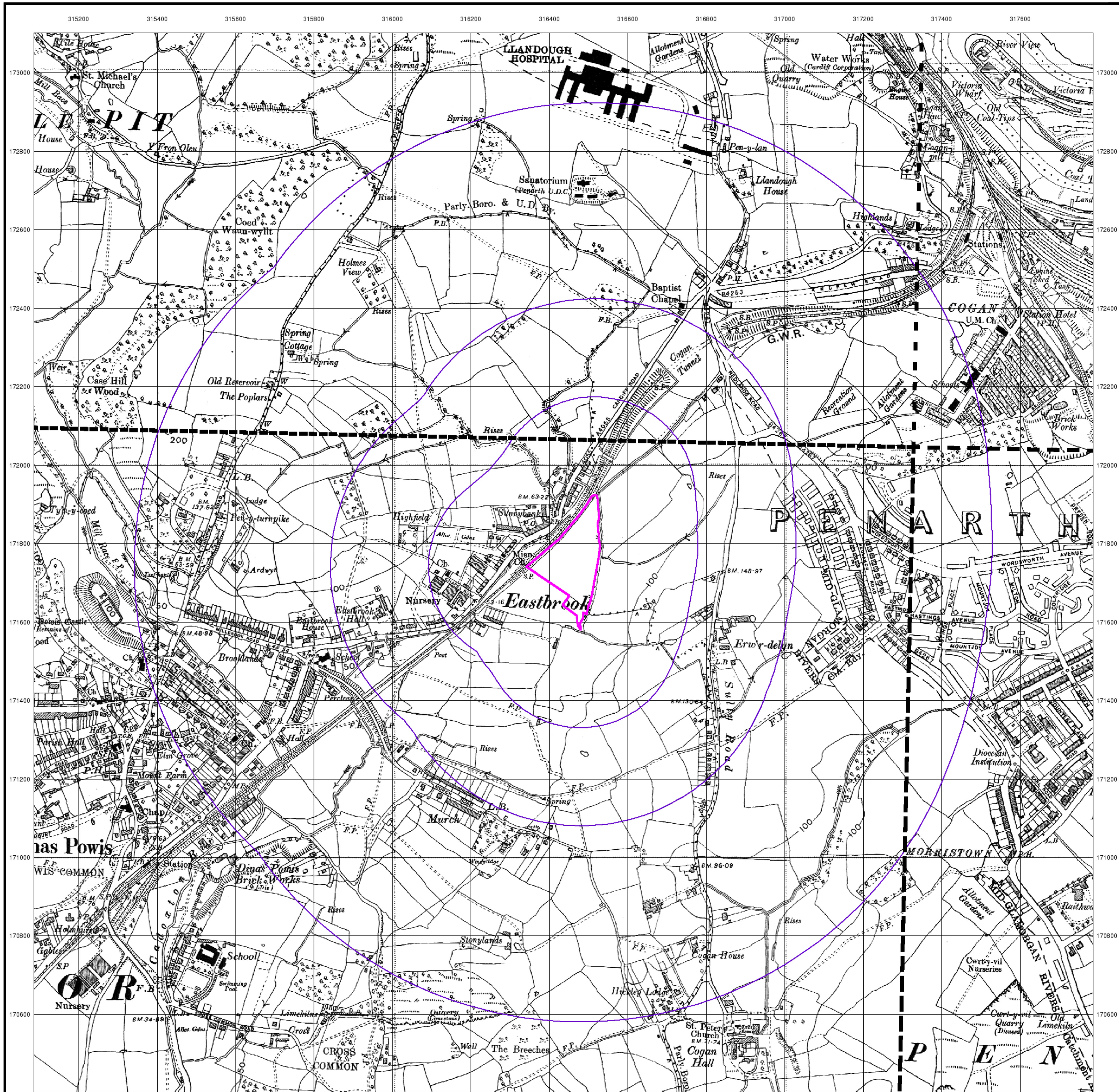

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Glamorganshire

Published 1938 - 1947

Source map scale - 1:10,560

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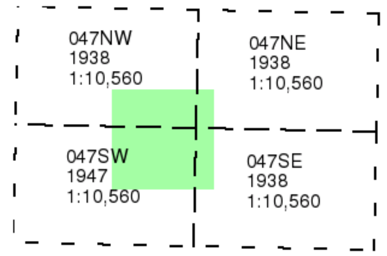
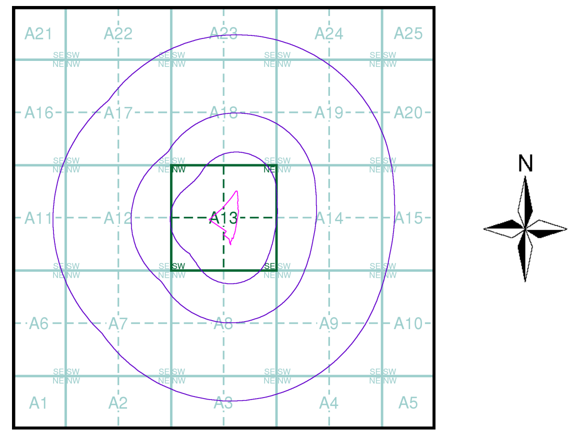


Historical Map - Slice A



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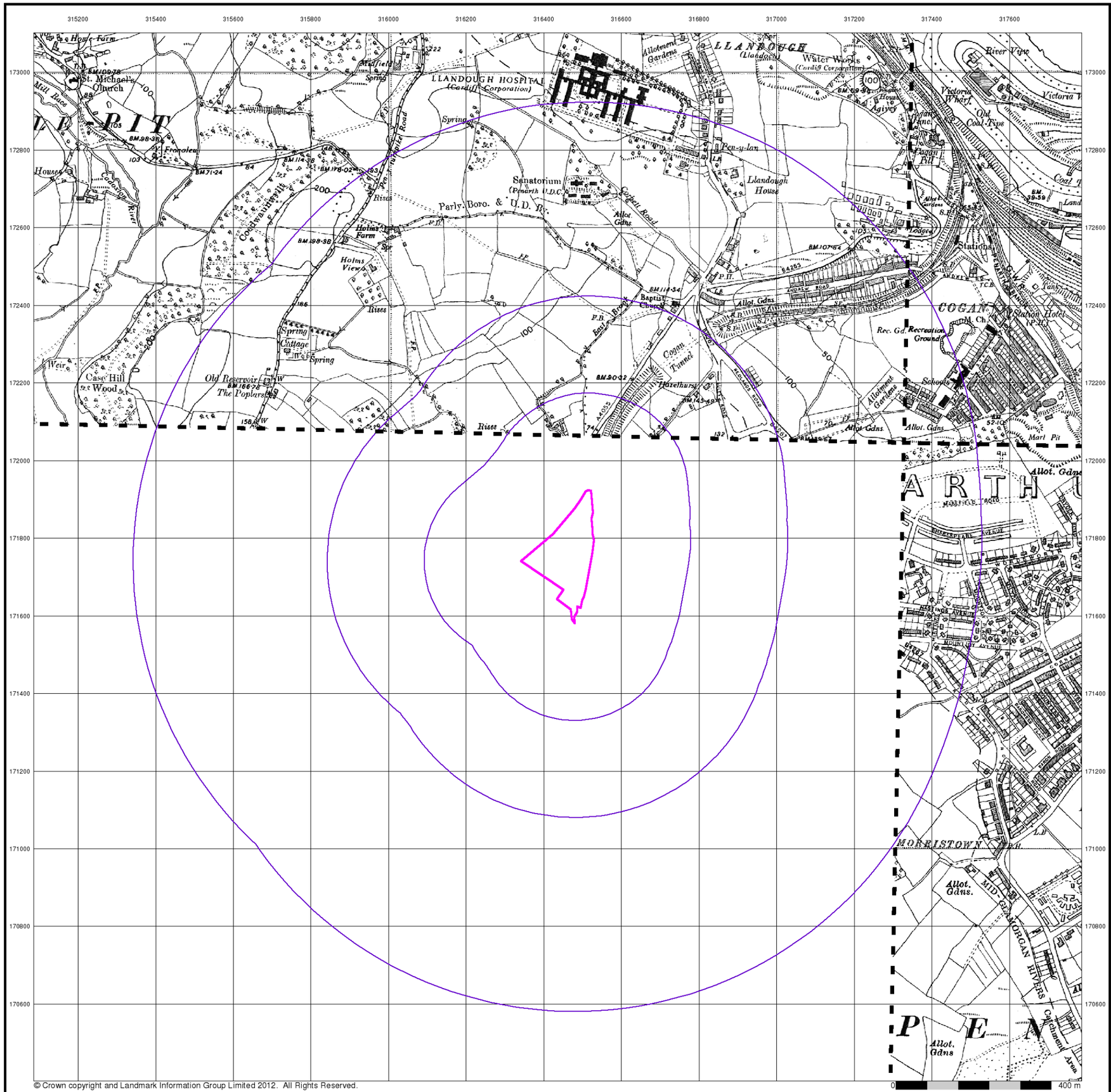

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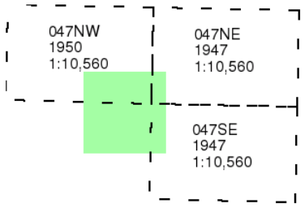
Glamorganshire

Published 1947 - 1950

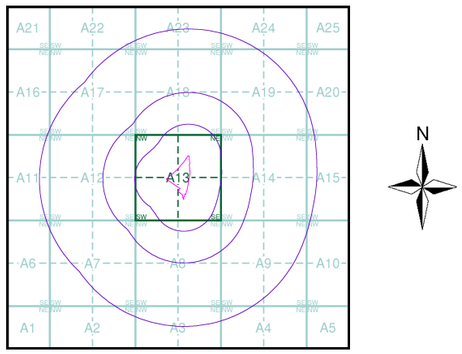
Source map scale - 1:10,560

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



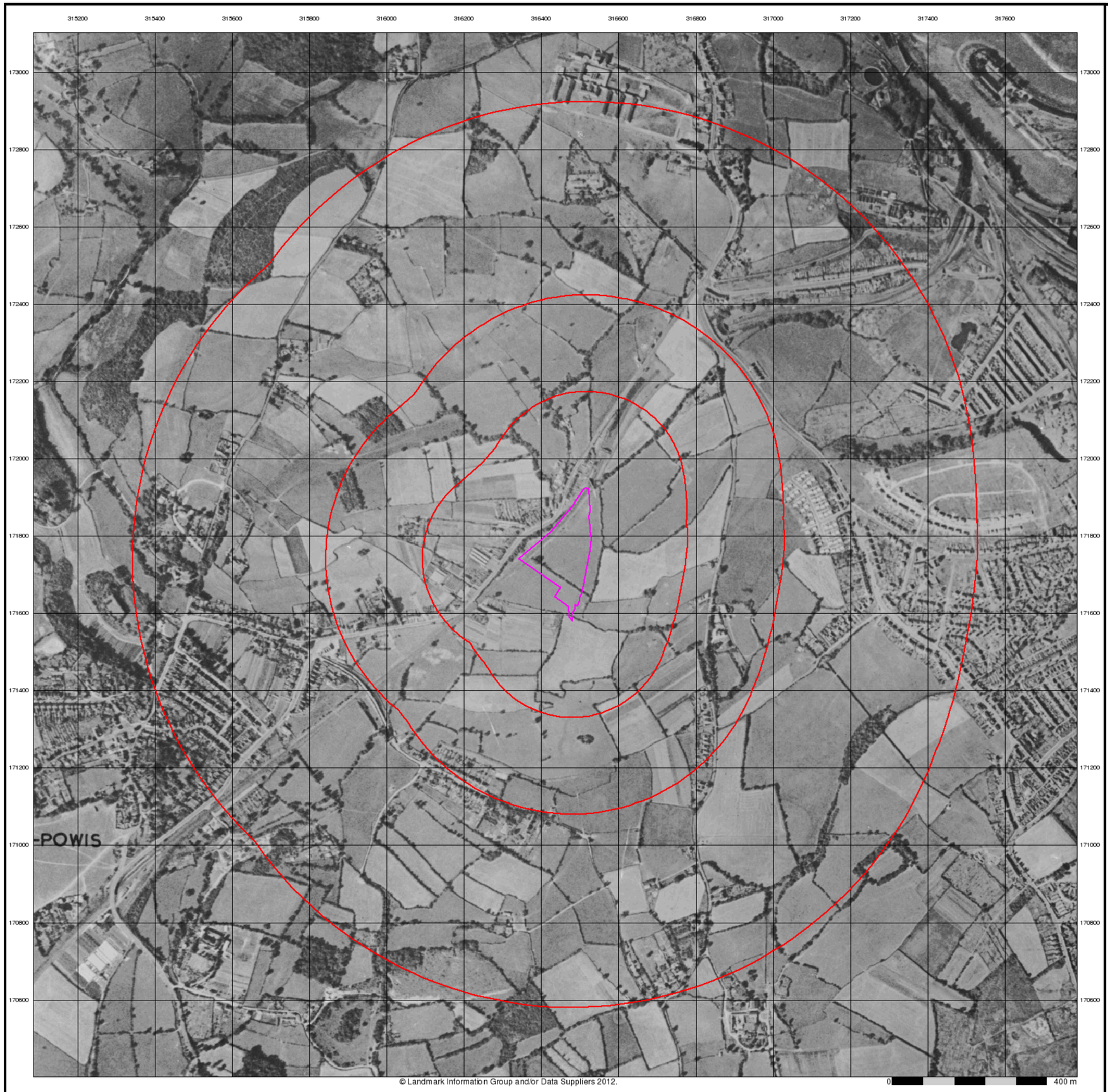
Order Details

Order Number:	46777449_1_1
Customer Ref:	12224
National Grid Reference:	316460, 171750
Slice:	A
Site Area (Ha):	2.79
Search Buffer (m):	1000

Site Details

Land off Caerleon Road, Dinas Powys, CF64 4PW

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

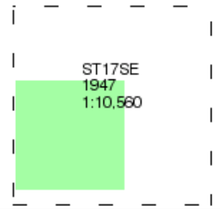


terrafirma

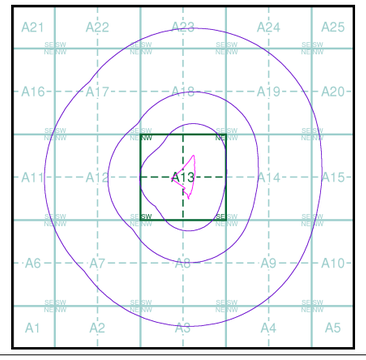
Historical Aerial Photography
Published 1947
Source map scale - 1:10,560

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.

Map Name(s) and Date(s)



Historical Aerial Photography - Slice A



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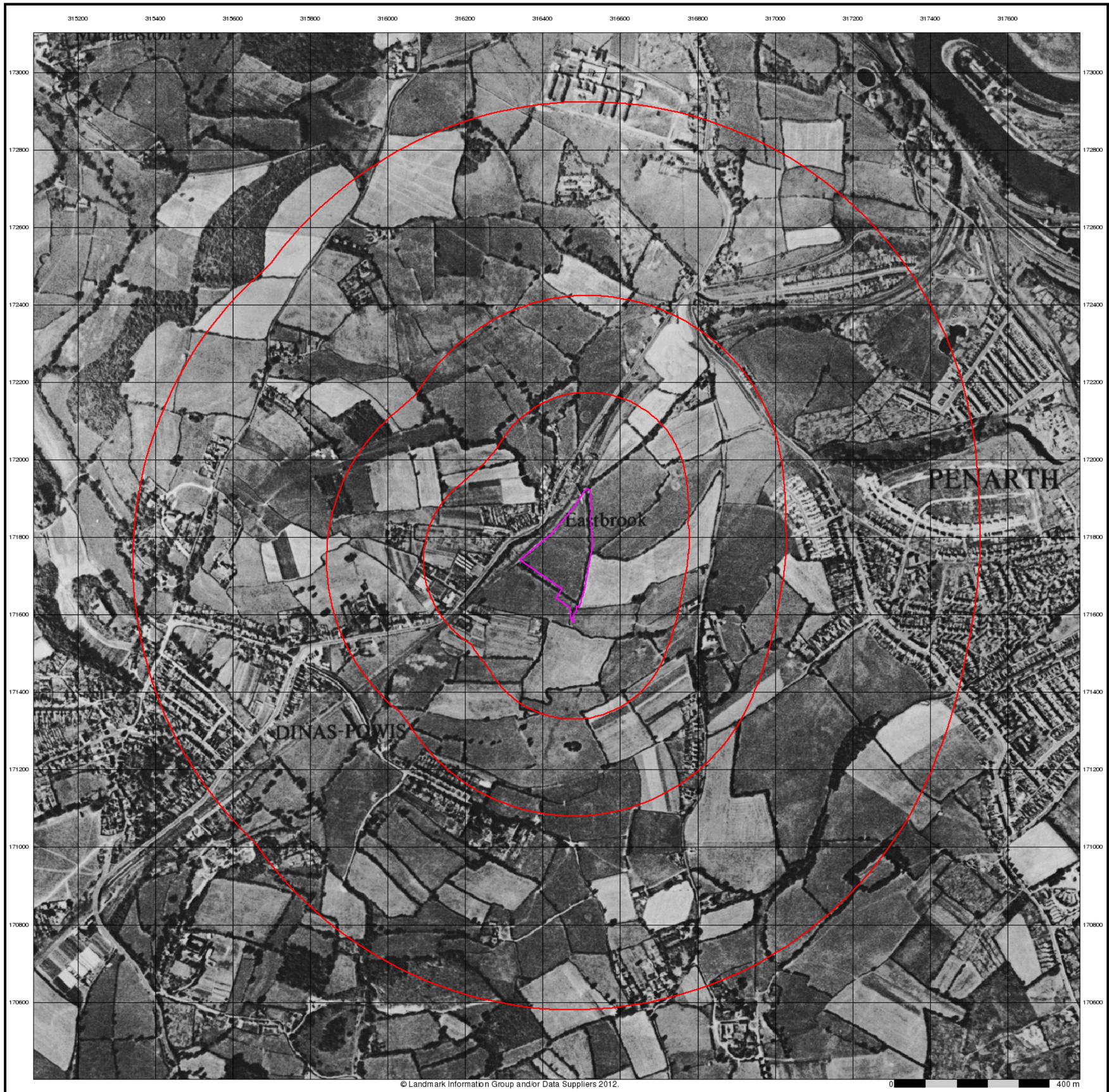

terrafirma

Historical Aerial Photography

Published 1947

Source map scale - 1:10,560

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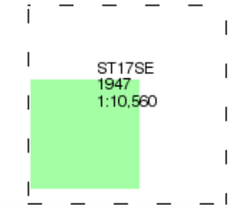
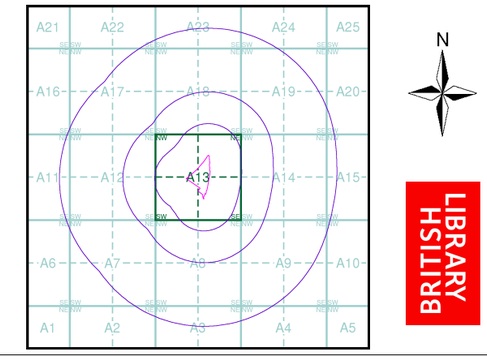


Historical Aerial Photography - Slice A



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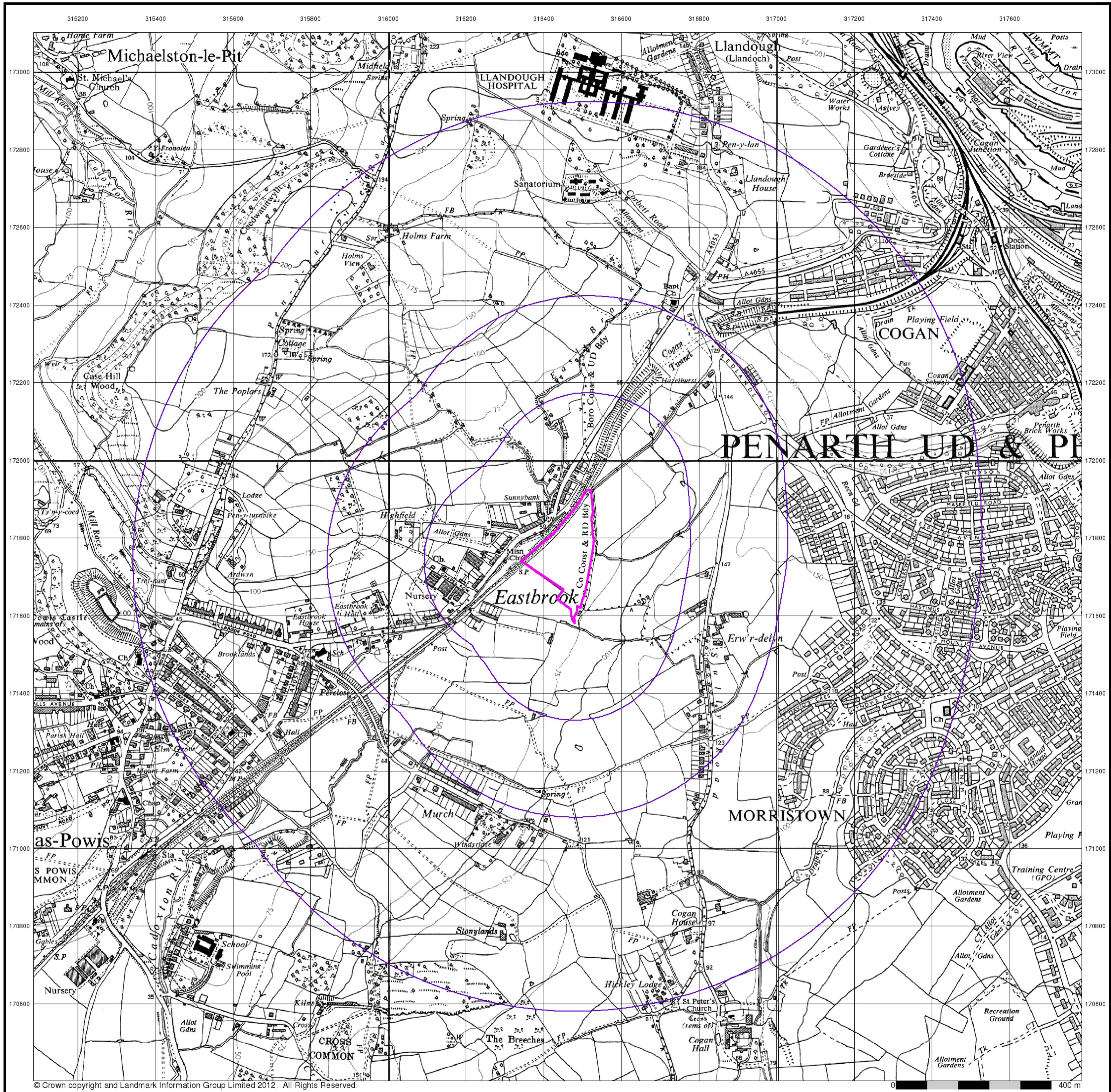

terrafirma

Ordnance Survey Plan

Published 1965

Source map scale - 1:10,000

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.

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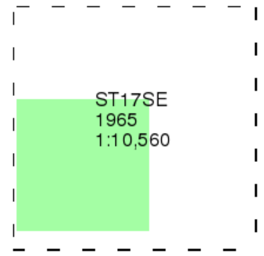
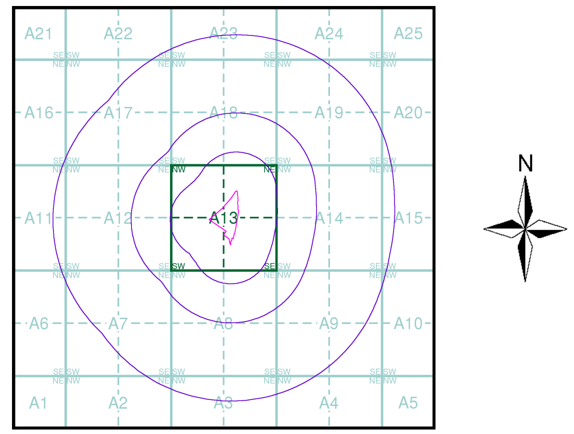


Historical Map - Slice A



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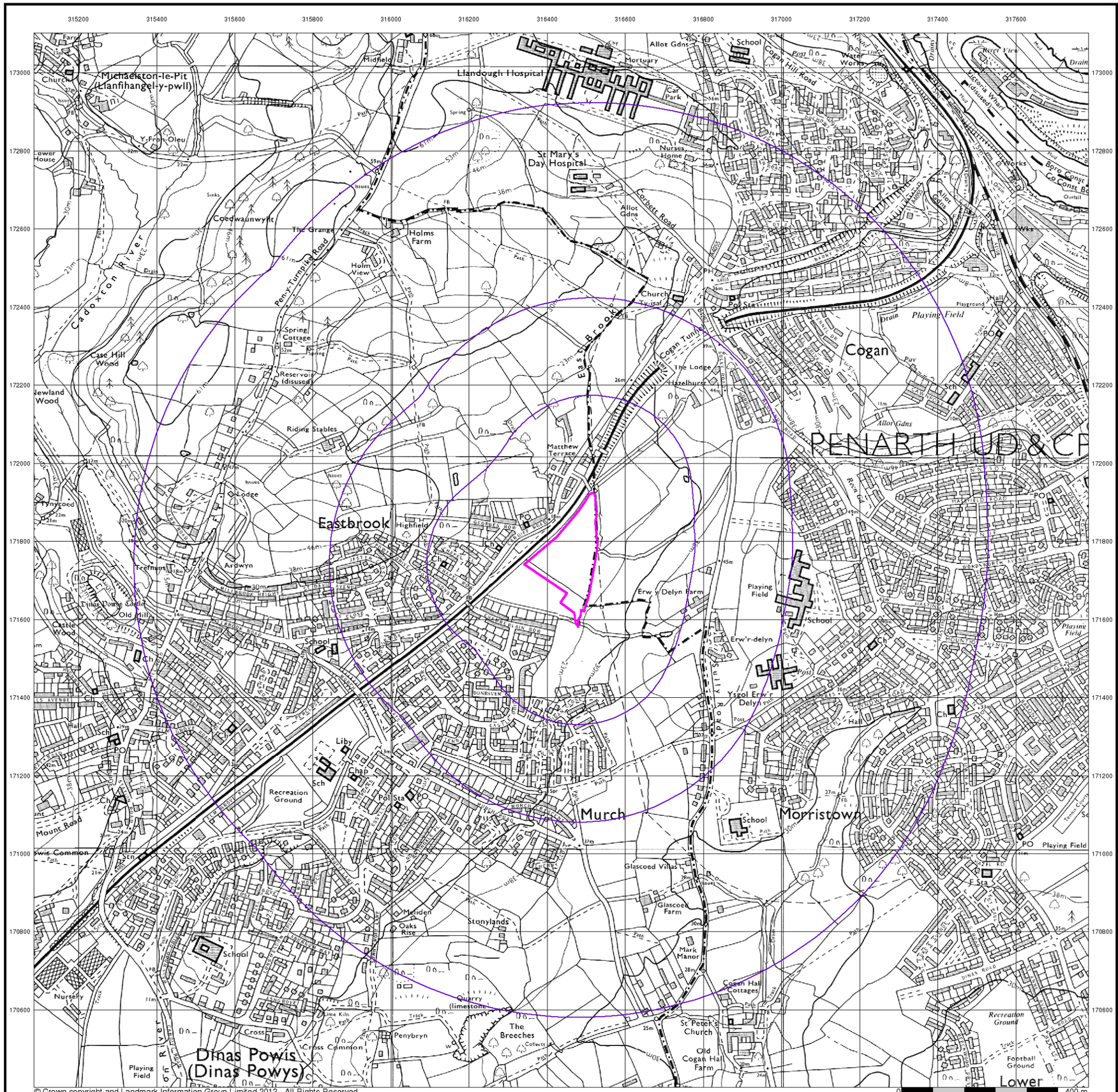

terrafirma

Ordnance Survey Plan

Published 1974

Source map scale - 1:10,000

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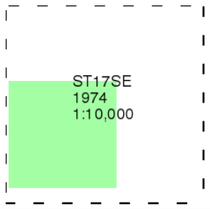
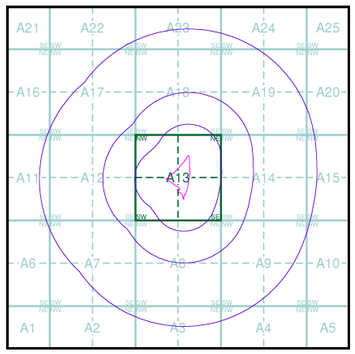
Map Name(s) and Date(s)



Historical Map - Slice A



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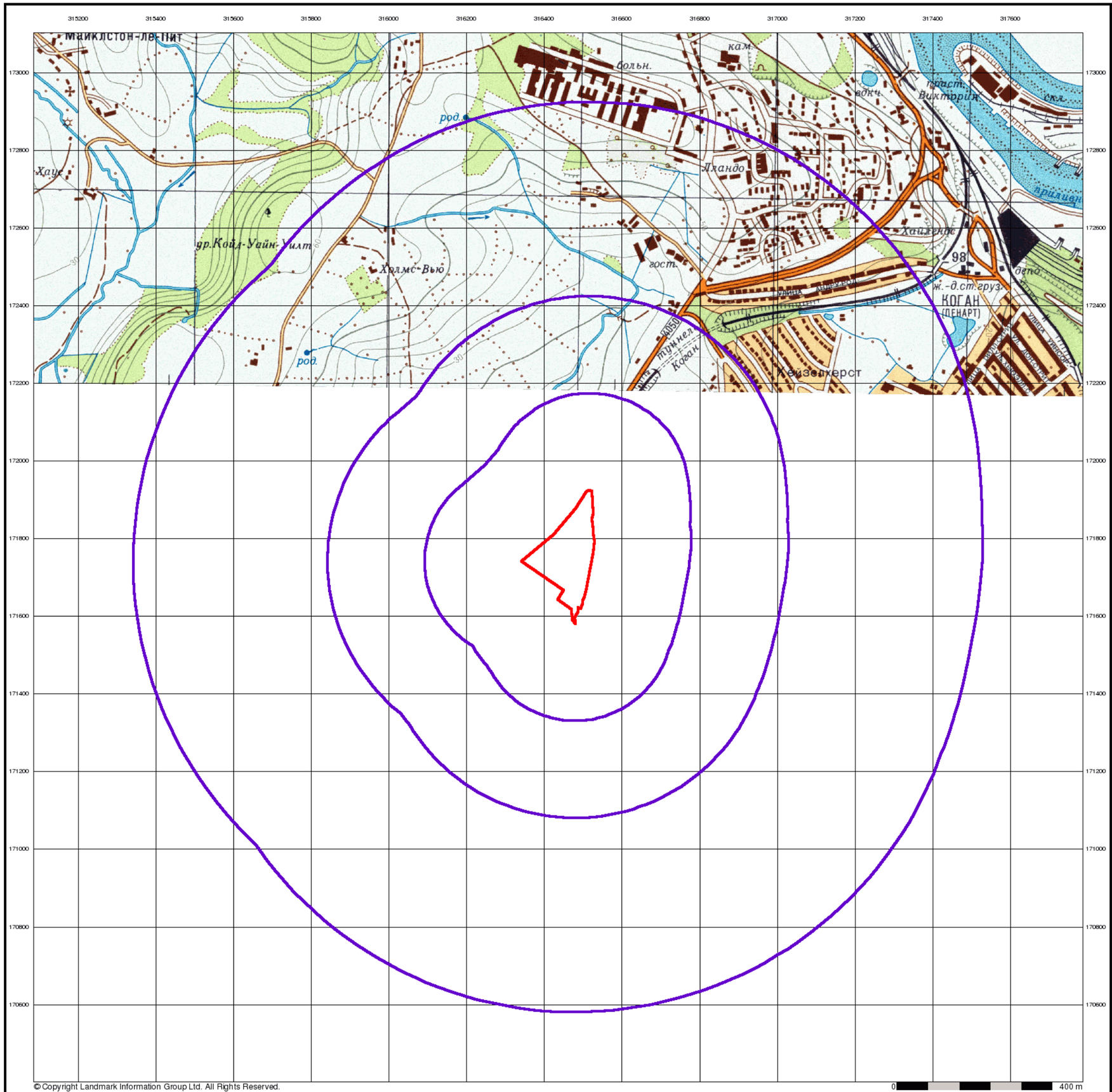
Site Details

Land off Caerleon Road, Dinas Powys, CF64 4PW



terrafirma

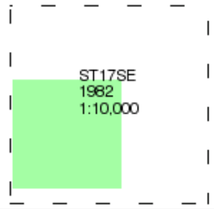
Cardiff

Published 1982

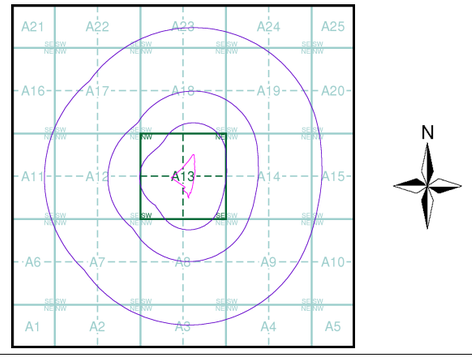
Source map scale - 1:10,000

These maps were produced by the Russian military during the Cold War between 1950 and 1997, and cover 103 towns and cities throughout the U.K. The maps are produced at 1:25,000, 1:10,000 and 1:5,000 scale, and show detailed land use, with colour-coded areas for development, green areas, and non-developed areas. Buildings are coloured black and important building uses (such as hospitals, post offices, factories etc.) are numbered, with a numbered key describing their use.
They were produced by the Russians for the benefit of navigation, as well as strategic military sites and transport hubs, for use if they were to have invaded the U.K. The detailed information provided indicates that the areas were surveyed using land-based personnel, on the ground, in the cities that are mapped.

Map Name(s) and Date(s)



Russian Map - Slice A



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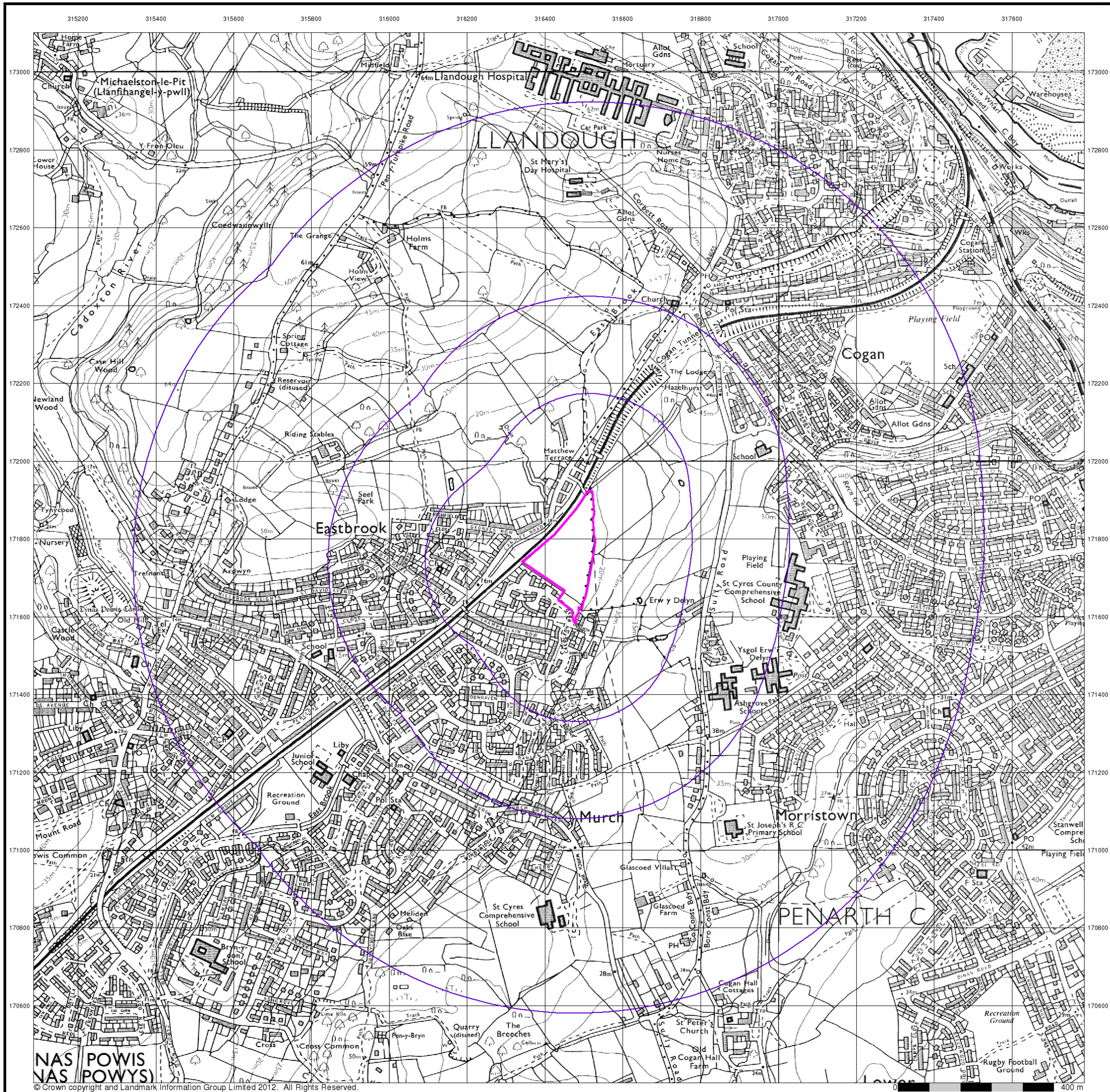

terrafirma

Ordnance Survey Plan

Published 1984

Source map scale - 1:10,000

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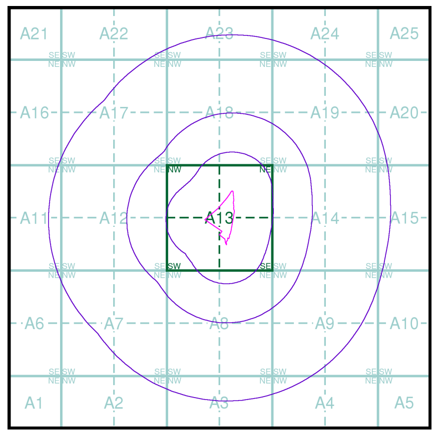
Map Name(s) and Date(s)

ST17SE
1984
1:10,000

Historical Map - Slice A



N

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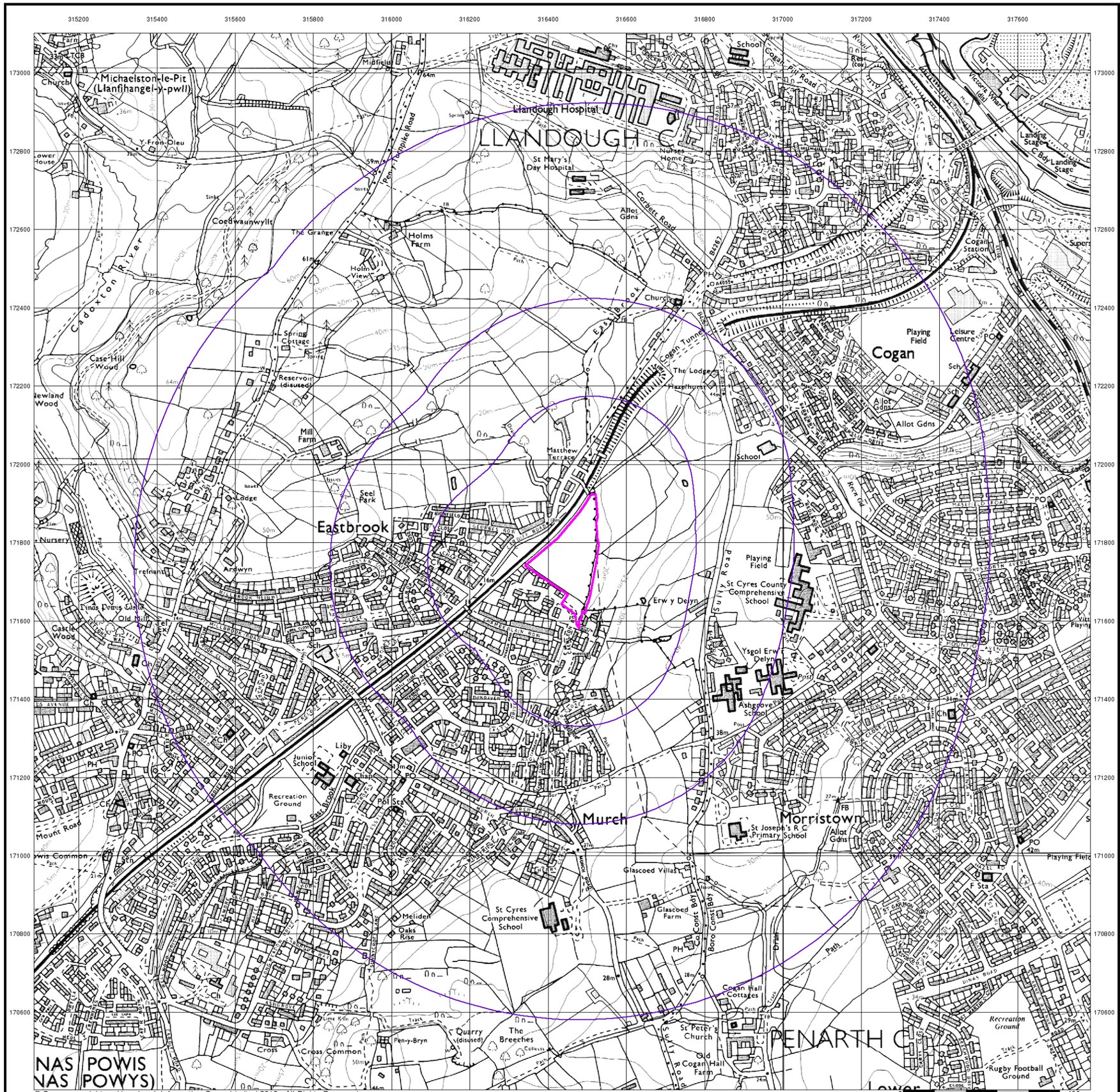

terrafirma

Ordnance Survey Plan

Published 1996

Source map scale - 1:10,000

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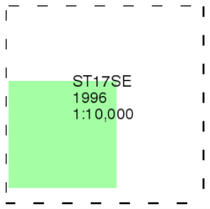
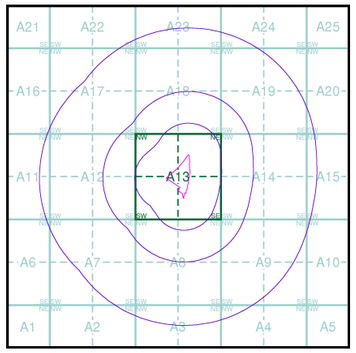


Historical Map - Slice A



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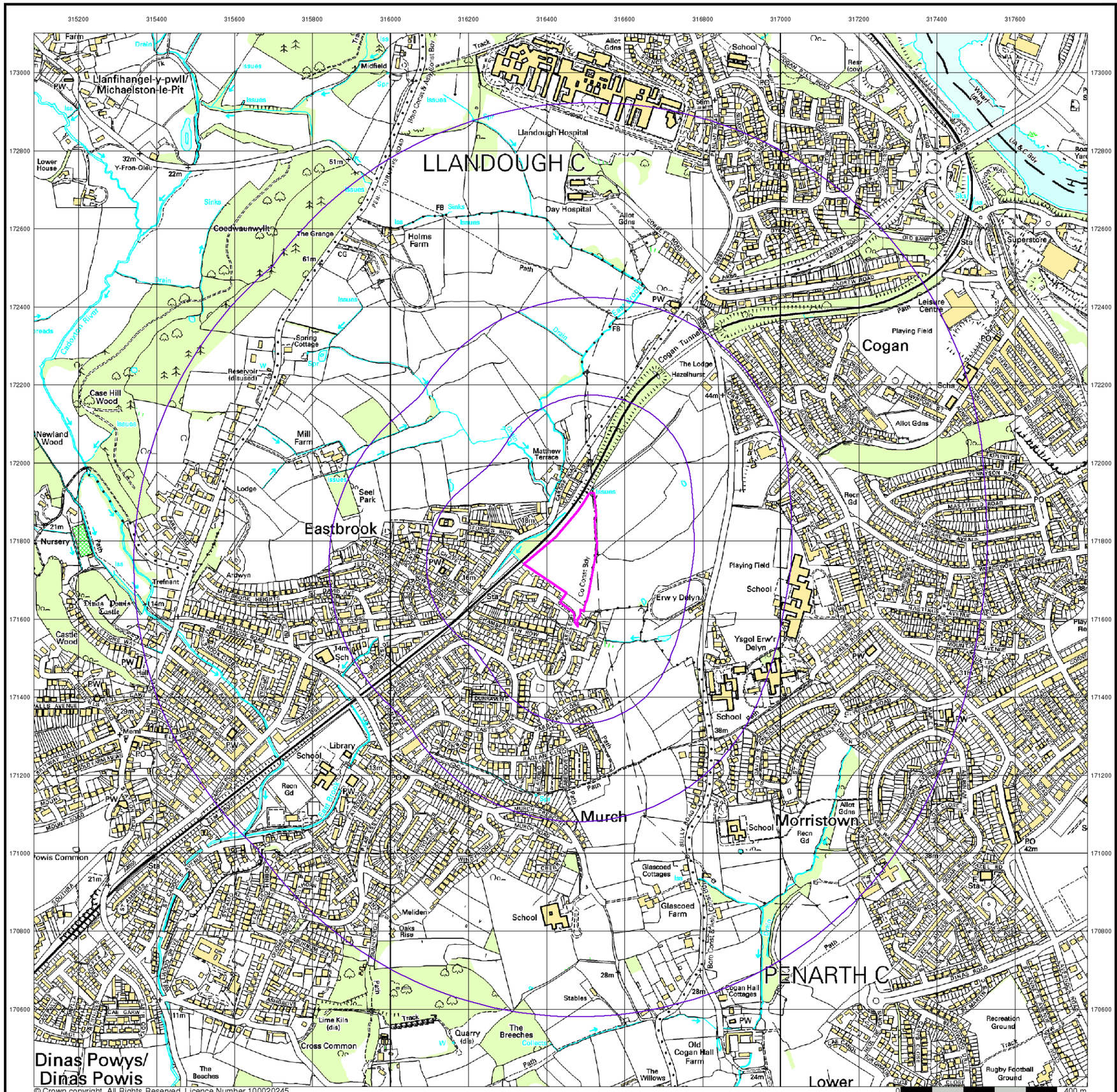


terrafirma

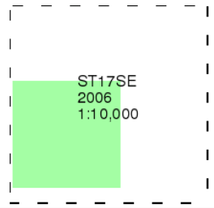
10k Raster Mapping

Published 2006

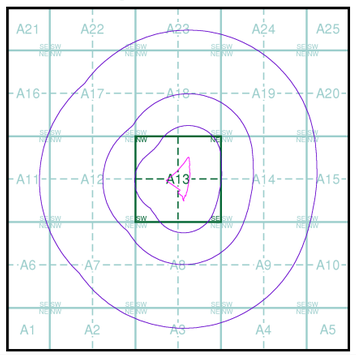
Source map scale - 1:10,000

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



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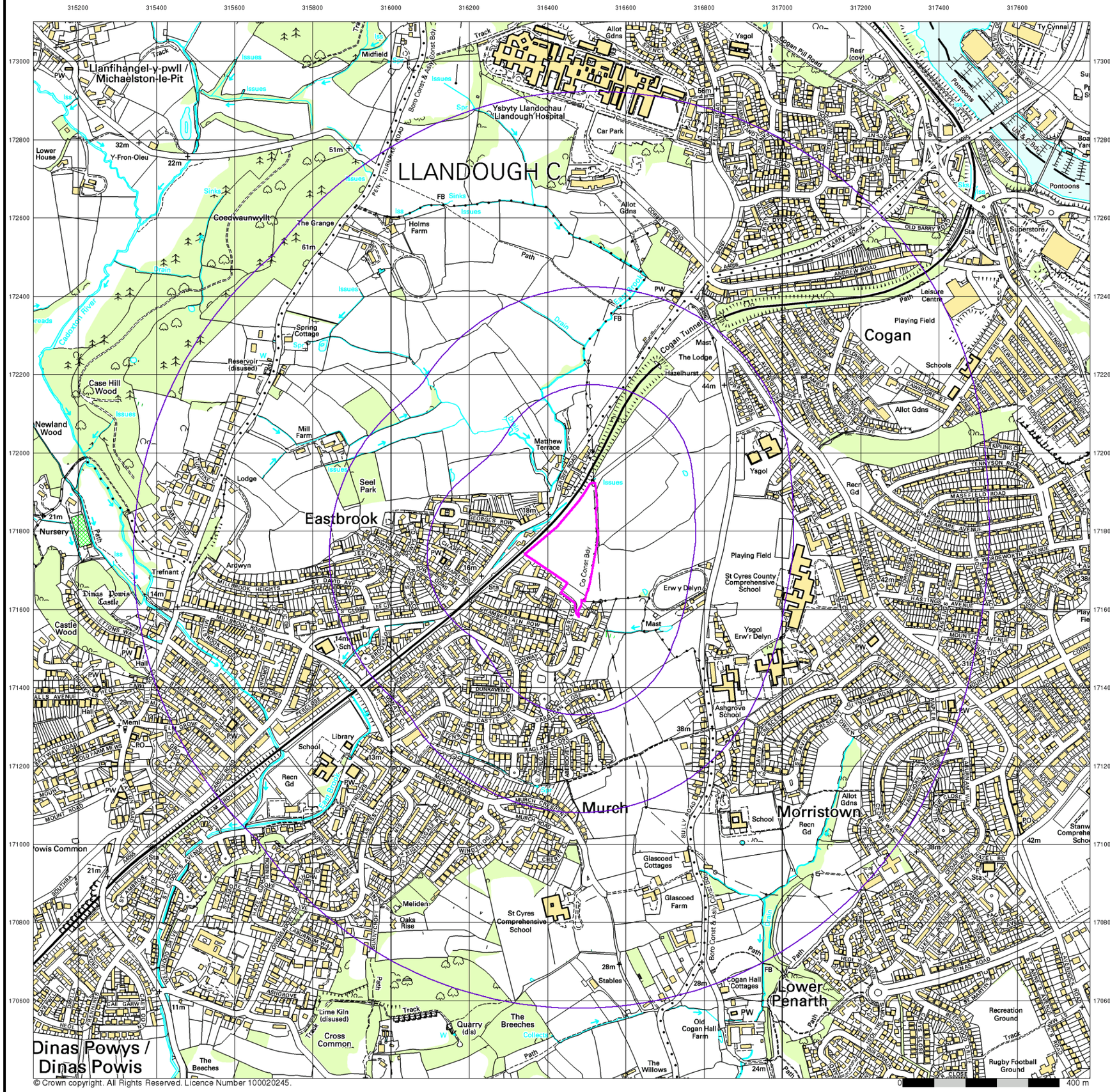

terrafirma

10k Raster Mapping

Published 2013

Source map scale - 1:10,000

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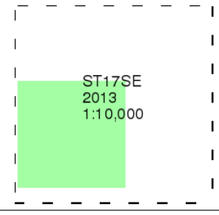
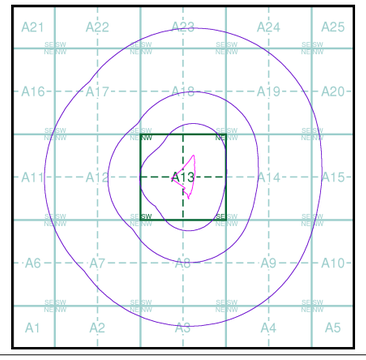


Historical Map - Slice A



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ANNEX B
Radon Report

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

GeoReports

Gwyn Lake
Terra Firma (Wales) Ltd
5 Deryn Court
CF23 7HA

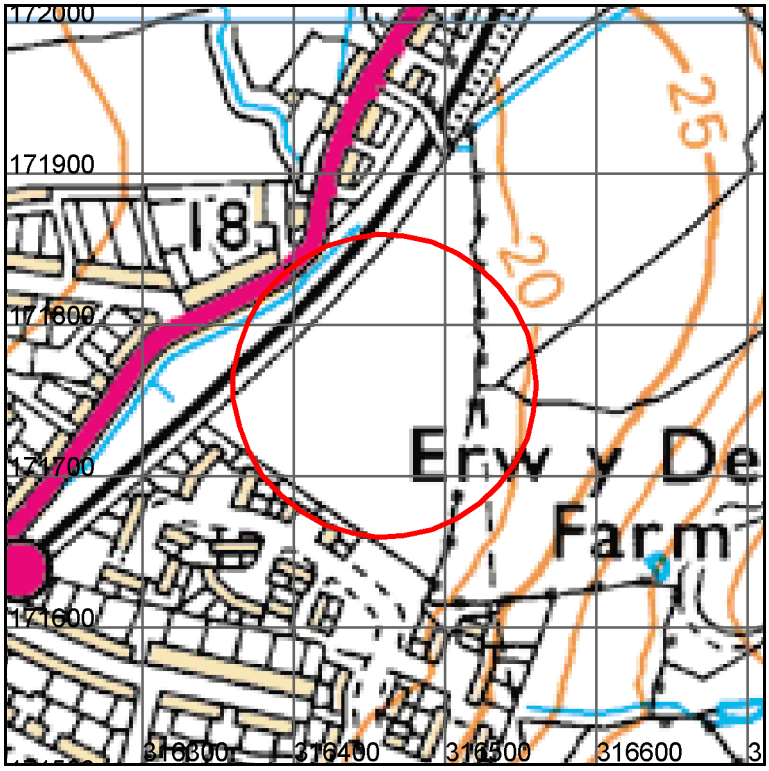
Radon Report: England and Wales

Advisory report on the requirement for radon protective measures in new buildings, conversions and extensions to existing buildings. The report also indicates whether a site is located within a radon Affected Area

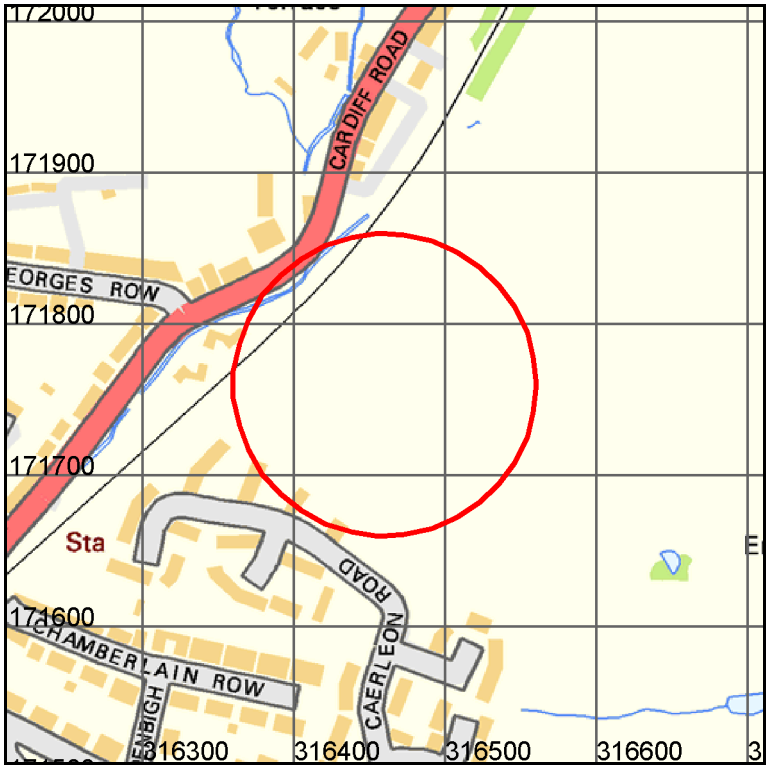
Report Id: ***GR_206779/1***

Client reference: 12224

Search location



Scale: 1:5 000 (1cm = 50 m)



OS Street View: Scale: 1:5 000 (1cm = 50 m)

This report describes a site located at National Grid Reference 316460, 171760. Note that for sites of irregular shape, this point may lie outside the site boundary. Where the client has submitted a site plan the assessment will be based on the area given.

Search location indicated in red

Radon Report: England and Wales

This is an advisory report on the requirement for radon protective measures in new buildings, conversions and extensions. The report also indicates whether a site is located within a radon Affected Area

Requirement for radon protective measures
The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2007 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

NO RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

The BGS is not able to provide advice on the technical specifications of 'basic' and 'full' radon protective measures. This information is detailed in **BRE Report BR211 Radon: guidance on protective measures for new buildings** which may be purchased from **brebookshop.com.** This report offers guidance on the technical solutions that are required to satisfy Building Regulations requirements.

Technical solutions to radon protection in new build and existing dwellings in radon affected areas are available on the BRE web site at:
http://www.bre.co.uk/page.jsp?id=1626 and http://www.bre.co.uk/radon/ and in a range of technical reports available from **brebookshop.com;** Tel: 01923 664262, email: bookshop@bre.co.uk.
Summary guidance is available on the web at:
http://www.bre.co.uk/radon/protect.html.

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

Radon in existing buildings

Is this property in a radon affected area – NO

The answer to the standard enquiry on house purchase known as **CON29 Standard Enquiry of Local Authority 3.13 Radon Gas: Location of the Property in a radon Affected Area is NO** this property is not in a Radon Affected Area as defined by Public Health England (PHE).

The estimated probability of the property being above the Action Level for radon is: 0-1% (LOWER PROBABILITY).

The result informs you of the estimated probability that this particular property is above the Action Level for radon. This does not necessarily mean there is a radon problem in the property. The only way to determine whether it is above or below the Action Level is to carry out a radon measurement within the existing property.

Radon Affected Areas are designated by Public Health England. They advise that radon gas should be measured in all properties within Radon Affected Areas.

If you are buying a new build property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.

If you are buying a currently occupied property in a Radon Affected Area you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were above the Radon Action Level and if so whether remedial measures were installed, radon levels were retested, and the that the results of re-testing confirmed the effectiveness of the measures.

In radon affected homes, the problem of radon can usually be tackled with simple, effective and relatively inexpensive measures. These measures are comparable in cost to work such as damp-proofing and timber treatment. You can get practical advice about construction work to reduce radon levels from the Building Control Officer at your local council.

For further information, advice about radon, its health risks and details of how to order the radon test, please contact the PHE Radon Helpline on 01235 822622 or go online at www.ukradon.org or write to Radon Survey, Public Health England, Centre for Radiation, Chemical and Environmental Hazards, Chilton, Didcot, Oxon, OX11 0RQ, email: radon@hpa.org.uk. You can obtain an information pack from the PHE free Radon answerphone on 0800 614529

What is radon?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m^{-3}). The Government advises householders that, where the radon level exceeds the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations, 1999, require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293)**: Radon in the workplace.** BRE publications may be obtained from the BRE Bookshop, Tel: 01923 664262, email: bookshop@bre.co.ukwebsite: www.brebookshop.com

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Terms and Conditions

General Terms & Conditions

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- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps, may be lost when small-scale maps are derived from them.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
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- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be quite historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

Report issued by
BGS Enquiry Service

ANNEX C
Risk Assessment Definitions

The contaminated land regime is set out in Part IIA of the Environmental Protection Act (EPA) 1990 and was introduced on the 1st April 2000 in England and 1st July 2001 in Wales. A similar regime was introduced in Scotland on 14th July 2000.

Part IIA was introduced to achieve two aims:

(1) The identification of contaminated land
(2) The remediation of contaminated land that poses an unacceptable risk to human health and/or the environment

Under Part IIA the statutory definition of 'contaminated land' is:

"any land which appears to the local authority in whose area it is situated, to be in such a condition, by reason of substances in, on, or under the land, that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) Pollution of controlled waters is being, or is likely to be, caused."

For land to be classified as 'Contaminated Land' there must be a '**pollutant linkage**'. A pollutant linkage requires three essential elements:

(1) A **CONTAMINANT** (hazard) - a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters

(2) A **RECEPTOR** (target) - something which could be adversely affected by a contaminant

(3) A **PATHWAY** - a route or means which either allows the contaminant to cause significant harm to that receptor, or that there is a significant possibility of such harm being caused to the receptor, or that pollution of controlled waters is being or likely to be caused.

The term 'Risk' is widely used in different contexts and situations, but a prescriptive definition is given by the Guidelines for Environmental Risk Assessment and Management (DEFRA *et al*, 2000):

'Risk is a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence'.

A 'Hazard' is defined as '*a property or situation that in particular circumstances could lead to harm'.*

The classification of consequences and probability and determining the risk category are defined in the following sections.

Classification of Consequence

Table A Classification of Consequence	
Classification	**Definition**
Severe	• Short term (acute) risk to human health likely to result in significant harm • Short term risk to controlled waters • Catastrophic damage to buildings/structures • Short term risk to an ecosystem or organism within the particular ecosystem
Medium	• Chronic damage to human health (long term risk) • Pollution of a sensitive water resource • A significant change in an ecosystem or organism within the ecosystem
Mild	• Pollution of non-sensitive water resources • Significant damage to buildings/structures
Negligible	• Harm (not necessarily significant) which may result in financial loss • Non permanent health effects to humans (easily prevented by PPE for example) • Easily repairable effects of structural (building) damage

Classification of Probability

Table B Classification of Probability	
Classification	**Definition**
High	• There is a complete pollution linkage and an event appears very likely to occur in the short term and is inevitable in the long term. • Evidence of harm to the receptor
Medium	• There is a complete pollution linkage which means that is it probable that an event will occur • The event is not inevitable but possible in short term and likely in the long term
Low	• There is a complete pollution linkage and circumstances are possible under which an event could occur • It is not certain that an event will occur in the long term, and it is less likely to occur in the short term
Negligible	• There is a complete pollution linkage but circumstances are such that it is improbable that an event would occur even in the long term

Risk Assessment Matrix

By comparing the consequences of a risk and the probability of the risk of a pollution linkage, the likely risk category can be determined as shown in **Table C** below.

Table C Risk Assessment Matrix

Increasing acceptability →		Consequence			
		Severe	**Medium**	**Mild**	**Negligible**
Probability	**High**	High	High	Medium / Low	Near zero
	Medium	High	Medium	Low	Near zero
	Low	High / medium	Medium / Low	Low	Near zero
	Negligible	High / medium / Low	Medium / Low	Low	Near zero

High Risk
There is a high probability that severe harm could risk a receptor, or there is evidence that a receptor is being harmed. The risk if realised is likely to result in liability, and urgent investigation or remediation will be required.

Medium Risk
It is probable that harm will arise to a receptor. However it is relatively unlikely that such harm would be severe, or if harm does occur the harm is likely to be relatively mild. Investigation will be required to determine the liability, and some remedial works may be required in the long term.

Low Risk
It is possible that harm may arise to a receptor, but it is likely that the harm would be mild.

Near Zero Risk
There is a very low risk of harm to the receptor. In the event of harm being realised the harm is not likely to be severe.

ANNEX D
Trial Pit Logs

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Trialpit No
TP1
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 2.60m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft brown sandy CLAY (topsoil).
			0.50			Firm red brown CLAY
			1.10			Medium dense red brown occasionally blue grey clayey fine to coarse angular GRAVEL of mudstone.
			2.60			Trialpit Complete at 2.60 m

Remarks:

Groundwater:

AGS

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Trialpit No
TP2
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 1.30m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft light brown sandy CLAY (topsoil)
			0.50			Firm red brown CLAY
			1.30			Trialpit Complete at 1.30 m

Remarks:

Groundwater:

AGS

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Trialpit No
TP3
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 1.30m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft light brown CLAY (topsoil)
			0.40			Firm red brown CLAY.
			1.30			Trialpit Complete at 1.30 m

Remarks:

Groundwater:

AGS

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Trialpit No
TP4
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 2.50m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft brown CLAY (Topsoil)
			0.40			Firm to stiff red brown CLAY
			0.90			Medium dense red brown slightly clayey medium to coarse angular GRAVEL of mudstone.
			2.30			Medium dense red brown fine to medium angular GRAVEL of friable mudstone.
			2.50			Trialpit Complete at 2.50 m

Remarks:

Groundwater:

AGS

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Trialpit No
TP5
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 2.70m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft lightly brown CLAY
			0.50			Firm to stiff red brown CLAY.
			0.80			Medium dense red brown clayey fine to coarse angular GRAVEL of mudstone.
			2.50			Very weak red brown MUDSTONE recovered as fine to coarse angular GRAVEL.
			2.70			Trialpit Complete at 2.70 m

Remarks:

Groundwater:

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Trialpit No
TP6
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 1.70m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft light brown sandy CLAY (topsoil).
			0.40			Firm red brown CLAY
			1.10			Medium dense red brown occasionally blue grey clayey fine to coarse angular GRAVEL of mudstone
			1.60			Very weak red brown MUDSTONE recovered as fine to coarse angular gravel.
			1.70			Trialpit Complete at 1.70 m

Remarks:

Groundwater:

AGS

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Trialpit No
TP7
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Dinas Powys	12224	Level: -	18/06/2013
Location: Land off Caerleon Road		Dimensions: -	Scale 1:25
Client: United Welsh		Depth 2.40m	Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft brown sandy CLAY with many rootlets (topsoil)
			0.40			Firm red brown CLAY with occasional rootlets.
			1.40			Medium dense red brown occasionally blue grey clayey fine to coarse GRAVEL of mudstone.
			1.90			Very weak angular and tabular MUDSTONE recovered as Medium to coarse gravel.
			2.40			Trialpit Complete at 2.40 m

Remarks:

Groundwater:

AGS

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Trialpit No
TP8
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 3.00m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft light brown CLAY
			0.20			Stiff light red brown slightly gravelly CLAY. Gravel is fine to coarse angular of mudstone.
			0.70			Firm red brown occasionally blue grey CLAY.
			2.60			Very weak red brown MUDSTONE recovered as tabular gravel and cobbles.
			3.00			Trialpit Complete at 3.00 m

Remarks:

Groundwater:

AGS

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Trialpit No
TP9
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 2.60m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft to firm light brown CLAY.
			0.40			Firm to stiff red brown CLAY.
			1.80			Medium dense red brown clayey fine to coarse angular GRAVEL of mudstone.
			2.20			Very weak weathered red brown MUDSTONE recovered as shaley gravel.
			2.60			Trialpit Complete at 2.60 m

Remarks:

Groundwater:

AGS

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Trialpit No
TP10
Sheet 1 of 1

Project Name Dinas Powys	Project No. 12224	Co-ords: - Level: -	Date 18/06/2013
Location: Land off Caerleon Road		Dimensions: - Depth 2.80m	Scale 1:25
Client: United Welsh			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Soft light brown slightly sandy CLAY
			0.50			Firm red brown CLAY
			1.30			Medium dense red brown clayey fine to coarse angular GRAVEL of friable mudstone.
			2.80			Trialpit Complete at 2.80 m

Remarks:

Groundwater:

AGS

ANNEX E
Laboratory Soil Chemical Testing

Certificate of Analysis

2139

Certificate Number: 13-83458

Date: 27/06/2013

Client:	Terra Firma (Wales) Ltd 5 Deryn Court Wharfdale Road Pentwyn Cardiff CF23 7HB
Our Reference:	13-83458
Client Reference:	12224
Contract Title:	Dinas Powys
Description:	6 soil samples
Date Received:	20 June 2013
Date Started:	20 June 2013
Date Completed:	27 June 2013
Test Procedures:	Identified by prefix DETSn, details available upon request.
Notes:	Observations and interpretations are outside the scope of UKAS accreditation
Approved By:	Rob Brown, Business Manager

Information in Support of the Analytical Results

Analysis

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425um sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28oC +/-2oC.

Key

*	Denotes test not included in laboratory scope of accreditation
#	Denotes test that holds MCERTS accreditation, however, MCERTS accreditation is only implied if the report carries the MCERTS logo
$	Denotes tests completed by an approved subcontractor
I/S	Denotes insufficient sample to carry out test
U/S	Denotes that the sample is not suitable for testing

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month
Liquids - 2 weeks
Asbestos (test portion) - 6 months

Summary of Chemical Analysis
Matrix Descriptions

Our Ref: 13-83458
Client Ref: 12224
Contract Title: Dinas Powys

Sample ID	Depth	Sample No	Completed	Matrix Description
TP1	0.40	525686	27/06/2013	Brown very sandy CLAY with numerous rootlets
TP2	0.30	525687	27/06/2013	Brown very sandy CLAY with numerous rootlets
TP5	0.50	525688	27/06/2013	Brown very sandy CLAY with numerous rootlets
TP7	0.50	525689	27/06/2013	Brown very sandy CLAY with numerous rootlets
TP8	0.40	525690	27/06/2013	Brown very sandy CLAY with numerous rootlets
TP10	0.30	525691	27/06/2013	Brown very sandy CLAY with numerous rootlets

Summary of Chemical Analysis
Soil Samples

Our Ref: 13-83458
Client Ref: 12224
Contract Title: Dinas Powys

			Lab No.	525686	525687	525688	525689
			Sample ID	TP1	TP2	TP5	TP7
			Depth	0.40	0.30	0.50	0.50
			Sample Ref				
			Sample Type	D	D	D	D
			Sampling Date	18/06/2013	18/06/2013	18/06/2013	18/06/2013
			Sampling Time				
Test	**Units**	**DETSxx**	**LOD**				
Mercury	mg/kg	DETSC 2325#	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic	mg/kg	DETS 042#	0.2	5.9	7.4	7.8	7.0
Cadmium	mg/kg	DETS 042#	0.1	0.8	0.9	0.9	1.0
Chromium	mg/kg	DETS 042#	0.15	34	26	30	28
Chromium III	mg/kg	DETS 042*	0.15	34	26	30	28
Copper	mg/kg	DETS 042#	0.2	16	22	18	16
Nickel	mg/kg	DETS 042#	1	25	26	26	33
Lead	mg/kg	DETS 042#	0.3	18	25	27	18
Selenium	mg/kg	DETS 042#	0.5	< 0.5	< 0.5	3.3	< 0.5
Zinc	mg/kg	DETS 042#	1	64	52	60	69
Cyanide total	mg/kg	DETSC 2130#	0.1	0.1	< 0.1	< 0.1	< 0.1
Organic matter	%	DETSC 2002#	0.1	0.8	0.8	0.6	0.8
Total Sulphate as SO4	%	DETSC 2321#	0.01	0.02	0.04	0.04	0.04
pH		DETSC 2008#		8.2	8.1	8.3	8.1
PAH	mg/kg	DETSC 3301	1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenol - Monohydric	mg/kg	DETSC 2130#	0.3	< 0.3	< 0.3	< 0.3	< 0.3
Hexavalent Chromium	mg/kg	DETSC 2204*	1	< 1.0	< 1.0	< 1.0	< 1.0

Summary of Chemical Analysis
Soil Samples

Our Ref: 13-83458
Client Ref: 12224
Contract Title: Dinas Powys

			Lab No.	525690	525691
			Sample ID	TP8	TP10
			Depth	0.40	0.30
			Sample Ref		
			Sample Type	D	D
			Sampling Date	18/06/2013	18/06/2013
			Sampling Time		
Test	**Units**	**DETSxx**	**LOD**		
Mercury	mg/kg	DETSC 2325#	0.05	< 0.05	< 0.05
Arsenic	mg/kg	DETS 042#	0.2	6.9	9.1
Cadmium	mg/kg	DETS 042#	0.1	1.0	1.1
Chromium	mg/kg	DETS 042#	0.15	33	37
Chromium III	mg/kg	DETS 042*	0.15	33	37
Copper	mg/kg	DETS 042#	0.2	19	18
Nickel	mg/kg	DETS 042#	1	29	29
Lead	mg/kg	DETS 042#	0.3	23	29
Selenium	mg/kg	DETS 042#	0.5	< 0.5	1.0
Zinc	mg/kg	DETS 042#	1	94	81
Cyanide total	mg/kg	DETSC 2130#	0.1	< 0.1	0.1
Organic matter	%	DETSC 2002#	0.1	0.9	2.3
Total Sulphate as SO4	%	DETSC 2321#	0.01	0.03	0.05
pH		DETSC 2008#		8.3	8.0
PAH	mg/kg	DETSC 3301	1.6	< 1.6	< 1.6
Phenol - Monohydric	mg/kg	DETSC 2130#	0.3	< 0.3	< 0.3
Hexavalent Chromium	mg/kg	DETSC 2204*	1	< 1.0	< 1.0

Sample Comments

DETS cannot be held responsible for the integrity of sample(s) received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating.

Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note "Guidance on Deviating Samples".

All samples received are listed below. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations.

If no sampled date (soils) or date/time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters), this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Lab No.	Sample ID	Date Sampled	Containers Received	Deviating due to holding time being exceeded for test(s)	Deviating due to inappropriate container for test(s)	Deviating due to headspace presence in container for test(s)
525686	TP1 0.40 SOIL	18/06/2013	Glass Jar 250ml (250ml), Plastic Tub 1 litre (1kg)			
525687	TP2 0.30 SOIL	18/06/2013	Glass Jar 250ml (250ml), Plastic Tub 1 litre (1kg)			
525688	TP5 0.50 SOIL	18/06/2013	Glass Jar 250ml (250ml), Plastic Tub 1 litre (1kg)			
525689	TP7 0.50 SOIL	18/06/2013	Glass Jar 250ml (250ml), Plastic Tub 1 litre (1kg)			
525690	TP8 0.40 SOIL	18/06/2013	Glass Jar 1 litre (1 litre), Glass Jar 250ml (250ml)			
525691	TP10 0.30 SOIL	18/06/2013	Glass Jar 250ml (250ml), Plastic Tub 1 litre (1kg)			

Appendix A - Details of Analysis

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS.
No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Method	Name of Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic Matter	%	0.01	Air Dried	No	Yes	Yes
DETSC 2003	Loss on Ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2004	Total Sulphate	%	0.01	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate	%	0.01	Air Dried	No	Yes	Yes
DETSC 2004	Water Soluble Sulphate	mg/l	10.00	Air Dried	No	Yes	Yes
DETSC 2076	Water Soluble Sulphate	mg/l	10.00	Air Dried	No	Yes	Yes
DETSC 2006	Chloride	mg/kg	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	0.10	Air Dried	No	Yes	Yes
DETS 042	Selenium	mg/kg	0.50	Air Dried	No	Yes	Yes
DETSC 2119	Ammonia	mg/kg	0.02	Air Dried	No	Yes	Yes
DETS 020	Boron (Water Soluble)	mg/kg	0.20	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10.00	Air Dried	No	Yes	Yes
DETS 042	Antimony	mg/kg	1.00	Air Dried	No	No	No
DETS 042	Arsenic	mg/kg	0.20	Air Dried	No	Yes	Yes
DETS 042	Barium	mg/kg	1.50	Air Dried	No	Yes	Yes
DETS 042	Beryllium	mg/kg	0.20	Air Dried	No	Yes	Yes
DETS 042	Cadmium	mg/kg	0.10	Air Dried	No	Yes	Yes
DETS 042	Cobalt	mg/kg	0.70	Air Dried	No	Yes	Yes
DETS 042	Copper	mg/kg	0.20	Air Dried	No	Yes	Yes
DETS 042	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETS 042	Iron	mg/kg	1.00	Air Dried	No	Yes	No

Appendix A - Details of Analysis

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS.
No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Method	Name of Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETS 042	Lead	mg/kg	0.30	Air Dried	No	Yes	Yes
DETS 042	Manganese	mg/kg	20.00	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETS 042	Molybdenum	mg/kg	0.40	Air Dried	No	Yes	Yes
DETS 042	Nickel	mg/kg	0.20	Air Dried	No	Yes	Yes
DETS 042	Thallium	mg/kg	1.00	Air Dried	No	No	No
DETS 042	Vanadium	mg/kg	0.80	Air Dried	No	Yes	Yes
DETS 042	Zinc	mg/kg	1.00	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (Free)	mg/kg	0.50	As Received	No	Yes	Yes
DETSC 3301	PAH by GC-FID	mg/kg	0.10	As Received	No	Yes	No
DETSC 3311	TPH (C10 - C40)	mg/kg	20.00	As Received	No	Yes	Yes
DETSC 3401	PCB	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Ethylbenzne	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Easily Liberatable Cyanide	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Complex Cyanide	mg/kg	0.30	Air Dried	No	Yes	No
DETSC 2130	Total Cyanide	mg/kg	0.40	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes

Appendix A - Details of Analysis

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS.
No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Method	Name of Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3431	VOC	mg/kg	0.01	As Received	No	No	No
DETSC 3303	PAH by GCMS (see list below)						
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Anthracene	mg/kg	0.03	As Received	No	Yes	No
DETSC 3303	Chrysene	mg/kg	0.03	As Received	No	Yes	No
DETSC 3303	Fluorene	mg/kg	0.03	As Received	No	Yes	No

ANNEX F
Plasticity Test Results

Laboratory Report

GEO Site & Testing Services Limited

Contract Number: 19908

Client's Reference: 12224

Report Date: 28-06-2013

Client Name: Terrafirma Wales Ltd
5 Deryn Court,
Wharfedale Road,
Pentwyn,
Cardiff,
CF23 7HB

Contract Title: Dinas Powys

For the attention of: Natalie

Date Received: 20-06-2013
Date Commenced: 20-06-2013
Date Completed: 28-06-2013

Test Description	Quantity	Checked	Approved
Disturbed/Pots/Tubs (D)	3		
Moisture Content 1377 : 1990 Part 2 : 3.2 *	3		
4 Point Liquid & Plastic Limit (LL/PL) Part 2 : 4.3 & 5.3 *	3		

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - Denotes test included in laboratory scope of accreditation**
 # - Denotes test carried out by approved contractor

Approved Signatories:
Paul Evans (Quality Manager), Emma Williams (Office Manager),
Benjamin Sharp (Laboratory Coordinator), Alex Wynn (Business Development Manager).

Client ref: 12224

Location: Dinas Powys

Contract Number: 19908-210613

Hole Number	Sample Number	Type	Depth (m)	Description of Sample*
TP1			1.00	Reddish brown gravelly fine to coarse silty CLAY.
TP2			1.20	Reddish brown gravelly fine to coarse silty CLAY.
TP6			1.00	Reddish brown gravelly fine to coarse silty CLAY.

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory

GSTL
GEO Site & Testing Services Limited

Checked By

Approved By:

Date Approved: 28.6.13

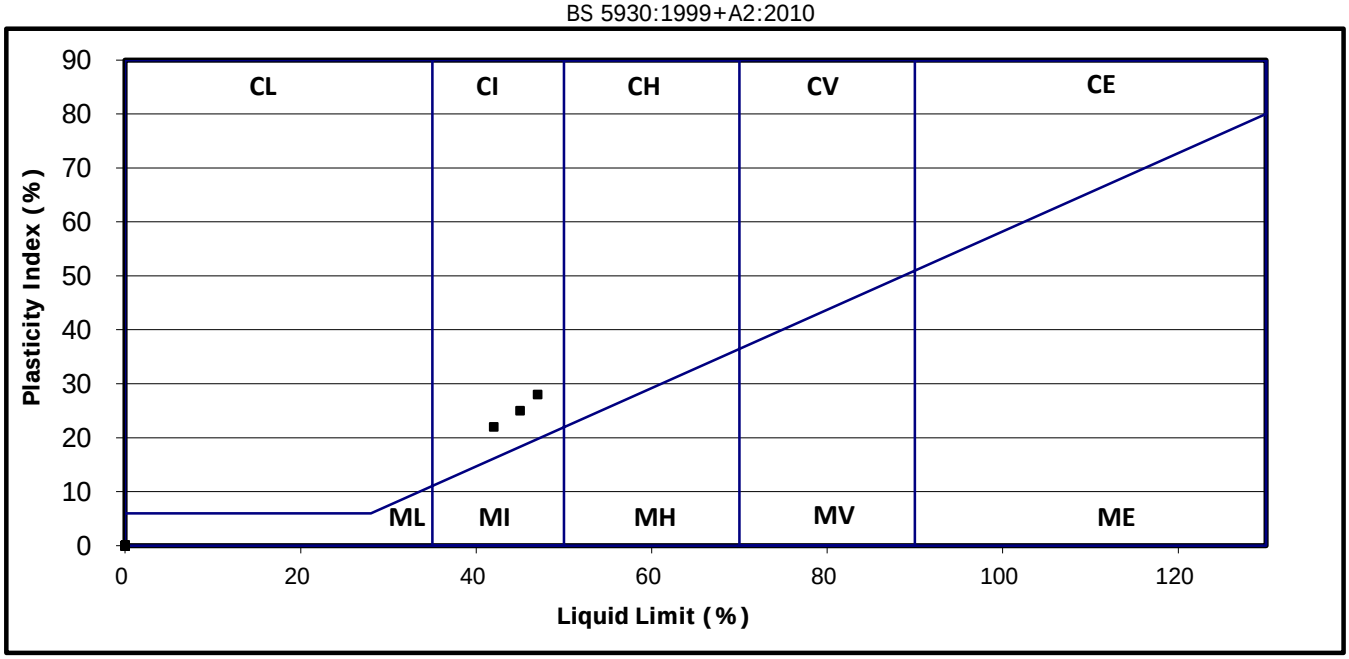
Test Report: **Method of the Determination of the plastic limit and plasticity index**
BS 1377 : Part 2 : 1990 Method 5

Client ref: **12224**
Location: **Dinas Powys**
Contract Number: **19908-210613**

Hole / Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
TP1		1.00	25	45	20	25	100	CI Intermediate Plasticity
TP2		1.20	23	42	20	22	100	CI Intermediate Plasticity
TP6		1.00	25	47	19	28	90	CI Intermediate Plasticity

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

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.
BS 5930:1999+A2:2010



GSTL
GEO Site & Testing Services Limited

Checked By

Approved By:

Date Approved: 28.6.13

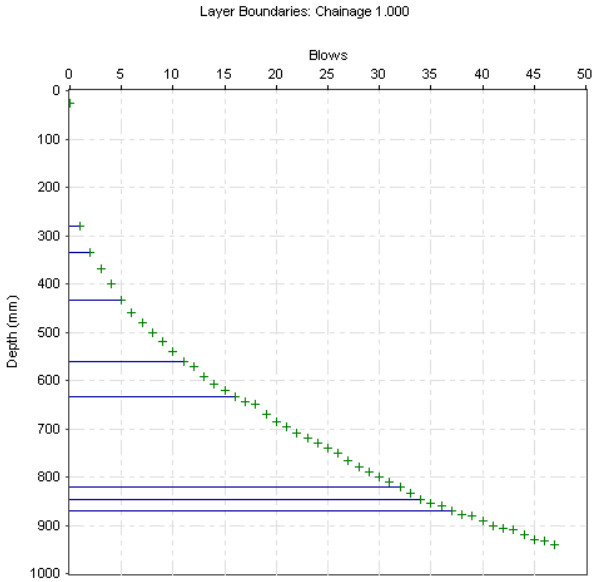
UKAS TESTING 2788

ANNEX G
CBR Test Results

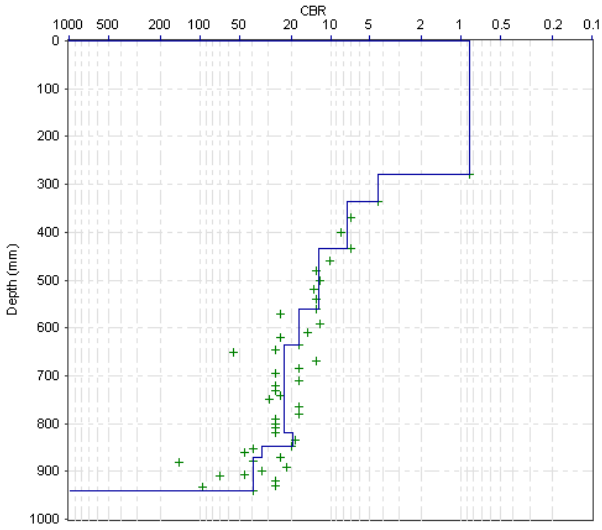
DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	1.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	255.00	1	280	280
2	55.00	4	55	335
3	33.33	7	100	435
4	20.83	12	125	560
5	15.00	17	75	635
6	11.56	23	185	820
7	13.50	19	27	847
8	8.00	34	24	871
9	6.90	39	69	940

CBR Relationship:

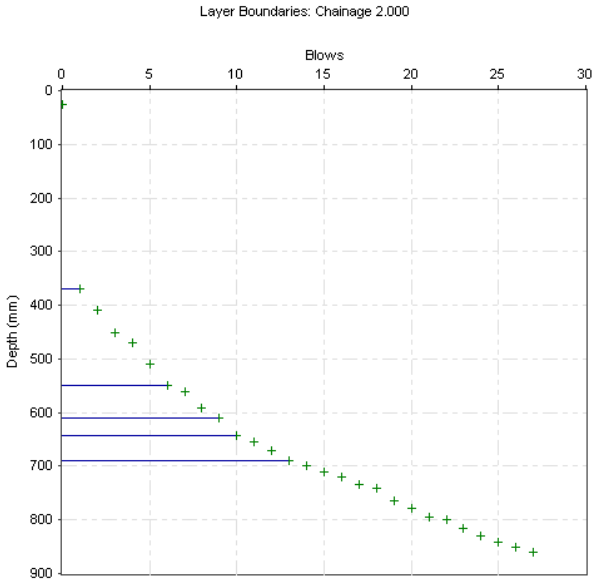
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

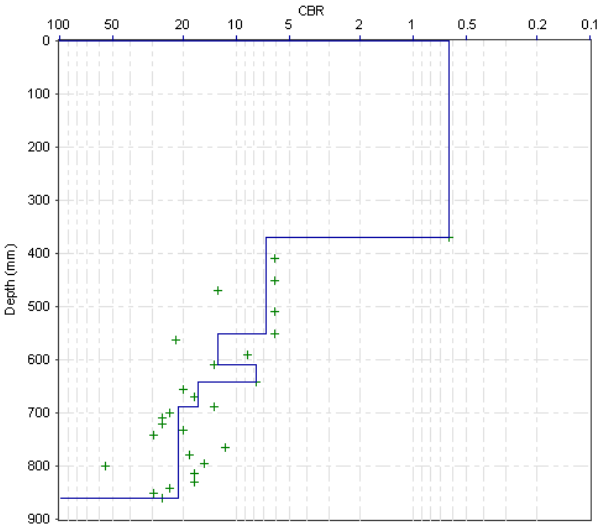
DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	2.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	344.00	1	370	370
2	36.00	7	180	550
3	20.00	13	60	610
4	32.00	8	32	642
5	15.67	16	47	689
6	12.21	21	171	860

CBR Relationship:

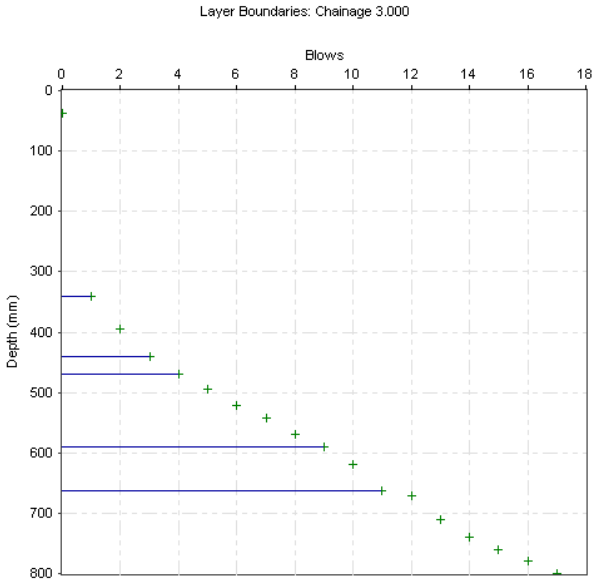
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

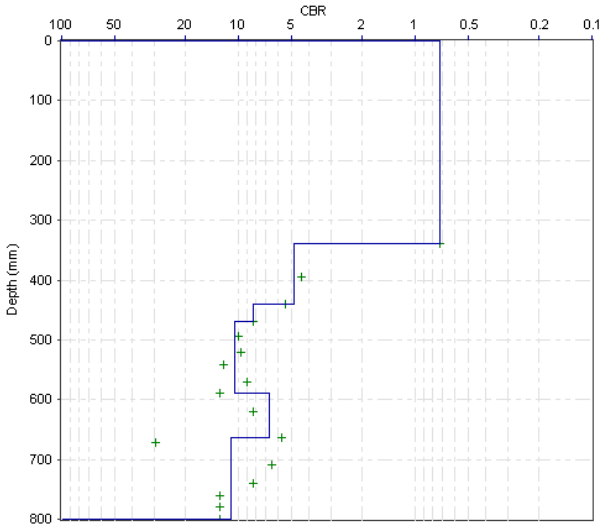
DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	3.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	303.00	1	340	340
2	50.00	5	100	440
3	30.00	8	30	470
4	24.00	10	120	590
5	36.50	7	73	663
6	22.83	11	137	800

CBR Relationship:

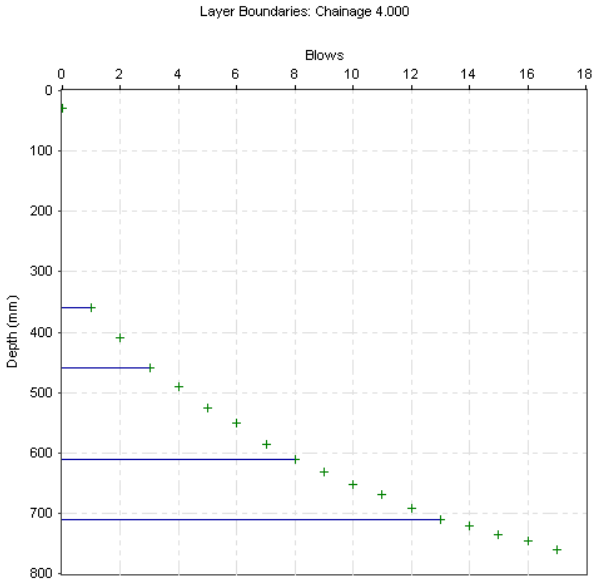
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

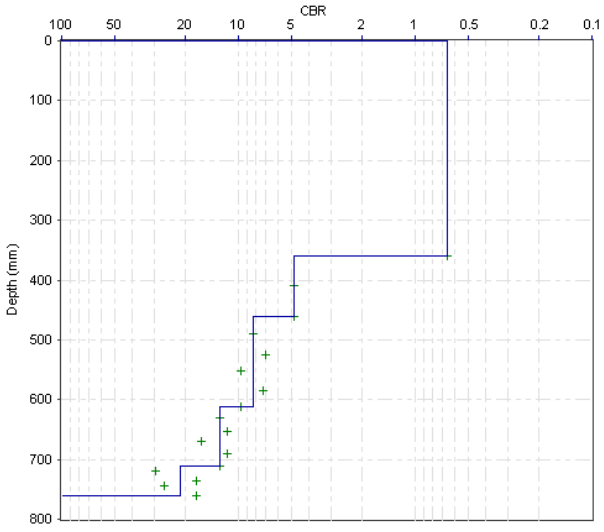
DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	4.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	330.00	1	360	360
2	50.00	5	100	460
3	30.20	8	151	611
4	20.00	13	100	711
5	12.25	21	49	760

CBR Relationship:

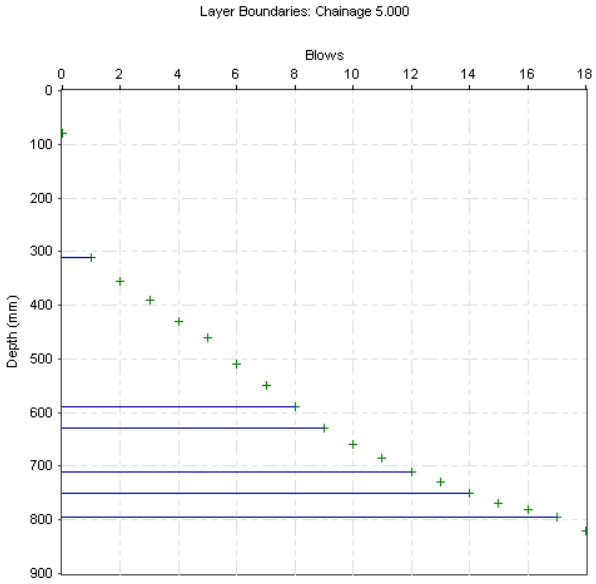
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

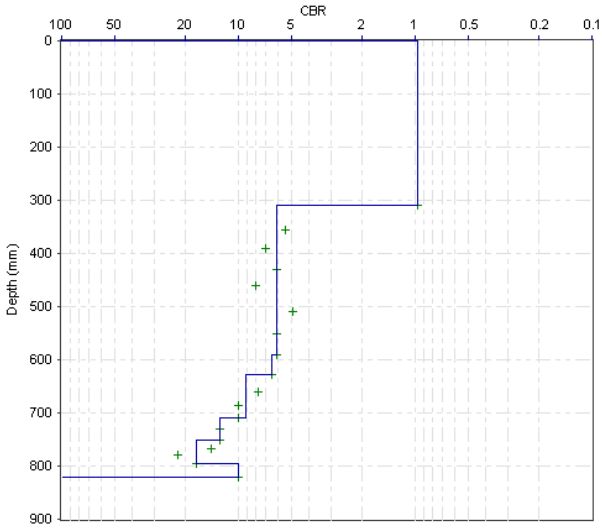
DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	5.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	230.00	1	310	310
2	40.00	6	280	590
3	38.00	6	38	628
4	27.33	9	82	710
5	20.00	13	40	750
6	15.00	17	45	795
7	25.00	10	25	820

CBR Relationship:

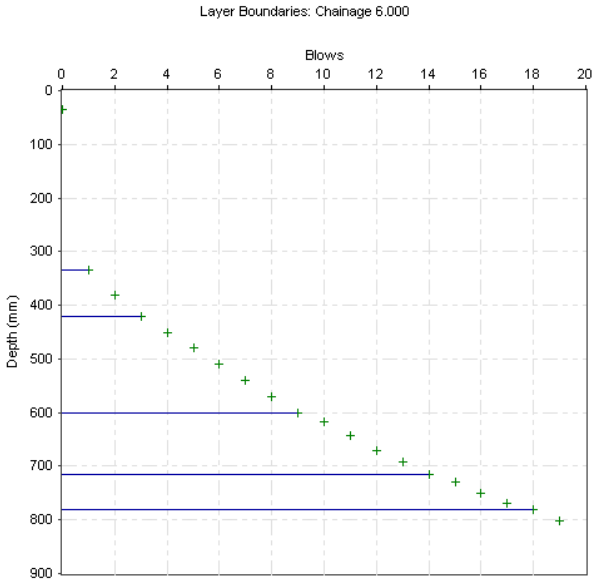
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

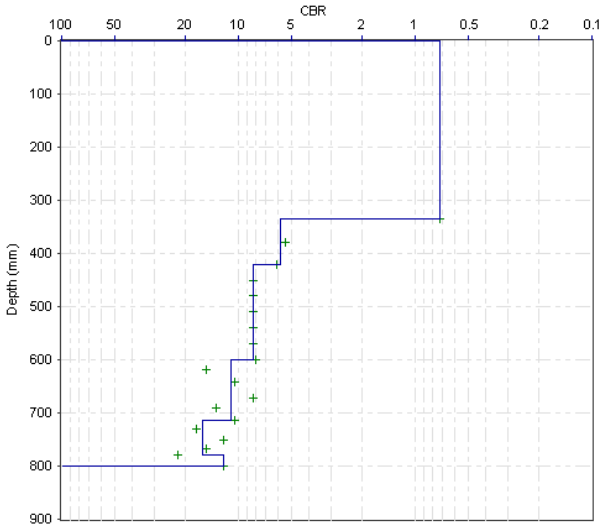
DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	6.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	300.00	1	335	335
2	42.50	6	85	420
3	30.17	8	181	601
4	22.80	11	114	715
5	16.25	16	65	780
6	21.00	12	21	801

CBR Relationship:

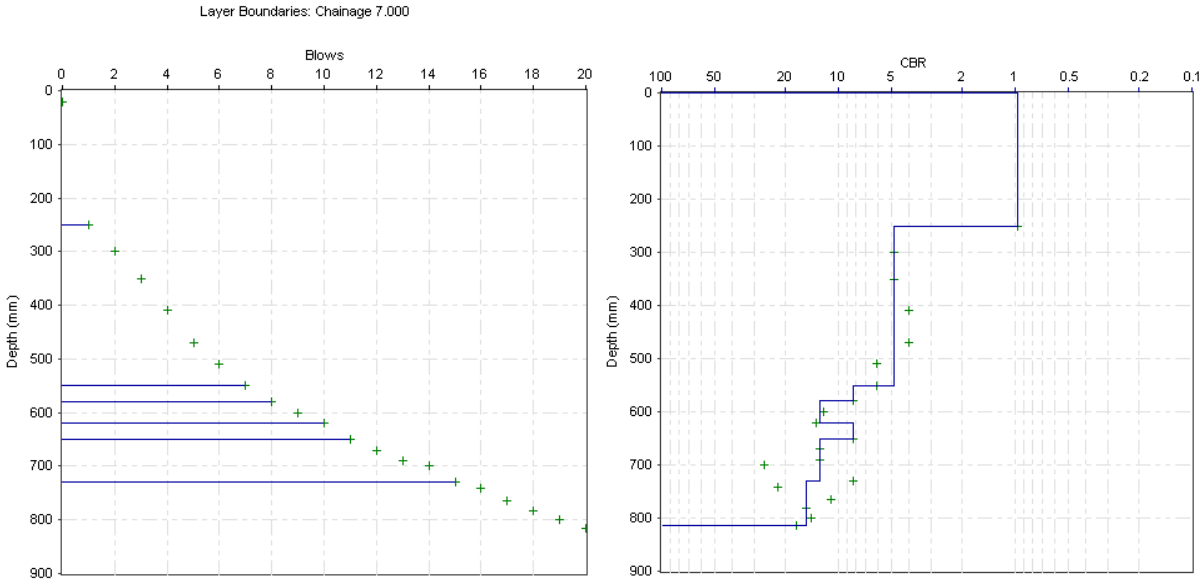
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	7.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart

CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	230.00	1	250	250
2	50.00	5	300	550
3	30.00	8	30	580
4	20.00	13	40	620
5	30.00	8	30	650
6	20.00	13	80	730
7	17.00	15	85	815

CBR Relationship:

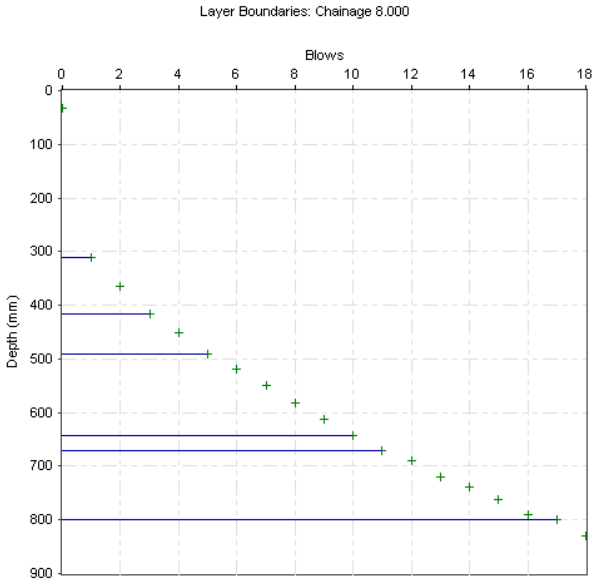
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

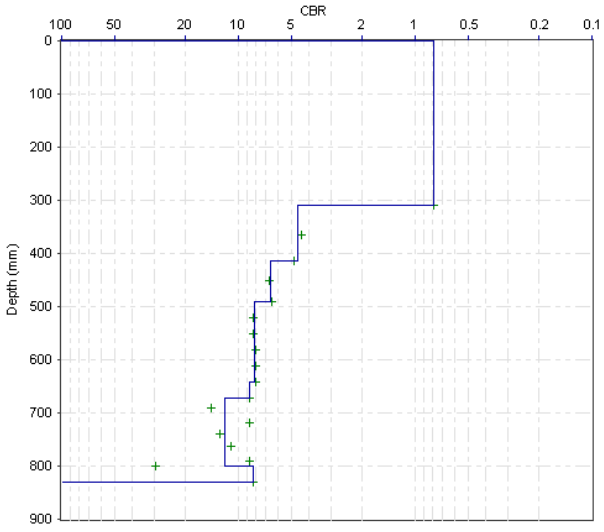
DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	8.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	278.00	1	310	310
2	52.50	5	105	415
3	37.50	7	75	490
4	30.60	8	153	643
5	29.00	9	29	672
6	21.33	12	128	800
7	30.00	8	30	830

CBR Relationship:

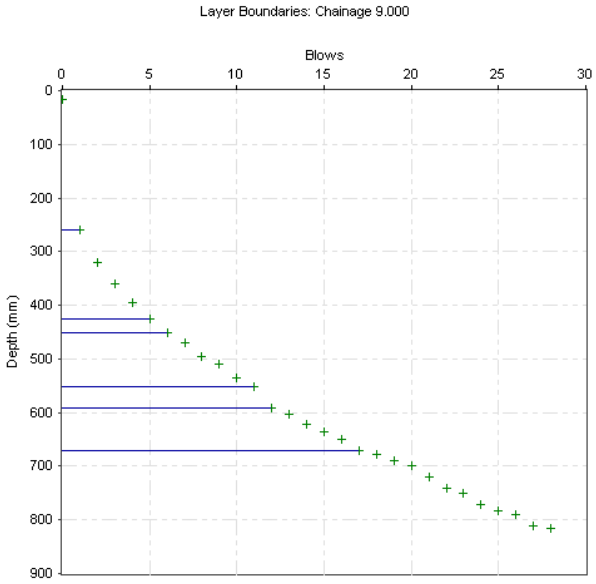
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

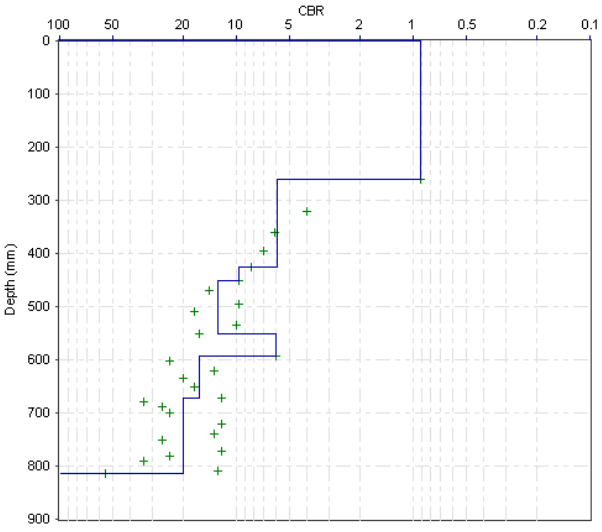
DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	9.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	244.00	1	260	260
2	41.25	6	165	425
3	26.00	10	26	451
4	20.00	13	100	551
5	41.00	6	41	592
6	15.80	16	79	671
7	13.09	20	144	815

CBR Relationship:

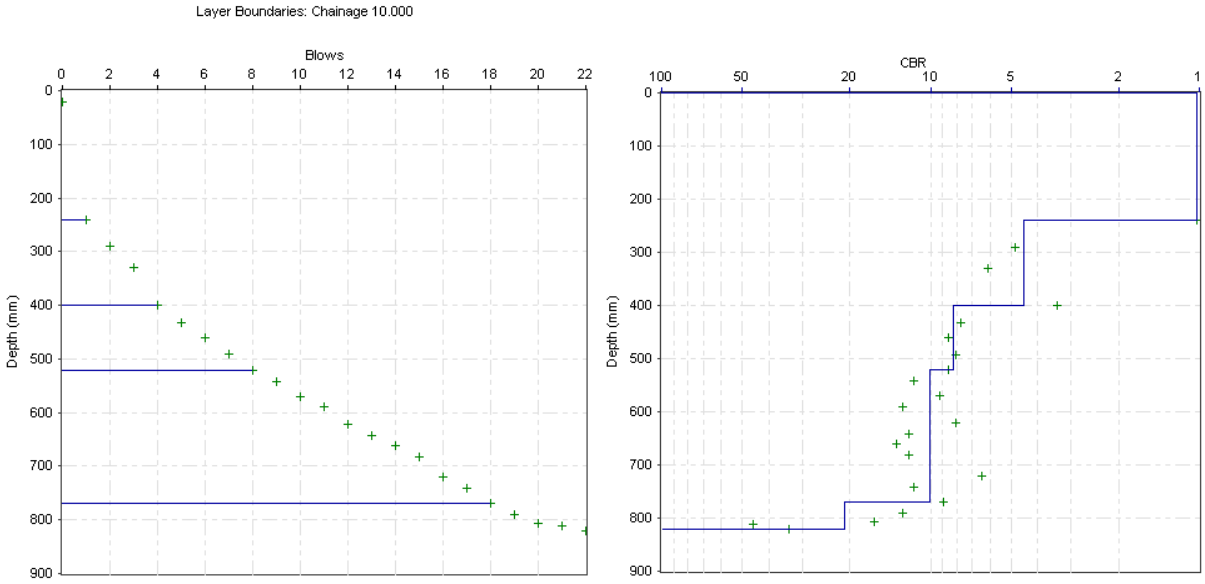
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	10.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart

CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	218.00	1	240	240
2	53.33	5	160	400
3	30.25	8	121	521
4	24.90	10	249	770
5	12.50	21	50	820

CBR Relationship:

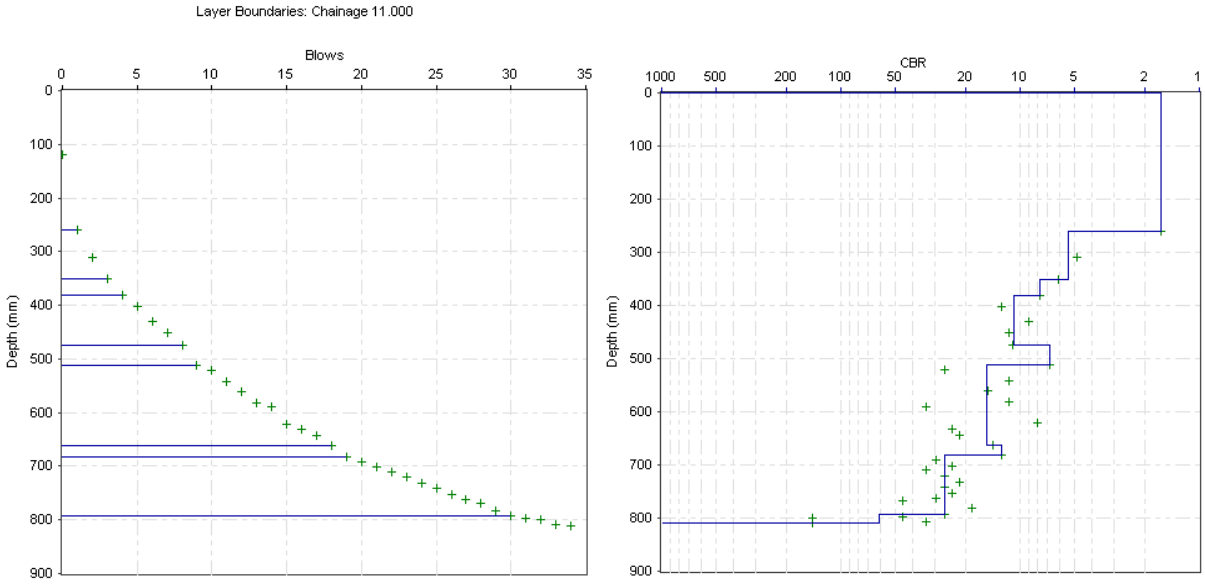
TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

DCP Layer Strength Analysis Report

Project Name: TRL probe

Chainage (km):	11.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Wet
Test Date:	21/03/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart

CBR Chart

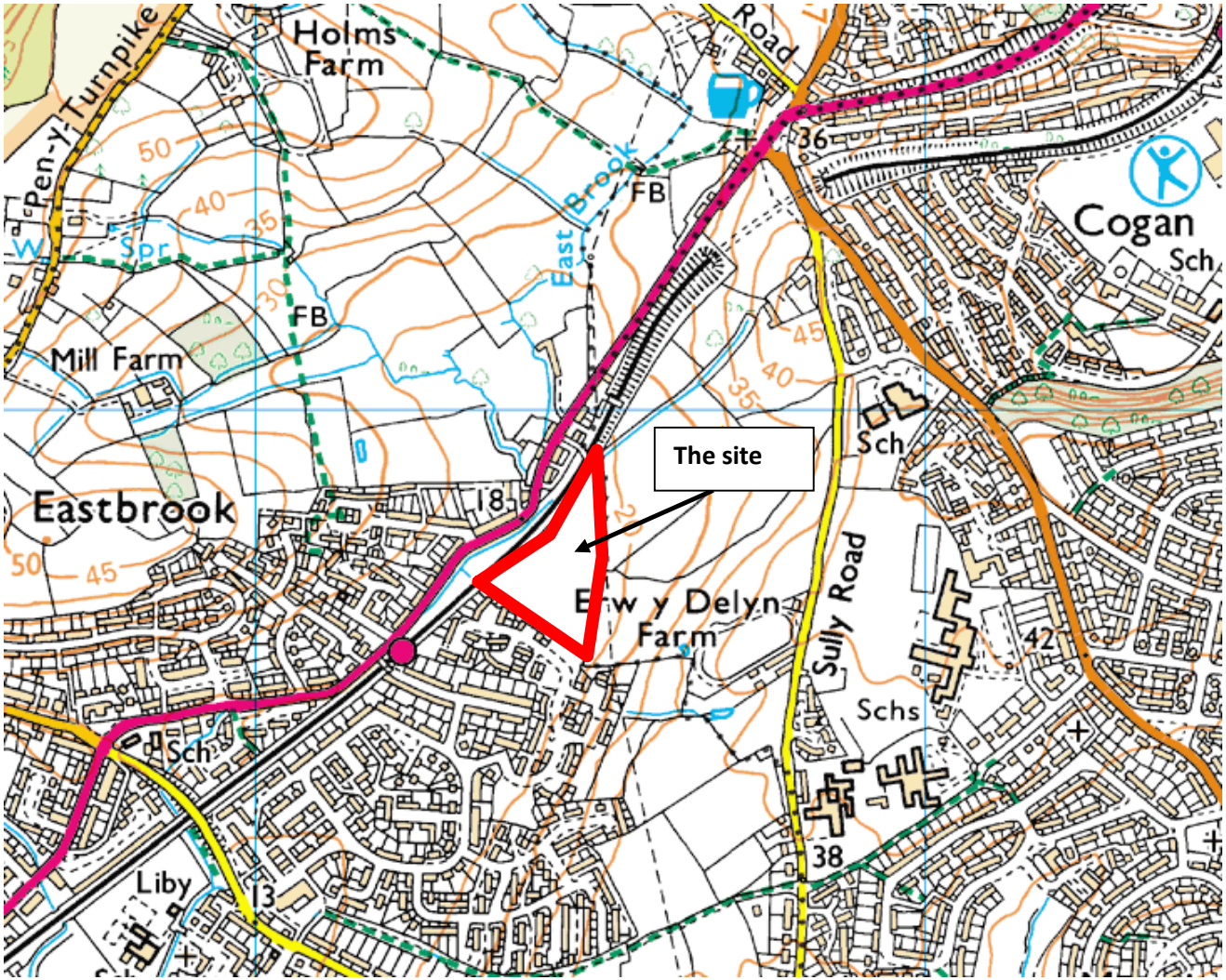
Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	140.00	2	260	260
2	45.00	5	90	350
3	32.00	8	32	382
4	23.25	11	93	475
5	36.00	7	36	511
6	16.78	15	151	662
7	20.00	13	20	682
8	10.00	26	110	792
9	4.50	62	18	810

CBR Relationship:

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

Report produced by .....



terrafirma

Job Number:
12224

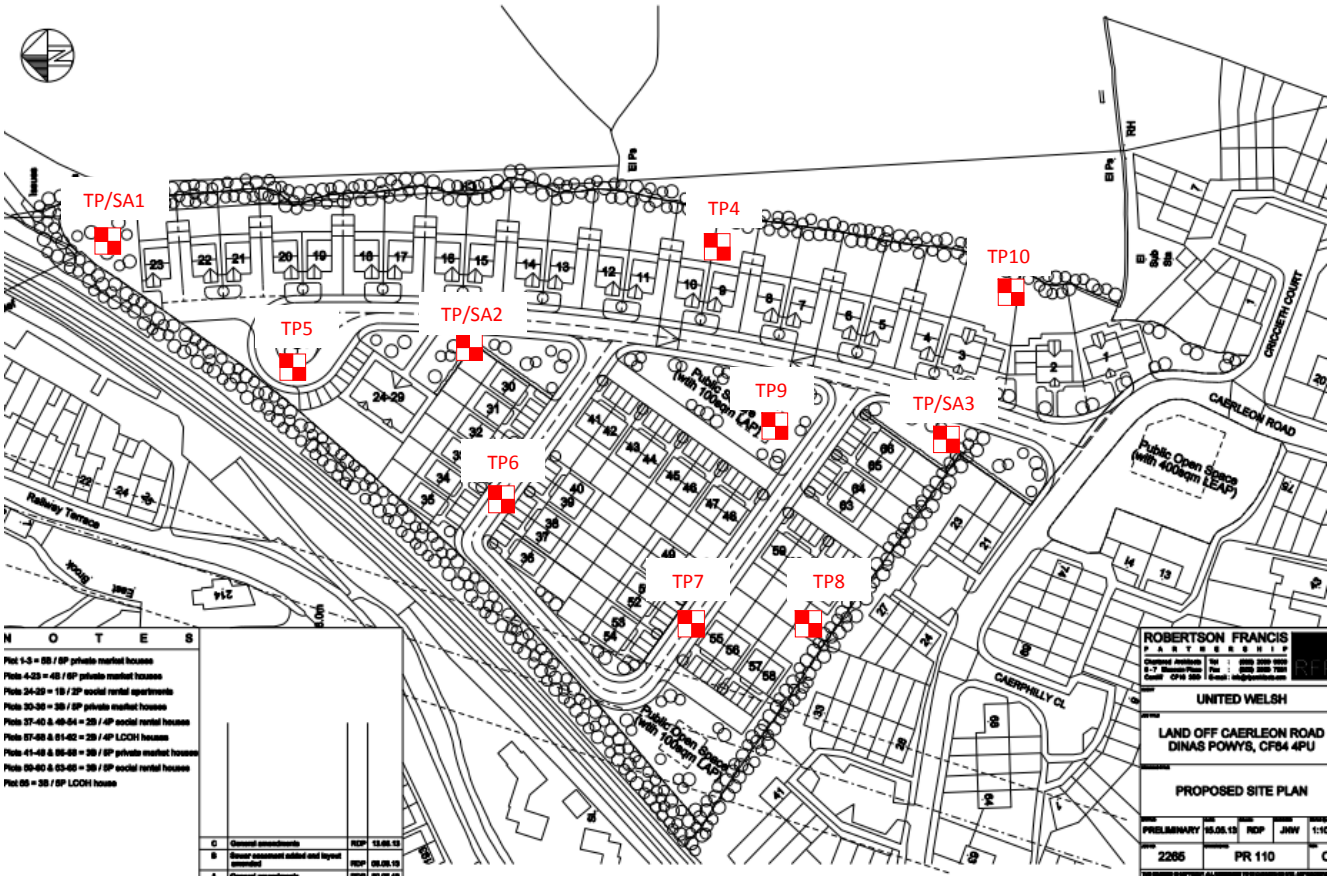
Job Title:
Land off Caerleon Road, Dinas Powys

Drawing Title:
Site Location

Drawing Number:
01

Scale:
Not To Scale

North



terrafirma

Job Number:

12224

Job Title:

Land off Caerleon Road, Dinas Powys

Drawing Title:

Current Site Layout

Drawing Number:

02

Scale:

Not To Scale

Legend:

TP = Trial Pit

TP/SA = Combined trial pit and soakaway

terrafirma

Job Number:

12224

Job Title:

Caerleon Road, Dinas Powys

Drawing Title:

Site Layout

Drawing Number:

02

Scale:

NTS

Legend:

TRL probe Locations