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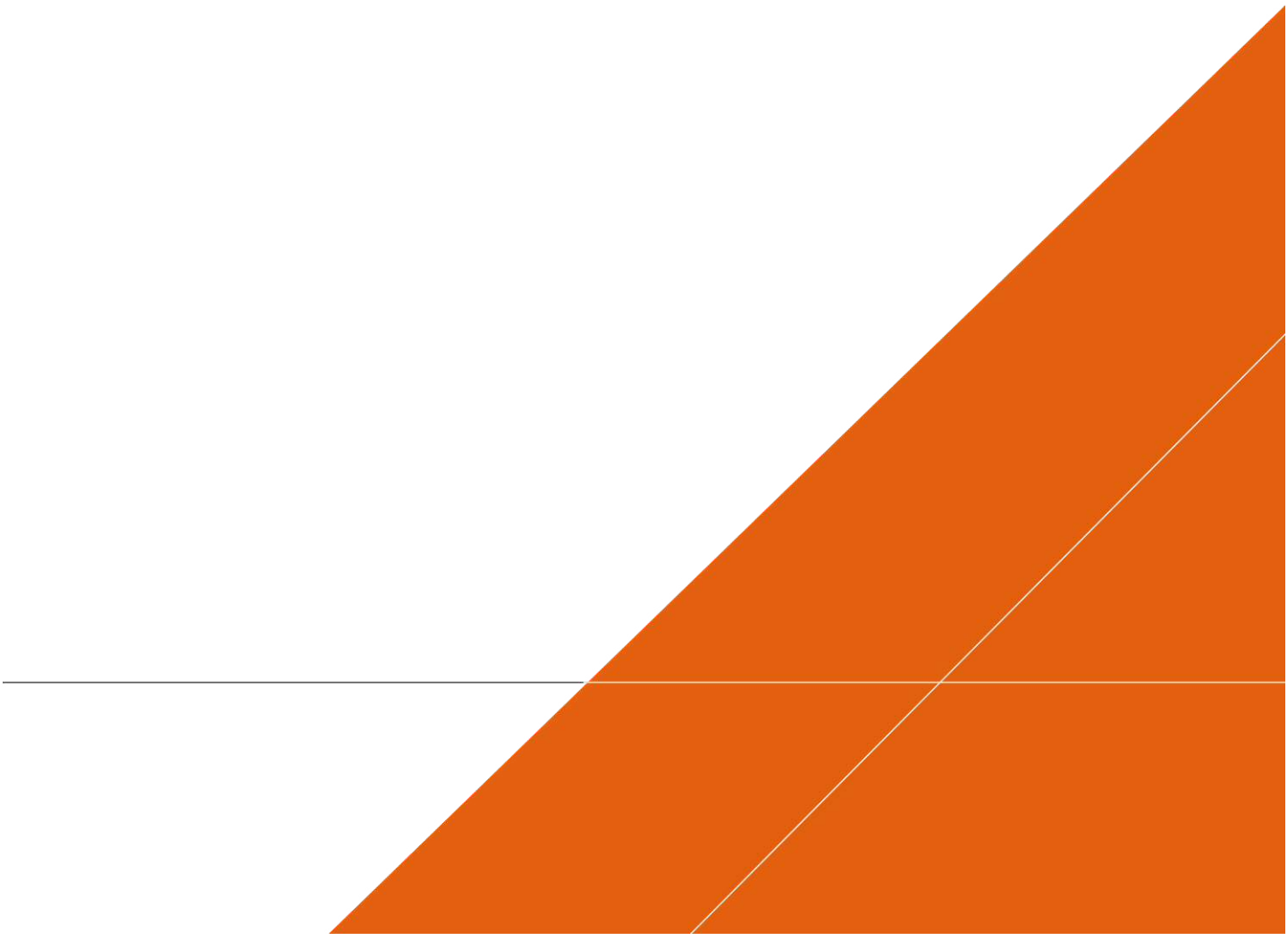
COSMESTON

Phase 1 Desk Study and Phase 2 Geo Environmental and Geotechnical Assessment Report

JULY 2018



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Cosmeston

Phase 1 Desk Study and Phase 2 Geo Environmental and Geotechnical Assessment Report

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VERSION CONTROL

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01	March 2018		First Issue
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03	July 2018		Final issue after client comments

This report dated 17 July 2018 has been prepared for Welsh Government (the "Client") in accordance with the terms and conditions of appointment (the "Appointment") between the Client and **Arcadis Consulting (UK) Limited** ("Arcadis") for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

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APPENDICES

1 INTRODUCTION

1.1 Terms of Reference

Arcadis Consulting (UK) Limited (Arcadis) received instructions from the Welsh Government (WG) to undertake professional services on a site located at Cosmeston, Penarth, CF64 5UB. The site is proposed to be developed into residential housing, a school and open space. The works undertaken are to assist with the masterplanning stage of the works.

1.2 Proposed Development

The site at Cosmeston is shown in Figure 1 below. The original allocation was on the western side of the site outlined in red, however this was extended by the Vale of Glamorgan Council to include the eastern area highlighted in red.

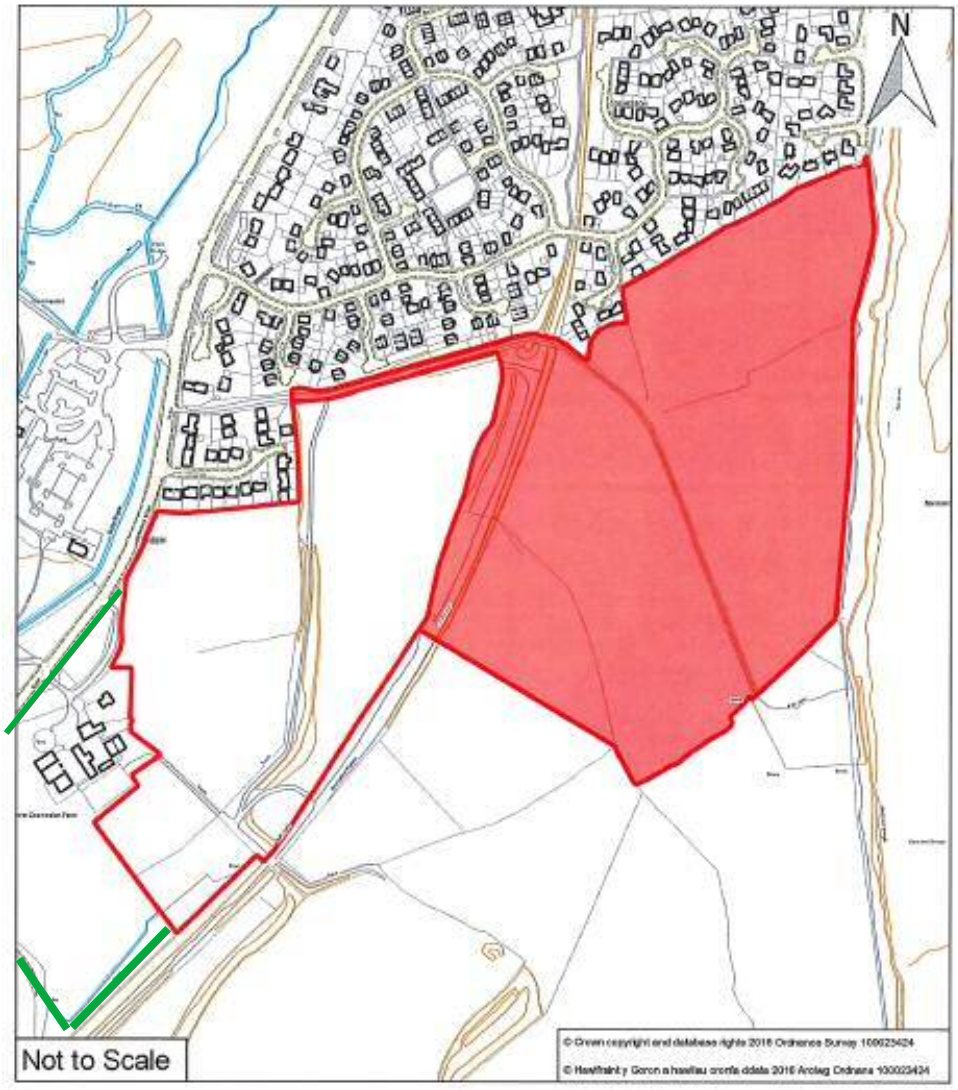

Figure 1 Red Line Boundary showing the area allocated for housing by Vale of Glamorgan

In addition to the area within the red line boundary, an extra area shown by the green line to the south west including the farm and the field to the south was also investigated and whilst not within the current red line boundary, the findings will be included within this report for completeness.

The scope of works has developed over time due to the additional allocated area. The work has currently included the following elements;

- Phase 1 desk study to identify potential geo-environmental issues that may represent a constraint to redevelopment, and
- Site investigation across the proposed development areas to establish the general ground conditions and potential constraints to development.

1.3 Limitations

This report has been compiled from many sources, which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time. Consequently, there is a potential for further information to become available, which may change this report's conclusion and for which Arcadis cannot be responsible.

The approach adopted by Arcadis for the assessment of contamination at the site is based on critical evaluation of the methodologies currently available, to decide which are most applicable to the site conditions and proposed end-use. Guidance in land contamination is in a transitional state. Therefore, no responsibility can be accepted for future changes in legislation or guidance, which may affect the approach used or the findings of this report.

It should be noted that ground conditions between exploratory holes may vary from those identified during this ground investigation; any design should take this into consideration. It should also be noted that groundwater levels may be subject to diurnal, seasonal, climatic variations and those recorded in this report are solely dependent on the time the ground investigation was carried out and the weather before and during the investigation.

2 SITE SETTING

2.1 Site Location

The site is situated near Lower Cosmeston Farm (Livery Stables), Penarth, approximately 11 km south of Cardiff. The site is centred on National Grid Reference (NGR) of ST182691. The red line boundary area as shown in Figure 1 is approximately 22 hectares in size. With the additional area including the farm and extra field to the south west (green line), the total area is approximately 25.5 hectares.

2.2 Site Description

A walkover survey of the site was undertaken by Arcadis Consultants prior to and during the site works. A summary of the findings of this survey are provided below and photographs of the site walkover are presented in Appendix A.

The site is accessed from Lavernock Road (B4267) directly from the west side of the site and via the stables of the Cosmeston Livery. There are several gates within the livery that provide access to the site from the western boundary. The site slopes downwards from centre to east and centre to west with the ground being raised up on an embankment to the historical rail line (approximately 10m above surrounding ground level) which is passing through the centre of the site.

The fields on the western side of the site are used by the livery for horse / donkey grazing and jumping practices. There are ropes and electric fencing present in the fields to separate areas. During winter months the horses are in the fields nearer to the stables, but in the spring / summer they move to the field adjacent to the former railway line which is known as the summer paddock. Overhead power cables are present within this area.

The fields were observed to be boggy and water logged with standing water present. During the site works it was difficult to get equipment to position due to the wet ground conditions.

The historical railway line is used for storage of various materials, much of this is related to highways work including fencing, signage, cones and metal ISO containers present. Plastic tubs containing mortar, cement, lubricants and tarmacadam products were stored directly on the ground along with bottles of propane gas and an electrical generator. There were many metal drums, most of which were corroded/rusted and labelled with various contents including gasoline, frozen orange juice, lubricants and oils. Fly-tipped rubbish including fridge-freezers, ovens, sofas, possible asbestos containing materials, timber, metal and general domestic rubbish was also noted on parts of the site. There was an open drum with evidence of spilled contents on to the bare ground, with an oily sheen present on surrounding surface water.

The fields on the eastern side of railway line are not currently used by the livery and appear to be used for crops. The far eastern boundary is formed by sea cliffs, approximately 30 m above the beach and wave cut platform below. Assessment of cliff stability, rate of erosion, and appropriate distance for nearest development to the top of existing cliff is not part of the scope of this phase of works.

There is a historical landfill in the south east of the site which is grassed with an undulating surface profile.

2.3 Surrounding Land Uses

The site is bounded to the west by the B4267 Lavernock Road with the eastern boundary adjacent to the coastline of the Severn Estuary. North of the site there is residential housing and south of the site are fields. The topography surrounding the site (north, south and east) is sloping downwards towards the east to the Severn Estuary. The area west of the site continues to slope downwards to the west towards Cosmeston Lakes.

3 Physical Setting and History of Site

3.1 Geology

The BGS online geology viewer (Ref 1) and published geological map comprising the site (Ref 2) were consulted to determine the underlying geology of the site.

3.1.1 Superficial and Solid Geology

Generally there are no superficial deposits mapped across the site, however on the extreme western side, alluvium deposits associated with the Sully Brook are indicated. Alluvium deposits are described as soft to firm normally consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel.

The solid bedrock geology underlying the site is the St Mary's Well Bay Member. This is described as interbedded mudstone and limestone of Rhaetian Age to Hettangian Age. The southern corner of the site is underlain by the Lavernock Shales Member which is a mudstone lithology.

The solid geology underlying the eastern side of the site at the top of the cliffs is the Penarth Group. This is described as interbedded mudstone and limestone of Rhaetian Age.

Given the presence of the historical railway line, Made Ground / reworked material is anticipated to be present along the line of the former rail line. Made Ground including waste is anticipated in the area of the historic landfill site.

3.1.2 Historical Borehole Records

Eleven historical borehole records are detailed on the BGS online viewer in surrounding area. Two borehole records (approximately 10-30m from the site boundary) to the west of the site indicate that topsoil is present for up to 0.40m bgl which is in turn underlain by grey and brown clay which becomes laminated with weathered siltstone with depth up to 1.95m; below this, one borehole encountered weathered limestone at 1.85 – 7.00m bgl, the other encountered siltstone at 1.95 - 2.30m bgl.

North of the site, associated with the residential development, nine borehole records are available for review. Topsoil was present in four of the holes to 0.30m bgl. All the boreholes contained made ground deposits. Four of the boreholes had thin layers of made ground ranging from ground level to 1.30m bgl which consisted of grey and brown gravelly clay with bricks. The remaining 5 boreholes had much thicker made ground layers ranging from ground level to 8.70m bgl; this was described as brown and grey gravelly clay with cement waste. This is likely to be associated with infilling of former quarries in this area (see site history in Section 3.4). Underlying the made ground all of the boreholes encountered weathered mudstone; this was described as a grey gravelly clay becoming a grey calcareous mudstone with depth, the deepest borehole recorded mudstone up to 9.00m bgl.

Strata recorded within these borehole records are generally consistent with the mapped geology of the site and surrounding area.

3.1.3 Radon

According to the Envirocheck report (Appendix B), the site is in a lower probability radon area, as less than 1% of homes are above the Action Level for Radon gas. Therefore, radon protective measures are unlikely to be a statutory requirement in the construction of new dwellings or extensions.

3.2 Hydrogeology

The Envirocheck report (Appendix B) indicates that the St Mary's Well Bay member bedrock underlying the site is designated as a Secondary A aquifer. Secondary A aquifers are described as being "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers". The superficial alluvium deposits underlying the north west part of the site are also classified as a Secondary A Aquifer.

The Lavernock Shales member is a Secondary B aquifer. Secondary B aquifers are described by the EA as being “predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering”.

According to the Envirocheck report, the site is not located in a Groundwater Source Protection Zone (SPZ). No SPZs are located within 1 km of the site boundary.

There is one licensed groundwater abstraction identified within 1 km radius of the site. This is located at Glamorganshire Golf Club where groundwater is abstracted from a borehole approximately 500m north of the site. The groundwater is used for a direct spray irrigation system on the golf courses; the permit start date is 18th May 2004.

3.3 Hydrology

Sully Brook is located to the west of the site and is one of the larger tributaries of the Cadoxton River. It flows southward through the Cosmeston Lakes Country Park before turning west and then south west. It finally joins with the Cadoxton near Barry Docks.

The two flooded historical quarries now form Cosmeston Lakes their total area is approximately 15 hectares in size. They are located approximately 200 metres west of the site boundary. The Brook and the lakes are both considered to be off-site receptors due to their location down hydraulic gradient of the site.

3.4 Site History

A review of the available historical Ordnance Survey maps (Appendix C) has been undertaken to assess the historical development of the Site and surrounding areas.

It is not the intention of this report to provide a full history, but to identify those past uses on and within the vicinity of the Site that could have resulted in contamination of the soils and/or waters. Significant changes to the land use of the Site and surrounding areas are summarised in Table 3.1 below.

Table 3.1: Summary of Site History

Date	On site	Surrounding Area
1879 – 1890	The site comprises agricultural fields separated by hedgerows. Lower Cosmeston Farm and a small orchard is within the site boundary (not within the red line boundary). A well is indicated within the farm complex.	Upper Cosmeston Farm and an associated orchard is adjacent to the north west. An unnamed road bounds the west of the site. The wider surrounding area is agricultural fields. An old limekiln and an old quarry are indicated to the south east. ‘
1900	The Taff Vale Railway line has been constructed and bisects the site on an embankment, running north east to south west. There are no significant changes within the site boundary.	Approximately 130m north of the site, the South Wales Portland Cement and Lime works has been constructed. This includes works buildings, tramways and a quarry. Golf Links course is shown to the north west.
1920	A quarry is now present on the western side of the railway line. This is linked by tramways to the Cement and Lime works to the north. There is another small quarry indicated on the eastern side of the railway line at the southern part of the site. This is also linked by tramways to the Cement and Lime works.	The Cement and Lime Works has expanded in size. Additional quarries are shown to west.

Date	On site	Surrounding Area
	An old quarry is present to the northeast within the site boundary.	
1940	The quarry on the western side of the railway has now been infilled and appears to have been returned to agricultural use. The quarry on the eastern side of the railway has expanded (beyond the site boundary) and appears to have been partially infilled. The old quarry to the north east appears to have been infilled.	No significant changes are noted in surrounding area.
1964 - 1965	The quarry is no longer present, however the embankment around the edge of the quarry remains. The quarry near the railway track is present. In 1977 this becomes a landfill (see Table 3.1 below for more information).	No significant changes are noted in surrounding area.
1968 - 1974	In the north western part of the site, spoil heaps are indicated near to Upper Cosmeston Farm.	A spoil heap is marked adjacent to the northern site boundary, extending north by approximately 80m. This appears to be linked to the Cement and Lime works. Downswood Limestone Quarry is located approximately 300m west of the site, extending in a northerly direction to approximately 1.5km away from the site. An Electricity Transmission Line (ETL) is located across the north west and north corners of the site.
1984 - 1989	The spoil heaps are no longer present.	The railway is now marked as dismantled. The Cement and Lime works have been removed and residential housing has been constructed up to the northern site boundary forming the village of Cosmeston. The Downswood Quarry has been landscaped with the southern half forming two large lakes and the northern half being filled in and landscaped forming Cosmeston Country Park.
2006 - 2015	There are no significant changes within the site boundary.	Upper Cosmeston Farm (adjacent to the northern end of the site) has been replaced with residential housing.

A drawing showing the main features across the site is included in Appendix D.

3.5 Unexploded Ordnance (UXO)

A UXO desk study and risk assessment was carried out by Zetica (Ref 3) on behalf of Arcadis to identify the potential UXO risk within the site and surrounding area.

This report concluded that there is evidence indicating that 2No. High Explosive (HE) bombs fell on the Site during World War Two (WWII). These both exploded and there is no evidence that any other bombing occurred on the Site.

No other significant military activity has been identified on the Site.

It is considered that the Site has a low UXO hazard level, as shown in Figure 2 below.

Figure 2 – UXO Hazard zone plan of the Site (taken from Zetica report)

3.6 Environmental Setting

Public register information for the site and the surrounding area is presented within the Landmark Envirocheck Report (Appendix B). The data has been reviewed and is summarised in Table 3.2 where the information is relevant to the context of the site (generally within 250m of the site) and the objectives of this desk study.

Table 3.2: Environmental Data

Register Information	Data Summary
Local Authority Pollution Prevention and Controls (PPC)	Approximately 400m north of the site is a Local Authority PPC for the Lavernock Road Service Station (VOG/23), dated 22nd December 1998. It is a local authority air pollution control for a petrol filling station.
Historical landfill sites	Information available from the Envirocheck report indicates that the quarry on the eastern side of the railway line was utilised as a landfill: Cosmeston No.1 – Old Tip. Its first input was in 1977, and last input in 1994. Specific deposited waste type included Inert, Industrial, Commercial, Household and Special Waste. Special waste is defined as 'Waste that has hazardous properties and is defined in the Special Waste Regulations 1996. Such properties may be flammable, irritant, toxic, harmful, carcinogenic or corrosive '. NRW were contacted but did not have any additional information regarding the landfill
Discharge Consents	Adjacent to the western boundary of the site: Welsh Water releases sewage discharges from the pumping station to the Sully Brook No other current surface water discharge consents were identified in a 500m radius of the site.
BGS Recorded Mineral Sites	There are five BGS recorded mineral sites within 500m of the site as detailed below. All are stated to be opencast limestone quarries and ceased in operation. • 2 within the site boundary (adjacent to the track (former old quarry) & historic landfill on eastern side of railway line) • To south east of the site. • Approximately 500m west of the site (former Downswood Quarry)
Pollution Incidents to Controlled Waters	There have been three recorded pollution incidents to Controlled Waters: • Approximately 200m west: Category 3 incident of farm slurry in 1991. • Approximately 240m south west: Category 3 incident of farm slurry/ effluent in 1991 diesel oils in 1997 • Approximately 270m north: Category 3 incident of diesel oils in 1997
Contemporary Trade Directory Entries	There are three active contemporary trade directory entries within 300m of the site: • Approximately 130m north; Venus Ironing Service, Ironing and Home Laundry Services • Approximately 170m north; Pat Jerome, Garage Services. • Approximately 300m south west; Meter and Instrument Services, Testing, Inspection and Calibration Equipment Manufacturers There is one inactive entry approximately 160m north for Catering Equipment.

Register Information	Data Summary
Ecologically important sites	The Cosmeston Lake Country Park located approximately 200m west of the site is a Nature Reserve and a Site of Specific Scientific Interest (SSSI). The SSSI designation extends beyond the lakes covering a total area of approximately 25 hectares. The coast overlooking the Severn Estuary approximately 30m east of the site is a SSSI, a Special Area of Conservation (SAC), and a Ramsar site.

4 Preliminary Conceptual Site Model

Geo-environmental assessments are required, in accordance with current regulatory guidance (CIRIA C552 – Ref 4 and CLR11 – Ref 5), to consider the significance of potential contamination in terms of plausible contaminant source-pathway-receptor contaminant linkages. As part of this process, it is necessary to develop a conceptual model of these potential contaminant linkages by identifying the potential contamination sources, sensitive receptors and potential exposure pathways.

The following sections detail the potential receptors, pathways and source of contaminants that may be present at the site based on the information presented in the previous sections. The definitions of a receptor, a pathway and a contaminant source are provided in the box below.

A receptor may be defined as either:

(a) a living organism, a group of organisms, an ecological system or a piece of property which is being, or could be, harmed, by a contaminant; or
(b) controlled waters which are being, or could be polluted by a contaminant.

A **pathway** may be defined as

A route, or routes, by which a receptor:

(a) is being exposed to, or affected by a contaminant, or

(b) could be so exposed or affected.

A pathway can only be identified if it can expose an identified receptor to an identified contaminant.

A **contaminant source** may be defined as

a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of controlled waters and/or pose a risk to human health.

The relationship between the above three elements is called a 'pollutant linkage'. All three elements must be present for a pollutant linkage to exist.

4.1 Potential Contaminative Sources

Based on the information obtained from the historical / environmental research and the site walkover, there are a number of potential contaminative sources identified on and off-site. These are detailed in Table 4.1 below.

It should be stressed that it is considered unlikely that all of these substances would be present at significant concentrations across the site.

Table 4.1: Potential Contaminative Sources

Potential Source	Potential contaminants
On Site	
Made Ground used to infill historic quarries.	Metals, hydrocarbons, asbestos, ground gas and vapour generation.
Historic landfill Site	Metals, hydrocarbons, VOC, sVOC (e.g. solvents), asbestos, ground gas and vapour generation, leachate from decay of materials.
Spoil Heaps / Fly tipping and materials being stored on former railway line	Metals, hydrocarbons, asbestos

Potential Source	Potential contaminants
Off Site	
Made Ground from infilled quarries	Metals, hydrocarbons, ground gas and vapour generation.

4.2 Potential Receptors

It is understood that the proposed development will comprise residential housing, a school and open spaces. The potential receptors detailed below take into consideration this future land use. It is considered possible that potential contamination within the soils may be disturbed during the construction phase, or during gardening or landscaping undertaken by future site users.

Human Health

- Future Site Users (residents, members of the public, teacher, pupils, dog walkers, users of open space).
- Contractors and maintenance workers

Contamination risks to construction workers are not appraised by chronic (long term) exposure human health risk assessments. There are no appropriate published criteria applicable to the assessment of potential risks to construction workers. The potential risks should be addressed by a site-specific construction workers risk assessment and implementation of appropriate health and safety measures, to adequately mitigate any potential risks. All works should be conducted in accordance with the CDM Regulations 2015 (Ref. 6) or any other relevant guidance. Constructions workers are not considered further in this assessment.

Controlled Waters

- Underlying Secondary A Aquifer in bedrock and superficial deposits.
- Secondary B aquifer in south eastern part of the site.
- Sully Brook to the west
- Cosmeston Lakes to the west
- SSSI marine environment to the east

Infrastructure

- Underground structures / services (water pipes, concrete, foundations) including sulphate attack.
- Proposed buildings.

4.3 Potential Pathways

Potential pathways are the routes that link the receptor the contamination. The potential pathways for this Site are summarised in the table below,

Table 4.2: Potential Contamination Pathways

Receptor	Pathways
Humans health (future site users)	Accidental ingestion of contaminants within soil, water and dust Inhalation of dust, vapours and ground gases Dermal contact with contaminants within soil, water and dust Ingestion of contaminated vegetables and soil attached to vegetables (private gardens only)
Controlled Waters	Leaching of contaminants from the unsaturated zone into underlying groundwater.

Receptor	Pathways
	Horizontal migration of contaminants into via groundwater into surface water. Surface runoff and lateral migration.
Infrastructure	Direct contact of building/structures/ services with contaminants in the soil and made ground. Gas and/or vapour accumulation in confined and poorly ventilated spaces.

5 Intrusive Ground Investigation

5.1 Scope of Works

The ground investigation was designed to establish the general ground conditions across the site to aid the masterplanning of the site and provide evidence of its suitability for the proposed land use. The work was based on a grid sampling pattern applied to the historic land use patterns.

To date, the work has included trial pitting, dynamic (window) sampling, permeability (soakaway) testing, dynamic probing, chemical testing (geo environmental and geotechnical) and gas monitoring.

Full details of the scope of works and an exploratory hole location plan is included in the Arcadis Factual report (Ref 7).

5.2 Ground Conditions

Full details of the ground conditions encountered are included in the exploratory hole logs presented in the factual report and are summarised below.

Based on the ground conditions encountered which are due to different historical activities, the site has been split into three different areas; general farmland, infilled quarry and historic landfill site. The ground conditions encountered in each area are described below:

5.2.1 General Farmland

The work undertaken across the general farmland includes window sampling and trial pitting. The land to the west of the railway line was investigated during Phase 1 of the investigation works and included WS04 to WS07 and TP07 to TP21. The farmland to the east of the railway line was investigated during Phase 2 of the investigation works and included WS101 to WS107 and WS116 and TP101 to TP112.

Topsoil

Grass over soft brown slightly sandy slightly gravelly CLAY with frequent roots and rootlets. Gravel is angular to subrounded fine to coarse of mudstone. The layer was found to be typically 0.20m to 0.30 m thickness.

Solid Geology

Below the topsoil, natural soils likely to from part of the St Mary Wells Bay member were encountered. These are described as Firm yellowish brown slightly sandy slightly gravelly CLAY with low cobble content. Gravel is angular to subrounded fine to coarse of mudstone. Cobbles are angular to subangular of mudstone. The layer was found to be 0.10 m to 0.60 m thickness and depth is maximum 1.60 m towards south.

Below this layer a thin layer of mudstone was encountered which is described as Weak to medium strong grey MUDSTONE recovered as angular to subrounded cobbles and boulders, with some gravel of angular to subrounded fine to coarse mudstone. Beneath this layer another clay layer was generally encountered which was similar to the above but stiffer in nature.

The layer of Medium strong grey MUDSTONE was found to be at the depth of 1.30 to 1.50m towards the southwest boundary

5.2.2 Infilled Quarry (Summer Paddock)

The work undertaken in this area includes 3 window sample holes (WS01, WS02 and WS03) and 5 trial pits (TP02, TP03, TP04, TP05 and TP06) which were completed in Phase 1 of the investigation works. During Phase 2 of the works, 12 dynamic probes (DP101 to DP112) were undertaken across the areas to gain a better understanding of the depth of the former quarry and variability of the backfilled materials.

Topsoil

Topsoil was encountered in all the exploratory holes to depths ranging typically from 0.2m to 0.4m bgl. The topsoil is generally described as Grass over soft brown slightly sandy slightly gravelly CLAY with frequent

roots and rootlets. The amount of sand and gravel did vary across the area. The gravel was mainly mudstone and brick, however parts of a ceramic pot were found in TP02.

Made Ground / Reworked Materials

Beneath the topsoil in TP05 a thin layer of black gravel of clinker and ash was encountered between 0.3m and 0.4m bgl.

In other locations soft yellowish grey clay was encountered with varying quantities of gravel / cobbles and boulders. Brick fragments were encountered in TP04. It is considered that the material encountered within these investigations is likely to be reworked natural materials which have been used to backfill the former quarry. This is possibly associated with the former Cement works to the north of the site.

Super Heavy Dynamic Probes were undertaken across this area to try to establish the depth of the former quarry. These terminated at depths ranging from 5.7 m (DP101) and 10.8 m (DP111). A number of probes, whilst the blow readings increased, they did not terminate with refusal on the bedrock. These were located towards the southern part of the former quarry. This indicates that in some places the quarry in the southern part is likely to have been deeper than 11.6 m.

5.2.3 Historic Landfill

Four dynamic (window) sample holes (WS108, WS109, WS110 and WS111) were drilled within the area of the historic landfill site. The content / composition of the waste in the historic landfill is unknown and therefore this method was deemed the most appropriate approach to initially investigate this area.

Landfill waste was encountered in all four locations at depths ranging from 0.5m to 0.75mbgl. The waste was described as containing plastic bags, plastic and glass fragments. The recovery of the material was poor as the waste was pushed down by the window sample tube. The maximum depth penetrated was 3.0 mbgl in WS110, still within the landfill waste.

Above the distinctive waste materials a variable “cap” layer of gravelly sand / clayey sand was initially encountered, with a layer of sandy clay (WS108, WS109 and WS111) and gravel (WS110).

5.3 Visual or Olfactory Evidence of Contamination

Across the majority of the site, no evidence of contamination was observed within the underlying soils. Localised areas of ash / clinker were observed in TP05 and brick fragments were encountered in TP04.

As would be expected, the main evidence of anthropogenic contamination was encountered in the historic landfill which contained waste products such as plastic bags and fragments of glass and plastic.

6 Geo-Environmental Assessment

6.1 Risk to Human Health – Soil

6.1.1 Data

In total 62 soil samples were analysed (34 in Phase 1 and 28 in Phase 2) across the site. The samples were chosen as they were considered to represent the overall ground quality at the site, or conversely, had visual signs of contamination.

These samples were analysed for a range of contaminants including inorganics, organics (PAHs, TPH, Phenol) to determine the potential risk to site end users. The laboratory sheets are included in the factual report.

6.1.2 Soil Screening Values (SSV)

The proposed end use of the site is for residential development with a school and areas of open space. All the soil chemical data has been screened against the current LQM/CIEH Suitable for Use Levels (S4ULs)[1] (Ref. 8) for human health risk assessment for a residential with plant uptake scenario as this is considered appropriate at masterplan stage and adopts the most conservative approach for the development. In the absence of a S4UL for lead, the Category 4 Screening Level (C4SL) has been adopted (Ref 9).

For organic contaminants SSVs for a 1 % Soil Organic Matter (SOM) have been used which is considered to be a precautionary approach.

6.1.3 Soil Results

Inorganic and Organic

Generally the soil contaminant concentrations were below the S4ULs / C4SLs. However a number of exceedances were noted and these are detailed in Table 6.1 below. The screening values applied are enclosed in Appendix E.

Table 6.1: Summary of contaminant results

Determinant	Concentration Range (mg/kg)	SSV (mg/kg) (Residential with plant uptake)	Location of exceedance / depth m (stratum)
Arsenic	53	37	TP06 / 0-0.25m (Made Ground)
	110		TP05 / 0-0.30m (Made Ground)
	37		TP04 / 0-0.30m (Made Ground)
Benzo(b)fluoranthene	5.7	2.6	WS04 / 0-0.50m (Made Ground)
Benzo(a)pyrene	3.1	2.2	
Dibenz(a,h)anthracene	0.59	0.24	

All the elevated results were from Made Ground strata. TP04, TP05 and TP06 are from the infilled quarry area. In WS04, where the elevated PAH results were recorded, ash and clinker were recorded and these are likely to be the source of the PAH contamination.

A number of samples were analysed for pesticides and these were found to be below limit of detection.

Asbestos

The soil samples were screened for asbestos as part of the general suite. Loose asbestos fibres (Chrysotile) were detected in one sample – TP06 at 1.0-1.90m depth. This was within a Made Ground layer in the infilled

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quarry. The strata included gravel of clinker, ash and brick. No asbestos fragments were observed so it is likely to be fibres within the soil matrix. Quantification was not undertaken.

6.2 Risk to Controlled Water

6.2.1 Data

3 groundwater samples were taken from the installations across the site and analysed for a suite of contaminants.

9 soil samples were scheduled for leachate testing for inorganic contaminants. The laboratory records are within the factual report.

6.2.2 Water Quality Standards (WQS)

To assess the groundwater in terms of its potential as a source of contamination to Controlled Waters, contaminant concentrations within water and soil eluate samples have been compared against appropriate Water Quality Standards (WQS).

The site is located on a Secondary A aquifer. There is a surface water feature (Sully Brook) located to the west of the site. For completeness the results have been compared to both UK Drinking Water Standards (UK DWS) and Environmental Quality Standards for freshwater (EQS).

The EQS values have been taken from the Water Framework Directive (WFD) which provides stringent screening values to be protective to the surface water environment.

When considering EQS values, for a number of contaminants, the hardness of the receiving water must be considered to determine the EQS. To be conservative the most stringent concentrations have been used.

For some of the metals, the WFD guideline for copper, zinc, lead and nickel are based on bioavailability. PNECs (Predicted No Effect Concentration) are calculated based on assumed Ca2+ and Dissolved Oxygen Concentrations.

The WQS used are included in Appendix E.

6.2.3 Groundwater Result

Groundwater was analysed from WS104 and WS111 which is inside the historic landfill site. The results were generally below the appropriate WQS for inorganics and organic contaminants.

One elevated result of lead was recorded in WS111. The concentration was 14ug/l compared to a PNEC derived value of 6ug/l (using DOC = 5mg/l).

6.2.4 Leachate Results

Leachate results above the WQS were recorded in the following samples;

- WS07 (0.0-0.2m bgl) Copper 25ug/l compared to 19.9ug/l
- TP08 (0.0-0.3m bgl) Copper 21ug/l compared to 19.9ug/l
- TP101 (0.05-0.15m bgl) Lead 14ug/l compared to 6ug/l
- TP112 (0.0-0.1 m bgl) Lead 8.2ug/l compared to 6ug/l.

It should be noted that these WQS are derived via the PNEC bio-accessibility tool using assumed input values and therefore may be conservative. Also the leachate test is laboratory test and therefore may not truly represent what is occurring on site. Whilst exceedances have been recorded, concentrations are the same order of magnitude as the screening criteria, and do not exceed by wide margin.

6.3 Risk to Human Health – Ground Gas

6.3.1 Introduction

To establish the ground gas regime for the site, the window sample installations were monitored. The wells installed during the Phase 1 works (WS01 and WS03) were monitored on the 16th and 25th September 2016.

During the Phase 2 works monitoring of the Phase 1 and Phase 2 wells (WS101, WS104, WS109, WS110 and WS111) was undertaken on three separate visits on 9th, 16th and 25th January 2018.

The ground gas monitoring was undertaken using an infra-red gas analyser with flow pod. Concentrations of methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) in % v/v, Hydrogen Sulphide (H_2S) and Carbon Monoxide in ppm and ground gas flow in litres per hour (l/h) were recorded during each visit.

After the monitoring was undertaken, each well was dipped to record the groundwater level in each location.

6.3.2 Gas Monitoring Results

Below is a summary of the range of ground gas monitoring results recorded during the monitoring rounds. Full details are provided in the factual report. The results from the historic landfill site (WS109, WS110 and WS111) have been summarised in a separate table (Table 6.3`) as these do not represent the whole site.

Table 6.2 Summary of gas monitoring data in general farmland and typically natural materials infilled quarry

	Range of Results (steady state)			
	2016 data *	09/01/2018	16/01/2018	25/01/2018
Methane (%v/v)	0.0-**0.1 (WS01)**	0.0	0.0	0.0
Carbon Dioxide (%v/v)	0.2-**2.9 (WS03)**	0.0-2.1	0.4-2.4	0.8-2.0
Oxygen (%v/v)	18.1-20.4	**14.1**-20.3	14.9-20.2	17.4-19.1
Carbon Monoxide (ppm)	0.0	0.0	0.0	0.0
Hydrogen Sulphide(ppm)	0.0	0.0	0.0	0.0
Ground Gas Flow (l/h) (steady)	0.0-**0.7 (WS03)**	0.1-0.3	0.1-0.6	0.1-0.2
Atmospheric Pressure	1009-1018	1006	1002	1006

* WS01 and WS03 only

BOLD = maximum result or lowest with regards to O2

Table 6.3 Summary of gas monitoring data in historic landfill

	Range of Results (steady state)		
	09/01/2018	16/01/2018	25/01/2018
Methane (%v/v)	3.1 - 37.1	0.0-**37.2 (WS109)**	0.0-36.3
Carbon Dioxide (%v/v)	12.5-**21.4 (WS109)**	0.1-19.1	0.2-18.0
Oxygen (%v/v)	0.0	0.0-20.3	0.0-20.1
Carbon Monoxide (ppm)	0.0	0.0	0.0
Hydrogen Sulphide(ppm)	0.0	0.0	0.0
Ground Gas Flow (l/h) (steady)	0.3 - 0.6	0.1-**0.9 (WS109)**	0.1-0.5
Atmospheric Pressure	1006	1002	1006

BOLD = maximum result or lowest with regards to O2

6.3.3 Hazardous Ground Gas Assessment

A ground gas risk assessment has been undertaken to evaluate the risk posed to potential receptors of the proposed residential development.

CIRIA guidance (*Assessing risk posed by hazardous gases to buildings,* CIRIA C665, 2006) (Ref 10) has been used to inform the ground gas assessment which adopts the method proposed by Wilson and Card (Situation A) and NHBC (Situation B). For residential housing Situation B is appropriate. For this approach, the ground gas concentration and borehole flow rate are used to calculate a Gas Screening Value and define a traffic light scenario (Situation B).

A Gas Screening Value (GSV) is calculated using the following equation:

GSV (l/h) = borehole flow rate (l/h) x ground gas concentration (v/v %)

Using the maximum concentrations and flow rate, the following GSVs have been calculated for the wells outside the landfill site;

- Methane = 0.0007l/hr (0.1% and 0.7l/h flow)
- Carbon Dioxide = 0.0203l/hr (2.9% and 0.7l/h flow)

Using the maximum concentrations and flow rate, the following GSVs have been calculated for the wells inside the landfill site;

- Methane = 0.3348l/hr (37.2% and 0.9l/h flow)
- Carbon Dioxide = 0.1926l/hr (21.4% and 0.9l/h flow)

Based on the above calculations the gas regime for the general farmland / infilled quarry would be Green (very low risk).

The gas regime within the landfill site would be Amber 1 based on the Gas Screening Value calculated or could be deemed to be Red due to the elevated concentrations of methane detected. Where the Red classification has typical concentrations above 20%v/v methane.

6.4 Contaminative Linkage Assessment

As discussed above in Section 4.0, for a pollutant linkage to be present on the site, a source, pathway and receptor must all be present at the site.

Across the majority of the site, soil concentrations recorded are below the appropriate SSVs and therefore a soil source is not considered to be present.

In three locations elevated Arsenic concentrations have been recorded and PAH compounds are recorded elevated in 1 location. These could pose a risk to site end users via from ingestion / inhalation and dermal pathways if they are within gardens / soft landscaping areas.

Asbestos fibres were found in one location but at a depth of 1.0-1.9m. If this material remains at this depth the risk to site end users is minimal as risk of inhalation would not occur, unless excavated.

From limited groundwater results, 1 elevated lead result has been recorded. Leachate results show that contaminants within soils are capable of leaching and to values slightly above WQS. These results indicate that there could be a low to moderate risk to the wider water environment from leaching and migrating off site.

Ground gases have been recorded on site. Across the majority of the site (natural ground), these are low and would not pose a risk to end users. However within the vicinity of the historic landfill site, higher concentrations of methane and carbon dioxide have been recorded together with some gas flow. These could pose a risk via inhalation in confined areas and possibly explosion due to a build-up of gases.

These initial results suggest that conditions exist within the landfilled materials, that could significantly restrict the ability to develop this area for residential properties. By one method of interpretation, the landfill area

would characterise as “Red” in accordance with NHBC guidance for low rise housing, on account of the relatively high maximum methane concentrations recorded (37% v/v).

Further detailed and high-quality monitoring of the gas regimes present will be required to support development plans and identify constraints. If development was considered feasible, full mitigation measures would be required to reduce this risk to an appropriate level.

It is noted that due to the mudstone / limestone bands encountered in the underlying geology, the wells outside the landfill area are generally only shallow (2.1m depth). In the areas around the historic landfill, the limestone / mudstone bands may prevent gases migrating vertically into the shallow soils. However if this band is removed during construction, a pathway may be created which could allow gases to migrate into properties / service trenches.

Future gas monitoring should include areas external to the landfill to assess migration pathways and potential associated risks to development.

7 Geotechnical Assessment

The geotechnical assessment has been divided into the three different areas as discussed in Section 5.2.

The stability of the cliff has not been included in this assessment, however it should be reviewed as part of detailed design.

7.1 General Farmland (Natural Ground West and East of the Railway)

7.1.1 Groundwater

Groundwater is sometimes present at shallow depth within 1m and 2m of the ground surface, and was variably encountered within the upper few metres of strata penetrated. Sometimes this ingress occurred during the very short period exploratory holes were open during site work, and sometimes in subsequent monitoring of installations.

Records of monitoring of Window Sample installations are contained in Appendix E of the factual report (Ref 7).

Shallow groundwater was sometimes encountered, possibly perched or semi-perched on mudstone or limestone horizons. Seepages at shallow depths are recorded within TP105, TP112, TP113, TP114 and TP115 to the east of the railway and TP15 and TP18 to the west of the railway, within the southern part of that area.

Notably within TP112 significant water entry occurred upon excavation through firm clay into the top of a limestone horizon at 1.10 m bgl. Water that entered at 1.10m had risen by nearly 0.5m within 15 minutes. A soakaway test was scheduled for that position, and during that test duration of 85 minutes, water continued to rise to close to ground level.

Initially dry on excavation, within the soakaway test at TP101, water levels started to rise during the 140 minutes test duration, rising from 1.80 m up to 1.30 m bgl. TP101 is located to the seaward cliff side and northern part of the land, east of the railway.

Water is recorded within the two installations located to the east of the railway. Within WS101, located towards the sea cliff, water is recorded at 1.80 m to 1.85 m bgl. Within WS104, located towards the southern end of those eastern fields, (and local to TP112), water is recorded at between 0.90m and 0.65 m bgl, spanning three monitoring events in January 2018.

No installations were included on the agricultural natural land, west of the railway.

Thus sub-artesian conditions are present, as recorded at TP101 and more notably at TP112. With recognition of the interbedded geology, where a weathered clay mantle often overlies the rock strata, occurrences of water entry and subsequent rise should be expected in other locations.

Groundwater control measures may need to be provided during ground works, particularly during wetter periods and for deeper excavations, such as those that may be required for main sewers, for example. Some pumping may be required to keep shallow foundation excavations free of water prior to concrete pours.

7.1.2 Soakaway Performance (Natural Ground)

Six soakaway tests were attempted within the natural ground to the east and west of the railway.

Typically the clay lithology present near the surface provided little or slight infiltration during the period the tests were run. A soakage infiltration value could not be calculated due to the lack of infiltration in any of these tests.

To the west of the railway, tests were undertaken in TP19 and TP21. Whilst infiltration was insufficient to define an infiltration value, water levels did drop slightly during the test, suggesting some limited infiltration was occurring. Both locations encountered clay, with refusal on mudstone rock strata. If fractured, such

rocks may have sufficient secondary permeability that might enable a non-standard form of infiltration system to be designed.

The often shallow depth to groundwater will also limit the application of standard infiltration drainage design, which requires a non-saturated zone to be present beneath the base of soakaways. It would be prudent to open an early dialogue with Natural Resources Wales to determine the regulator's requirement regarding possible direct discharge to groundwater and mitigation of associated pollution risks.

Infiltration drainage of normal shallow design is unlikely to provide a suitable drainage solution for this site.

Testing of borehole soakaway options would be prudent.

Infiltration would need to be kept outside of the zone of influence that could affect the stability of the sea cliffs.

7.1.3 Road Pavements

CBR is not a unique soil property, especially in clay soils, but rather varies with moisture content, where CBR values reduce as clays increase in moisture content and become softer.

Near surface conditions are typically clay soils and it is assumed road formation at perhaps 0.6m below existing ground levels would typically comprise clay soils as the lower bound design consideration. Plasticity Index results indicate clays of up to typically high plasticity, of index 25 % to 30 %.

With reference to "IAN 73/06 Design guidance for road pavement foundations (draft HD 25) (Revision 1 (2009))" Table 5.1 "Equilibrium Subgrade CBR Estimation" indicates an equilibrium CBR for "silty clay" Plasticity Index 30% to be of the order 3 to 4%.

It would therefore be prudent to adopt a relatively low CBR of 3% in the preliminary design and to open discussions with the local authority highways department in order to agree pavement design approaches. This should be done at an early stage, as design traffic, drainage arrangements and thickness/stiffness of a pavement all play a part in achieving a satisfactory performance and an adoptable design.

7.1.4 Ground Floor Slabs

In accordance with NHBC guidance 5.1 "substructure and ground bearing floors", shrinkable soil, expansive materials or other unstable soils may require suspended floor construction. Shrinkable soils are classified as those containing more than 35% fine particles (silt and clay) and have a modified Plasticity Index of 10% or greater (see Chapters 4.2 'Building near trees' (each section) and 5.2 'Suspended ground floors' (each section)).

The majority of site soils meet this criteria of "shrinkable soil" and hence the need for suspended ground floors should be assessed. However, the thickness of such shrinkable soils is generally limited by the occurrence of limestone and mudstone strata, sometimes within the uppermost meter or two meters. The detailed guidance contained within NHBC Chapter 5 should be consulted to help inform specific requirements at future design stages. For example, it may be permissible to utilise ground bearing slabs in areas of the site where the thickness of shrinkable soils prior to encountering a rock horizon is below a certain threshold thickness.

7.1.5 Foundations

It is assumed that the development will comprise traditional low rise 2 storey houses, of detached, semi-detached and link detached layout. It is thus assumed loadings will be modest, and unlikely to exceed 50kN per linear metre run of load bearing wall.

A significant proportion of materials at or beneath likely foundation depth are high shrinkage soils. Heave protection is likely to be required, as per guidance set out by NHBC Heave precautions (Revised 04/17).

A minimum foundation depth of 1.0m should be adopted (high volume change potential soils), in accordance with NHBC 4.3 "Strip and trench fill foundations, precautions in shrinkable and volume change soil". This

minimum depth may need to be increased to take account of existing trees and vegetation or proposed planting, depending on species and distance from the foundation.

However, rock strata comprising limestone and mudstone often occur within these depth ranges. These are indurated materials far less susceptible to volume change.

Foundations on the land to the west of the railway line are likely to often encounter and be able to found on shallow rock strata. This often occurs within the upper meter, although toward the cliff-line, weathering depth is greater and depth extent of firm clay materials extends deeper.

Similarly, to the west of the railway, rock strata are often encountered within 1 to 2m of the ground surface.

Prior to first occurrence of rock, soils present at the order of 0.8 to 1.0m depth have typical undrained shear strengths described typically as firm. STPs taken within window sample holes in this material record SPT of typically N=13 to 16, corresponding to an undrained shear strength of approximately 50 to 60 kN/m^2.

Beneath these upper materials, weathered rock materials are often encountered.

Thus an allowable bearing capacity of 80 to 100 kN/m^2 would be reasonable to adopt for initial indicative design, founding in clay materials that are at least of firm consistency with an undrained shear strength of 50 to 60 kN/m^2 or greater, subject to detail design and check that settlement at this applied stress is acceptable.

Some soft materials are present, for example in and around TP 19, in the southern area of the land west of the railway line. A reduced bearing capacity would need to be adopted, or foundations extended to intercept better materials, such as the mudstone, that in TP19 occurs at shallow depth.

Should higher foundation loadings be required, foundations could be taken down through the clay to found in competent bedrock strata.

Subject to being able to keep such excavations reasonably free of groundwater ingress, and assuming the competent materials are weak to medium strong, not highly weathered and with closed fractures >200mm spacing, then a presumed bearing value (net allowable) of the order 500kN/m^2 could be used to inform preliminary design of a pad foundation (not exceeding 3m square) with settlement then unlikely to exceed 25mm. [Tomlinson Foundation Design and Construction 7th Ed.].

Such an arrangement could be suitable to support development of a low rise School or similar type of municipal building.

7.1.6 Buried Concrete

Two soils samples (TP104 and TP114) were tested from the area east of the railway. Whilst these returned low aqueous extracts, acid soluble sulphate was slightly elevated indicating some potential sulphate needs to be resisted.

Two soil samples (TP10 and TP20) were tested from the area west of the railway. These too returned low aqueous extracts, however acid soluble sulphate was not reported.

In accordance with BRE Special Digest 1 2005 Third Edition, “Concrete in Aggressive Ground, and results of BRE BR 279 Chemical Analysis, and adopting a precautionary approach for preliminary advice, below ground concrete should comply with Table C1 design sulphate class DS-2 and ACEC class AC-1s.

This is to take into account the acid soluble sulphate results that fall in the range 0.24 to 0.6 % sulphate (DS-2).

Given this is based on only two results that determined acid soluble sulphate, it would be prudent to undertake further testing prior to commencement of development to help inform correct and cost effective concrete mix design.

Consultation would also be advised with Local Authority Building Control who will have considerable knowledge of buried concrete design in this strata type and area.

7.1.7 Earthworks Class

Below topsoil, the clay materials present above bedrock are likely to classify as General Cohesive Fill Class 2A "Wet Cohesive" material. Materials recovered of highly weathered bedrock materials and associated with stiff clay may classify as Class 2B "Dry Cohesive" material or Class 2C "Stoney Cohesive" material.

7.2 Infilled Quarry (Backfilled Natural Soils)

Phase 1 work identified this area of the site to be a former quarry.

The materials present do not appear to be of anthropogenic origin. Rather they are likely to be mostly natural materials returned to infill the quarry; i.e. likely to be materials that were not suitable for the cement works feedstock.

Within exploratory holes it is very difficult to identify whether such natural materials are in-situ geology or backfilled. Thus caution should be applied when interpreting the exploratory holes records for this area of the site. **Materials logged as in-situ geology may not be and could be backfilled clays and mudstones and possess high degrees of variability in engineering performance.**

7.2.1 Groundwater

WS01 was installed and monitored on four occasions. Three occasions were recorded as dry and one (09/01/18) recorded water at 2.10m, coincident with the base of the installation.

Groundwater entry did not occur during the short period trial pit excavations were open. These extended to depths of between 2.60m and 3.50 m bgl, in materials believed to be backfill to the former quarry in this area.

Recording presence of groundwater is not possible within the dynamic probe locations.

7.2.2 Soakaways

One test within TP02 was carried out, and infiltration was achieved over two test cycles.

The test in TP02 (northern end of the filled land to the west of the railway) returned infiltration f =f 9.86 x 10^{-3} m/s on cycle 1 and f = 1.34 x 10^{-3} m/s on cycle 2.

Whilst this result indicates the ground provides relatively good infiltration, this is most probably because the backfill is not well compacted. Voids and loose materials probably exist and have enabled water to infiltrate.

Many of the trial pits recorded unstable conditions / collapsing sides.

Design of infiltration into such material carries the risk of inundation settlement and erosion of fines and/or creation of preferred flow paths, leading to increase in loss of ground. These processes could cause instability and resultant settlement related damage to buildings and infrastructure.

Use of infiltration in this part of the site would be a non-standard application and the associated risks would have to be overcome and mitigated before it could be applied. It may not be possible to overcome all the risks and/or provide warranties on satisfactory performance.

7.2.3 Road Pavements

Assuming an in-situ form of ground treatment is applied, (see foundations below) a preliminary CBR of 3% and probably greater (depending on treatment applied) can be assumed. If no treatment or densification is applied, adequate performance of a road pavement is unlikely to be achieved.

7.2.4 Foundations

Whilst comprising of soft and firm clays and mudstones and limestones "pieces", the materials recorded are often co-mingled, in a variable and sometimes relatively loose state. The engineering performance under

self-weight and new applied loads is likely to be variable, possibly resulting in higher than tolerable total and differential settlements.

The current ground conditions are judged unsuitable for standard foundation arrangements for houses.

This judgement is underpinned by the following lines of evidence;

- Observed collapse of materials within trial pits, indicative of loose and unconsolidated ground
- Dynamic Probe records that recorded low and variable blow counts, with several zones of zero blow counts, indicative of voided or very loose materials
- Plate loading tests (2 no.) that recorded large settlement at relatively low applied bearing pressures, with PL 102 incurring strain softening, where the final increase in stress resulted in effective bearing capacity failure, i.e. settlement without increase in load.

Dynamic probe records indicate the depth of fill materials to be in the range 5.7 m bgl within DP101, to approximately 10m bgl within DP 110, DP111, and DP112. The dynamic probe records suggest a typical fill thickness of approximately 8 to 10 mbgl. However, an investigation method that can recover materials and bedrock, such as rotary coring, will be required to properly establish depth of fill and deeper in-situ material parameters, such as may be required to inform a deep foundation solution, such as piling.

The plate load tests utilised a plate of 450mm diameter and bearing stress of up to 175 kN/m^2. At this stress the test notes record “Ground too soft max travel reached”. Both tests recorded between 10 mm and 15 mm of “immediate” (undrained) settlement at an applied bearing pressure of 100kN/m^2. Settlement increased further at 150 kN/m^2 applied stress.

Given the small size of plate, and the relatively small bulb of pressure and corresponding shallow depth zone of ground tested, settlement of a 750 mm width house foundation of several meters in length would stress a considerably greater depth extent of ground. Settlements (immediate plus long term) considerably in excess of tolerable (usually taken to be not to exceed 25 mm) would reasonably be anticipated.

This “soft” response to loading, plus the strain softening recorded by PL 102, provides evidence additional to the dynamic probing that, untreated, the backfill is unsuitable to supporting shallow house foundations without risk of unacceptably high total and differential settlement.

Findings suggest that the backfill has not been placed to an engineering specification and probably has not benefitted from uniform compaction during historic placement.

Thus suitable foundation options include a piled foundation with fully suspected floor slabs. In such an option, the potential for some self-weight settlement of the backfilled ground external to the house footprint should be allowed. Design and timing of installation of services and infrastructure and final pavement surfaces would require appropriate selection to mitigate against such future movements, particularly at the “hard” interface with a piled structure.

Alternatives to piling could include ground improvement, designed to densify the ground and lessen the variability inherent within the existing backfill, or to otherwise “stabilise and solidify” the ground.

A programme of heavy dynamic compaction is one option. That would need to consider the depth to which the ground can be densified, the degree of improvement that can be attained and the resultant foundation options that would cater for. On suitably compacted ground, raft, semi-raft or possibly reinforced shallow foundations may be possible. The advice of ground improvement contractors should be sought.

A further option may be the in-situ stabilisation using stabilisation/solidification techniques, such as offered by Deep Soil Mixing. This uses a cementitious binder and in situ mixing to create a slurry that then cures to form individual or overlapping columns, akin to large diameter piles, of strengthened soil. Shallow raft or reinforced strip footings may then be suitable.

The choice of technique will be informed through early contractor discussions, and provisional costings based upon reasonable housing layout plans.

Given the risk of possible long term settlement if certain areas are left “untreated” a whole area improvement method, such as heavy dynamic compaction, applied at a foundation and road pavement reduced dig level, using a system that provides GPS linked dynamic feedback of shear modulus, should be included in the options assessment.

The clay materials, if not cement stabilised, will still retain their inherent shrink swell properties, and minimum foundation depths and protection from heave and precautions where planting, retaining or removing trees will be required, similar to natural soils discussed previously, in Section 7.1.5.

7.2.5 Buried Concrete

Four soils samples (TP04, TP06, WS01 and WS03) were tested from with the backfilled quarry area. Whilst these samples returned low aqueous extracts, similar to results obtained for natural in-situ soils (section 7.1.6 refers), where analysed, acid soluble sulphate was slightly elevated in those natural in-situ soils, indicating some potential sulphate needs to be resisted.

In accordance with BRE Special Digest 1 2005 Third Edition, “Concrete in Aggressive Ground, and results of BRE BR 279 Chemical Analysis, and adopting a precautionary approach for preliminary advice, below ground concrete should comply with Table C1 design sulphate class DS-2 and ACEC class AC-1s.

This is to take into account the acid soluble sulphate results that fall in the range 0.24 to 0.6 % sulphate (DS-2).

Given the relatively limited testing performed to date, it would be prudent to undertake further testing prior to commencement of development to help inform correct and cost effective concrete mix design.

7.3 Historic Landfill

Relatively little site investigation data is available for this area. Techniques deployed to date were unable to penetrate more than 3m into the wastes. Further investigation is planned. All exploratory holes completed to date (March 2018) are within the northern area of the landfill.

A typical description of the waste materials encountered is “Landfill waste constituting of plastic bags, plastic fragments and glass fragments. A “cap” of variable materials (sometimes sand, sometimes clay) and variable thickness, but relatively free of waste components, is present. Typical cap thicknesses of 0.50 m, (WS108 and WS109), to 0.70 m (WS110) are recorded.

Monitoring for ground gases has recorded both elevated methane and carbon dioxide together with depleted oxygen. This is typical of gases produced during the degradation of putrescible wastes.

7.3.1 Groundwater – Landfill Leachate

Three window sample locations were equipped with installations. Water that entered into the well from the surrounding waste mass is probably best described as landfill leachate. Water had not entered the well during the short period of drilling, only subsequently being recorded.

Landfill leachate was recorded within WS109, WS110 and WS111 at depths ranging between typically 1 m and 3 m bgl. Little variation is recorded within each well, on the three monitoring visits under taken during January 2018.

7.3.2 Road Pavements

Road Pavement design is likely to be dependent on the ground treatment applied, or other solution applied to support housing and settlement sensitive infrastructure.

7.3.3 Foundations

If houses and future residents can be adequately protected from landfill gases and the associated hazardous gas regime, and the contaminant profile of the wastes does not pose unacceptable risk, then the most likely form of house foundation would be piles, taken down to bear into the underlying solid geology.

The piling system used would need to be designed such as to not create new or higher risk pollutant pathways.

A piling risk assessment would need to form part of the planning and design process.

If a driven displacement piling system was demonstrated to be acceptable, this would have the benefit of not creating large quantities of waste arisings.

Whilst houses could be supported on plies, the long term settlement characteristics of the site surface and how that might place some constraints on the uniformity of support roads, pavements and associated services and infrastructure is uncertain.

Records of the landfill (table 3.2 refers) are that wastes were last deposited in 1994. Wastes are believed to be greater than 20 years old. Whilst some degradation processes are still ongoing, as characterised by the evolution of landfill gas, the high rate of initial settlement associated with newly landfilled domestic waste would be expected to have now slowed considerably (11).

However, relatively small long term settlements should be anticipated. The magnitude of these longer term anticipated slight movements are difficult to predict,

To help inform appropriate design for infrastructure, such as the need for flexible drainage systems and drainage falls, a programme of monitoring the surface and potential self-weight and degradation related settlements should be instigated as soon as reasonably practicable. “Permanent” settlement monoliths should be established to help enable high resolution survey techniques to establish a baseline of current surface elevation. This should then be re-surveyed, initially at moderately close time intervals, such as bi-monthly for the first six months (3 sets of data) and the findings reviewed to establish a suitable time interval for subsequent re-survey events.

The minimum period of surface level monitoring should be discussed early in the development masterplan for the area.

Alternatives to “hard” forms of piling may be possible, depending on the nature and thickness of waste materials present. Deep soil mixing may offer an alternative solution, but has its limits, where presence of putrescible materials may be too abundant for the technique to accommodate.

Use of vibro-techniques, such as installation of vibro-concrete columns may be possible, but not the use of vibro-granular columns, as these would create preferential pathways.

Once further site investigation data is available, it would be prudent to open an early dialogue with specialist contractors to gain a better understanding of material stabilisation constraints and opportunities.

7.3.4 Buried Concrete

In advance of specific data, a moderately aggressive environment to buried concrete should be assumed

8 Conclusions and Recommendations

8.1 Conclusions

8.1.1 Contamination

The site is currently used by a livery stable and for general farming. However it has a varied history with several quarries included in the site boundary. These have now been infilled with either natural re-worked materials likely to be associated with the historic cement and lime works to the north or landfill waste.

The contamination testing undertaken to date indicate that the site is not grossly contaminated and soil concentrations are below the SSV for a residential with plant uptake scenario (i.e. private gardens). A few hotspots of contamination were however encountered. The remedial action in these areas should be considered further once the final design of the masterplan is known i.e. are they under hardstanding or in soft landscaping.

Limited sampling and analysis was undertaken in the area of the historic landfill site due to poor recovery of samples.

Limited groundwater analysis has been undertaken but this has not indicated any significant contamination. A number of soil leachate results indicated slightly elevated results, however this was not reflected in the groundwater analysed.

Gas monitoring has indicated that generally there is a low risk based across the majority of the site underlain by natural ground. However In the area of the landfill site, the risk increases significantly and may place significant development constraints.

8.1.2 Geotechnical

Within site areas underlain by in-situ natural materials, ground conditions are generally suitable to development for residential properties and the other forms of development proposed, utilising normal forms of construction and shallow foundation systems.

The clay soils are shrinkable and suitable precautions will need to be taken. Bedrock occurs at relatively shallow depth, and this may enable the precautions normally required to be moderated.

Groundwater is relatively high and control measures are likely to be required.

Some areas of the site are underlain by backfilled essentially “natural” materials and other areas by landfill wastes, of relatively recent landfill origin.

Ground treatment and/or non-standard forms of construction will be required.

The surface stability of the landfill will need to be assessed to check for rate of ongoing settlement due to self-weight and degradation of the wastes.

Landfill gases are being produced within the landfilled wastes and an extended period of ground gas monitoring will be needed.

8.2 Recommendations

Further investigation is required to confirm the ground conditions in the historic landfill area and in the infilled quarries. This is required for foundation design and to establish the quality of the material in the landfill site.

Initial gas monitoring has shown that that landfill is gassing to a significant degree that may limit development plans.

Currently there is limited and insufficient monitoring within around the landfill to establish if this is migrating beyond the landfill site and could pose a risk to proposed properties. A detailed monitoring plan should be designed and checked acceptable with the Contaminated Land Officer. In the land surrounding the landfill the monitoring wells should be below the shallow limestone / mudstone layers as this may act as a barrier to migrating gases.

Further groundwater analysis should be included within the further investigation. Boreholes should be extended into the bedrock to establish the groundwater quality at depth.

The long term stability of the landfill surface should be established, through instigation of a grid of settlement monoliths and periodic high accuracy levelling survey.

9 REFERENCES

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5. DEFRA and the Environment Agency, 2004. Model Procedures for the Management of Land Contamination, Guidelines for Environmental Risk Assessment and Management, Contaminated Land Report 11 (CLR11).
6. The Construction (Design and Management) Regulations 2015.
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8. LQM / CIEH (2015) The LQM / CIEH S4ULs for Human Health Risk Assessment
9. Defra (2012) SP0101 Development of Category 4 Screening Levels Main Report
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11. Hyun Il Park , Borinara Park & Seung Rae Lee (2007) Analysis of Long-Term Settlement of Municipal Solid Waste Landfills as Determined by Various Settlement Estimation Methods, Journal of the Air & Waste Management Association, 57:2, 243-251, DOI: 10.1080/10473289.2007.10465318

APPENDIX A

Site Photographs and Plan showing location of photos

Plate 1: Access from Lavernock Road

Plate 2: Access through livery stables to site

Plate 3: Access through livery to site

Plate 4: Winter field, showing overhead power lines

Plate 5: Access to winter field

Plate 6: Horse jumping practice field

Plate 7: Drainage ditch between jumping practice field and donkey field

Plate 8: Donkey grazing field

Plate 9: Historical railway line and bridge

Plate 10: Access track through site

Plate 11: Storage tank and other smaller plastic containers

Plate 12: Summer field access

Plate 13: Storage area – caravan and pipes

Plate 14: Storage area – tipper truck

Plate 15: Storage area – pipes and asphalt

Plate 16: Historical landfill east of site

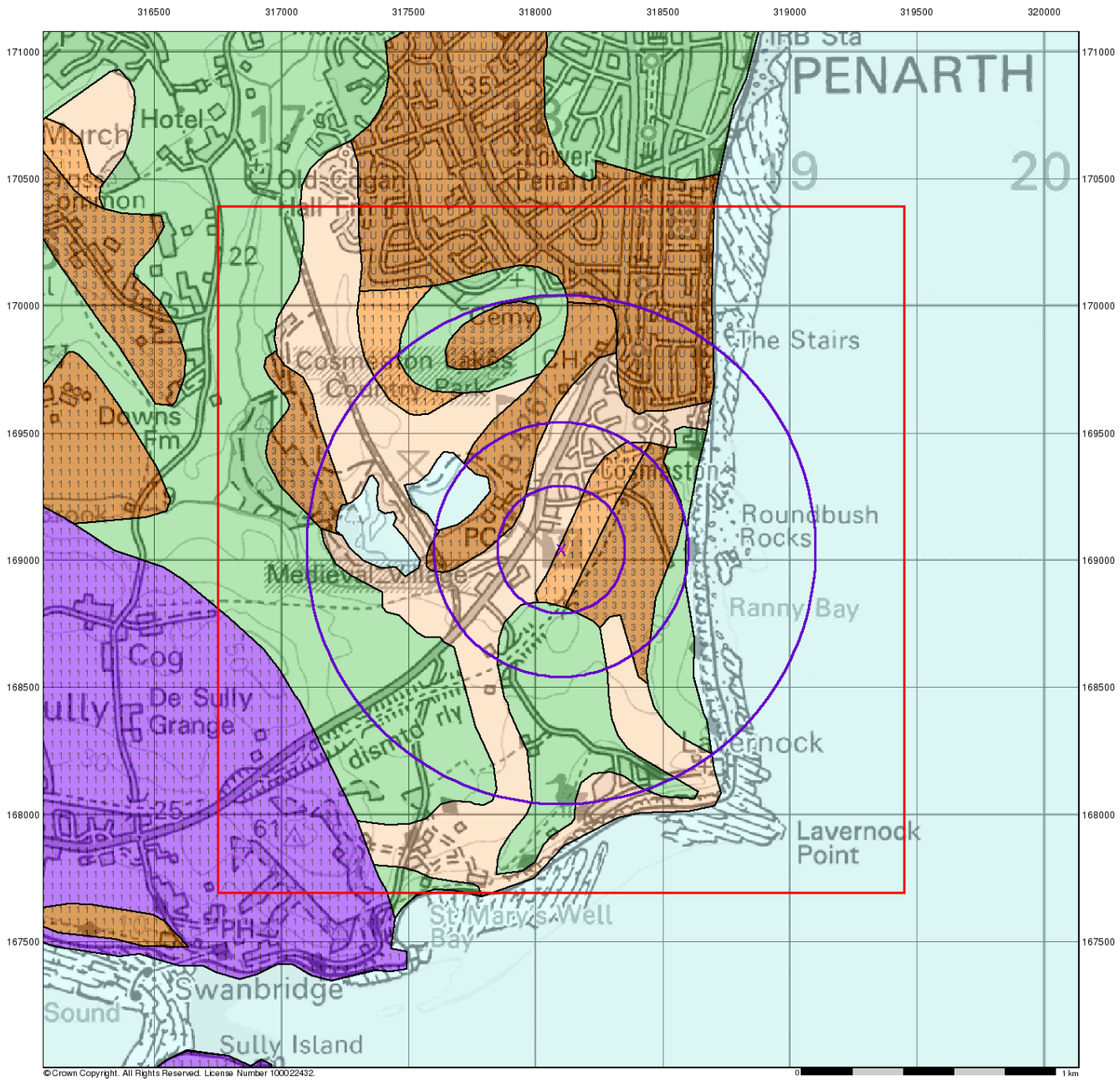
Plate 17: Access to historical landfill from summer field

Plate 18: Storage area off site - overview


Cosmeston Dr
Osprey Close
Raven Way
Fulmar Close
Shearwater Close
Upper Cosmeston Farm
B4267
Lavernock Rd
Plate 1
Plate 2
Plate 3
Plate 4
Plate 5
Plate 6
Plate 7
Plate 8
Plate 9
Plate 10
Plate 11
Plate 12
Plate 13
Plate 14
Plate 15
Plate 16
Plate17
Plate 18
Plate 19-28
N
Legend
Cosmeston Park
Historical Railway Track
Plate
Site
Sully Brook Stream
200 m
Google Earth
© 2018 Google

APPENDIX B

Envirocheck Datasheets



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Groundwater Vulnerability

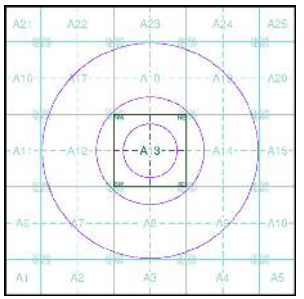
General

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

Agency and Hydrological

Geological Classes	Soil Classes
Major Aquifer (Highly Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Minor Aquifer (Variably Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Non Aquifer (Negligibly Permeable)	
Water or Sea	
Drift Deposit	

Site Sensitivity Context Map - Slice A



Order Details

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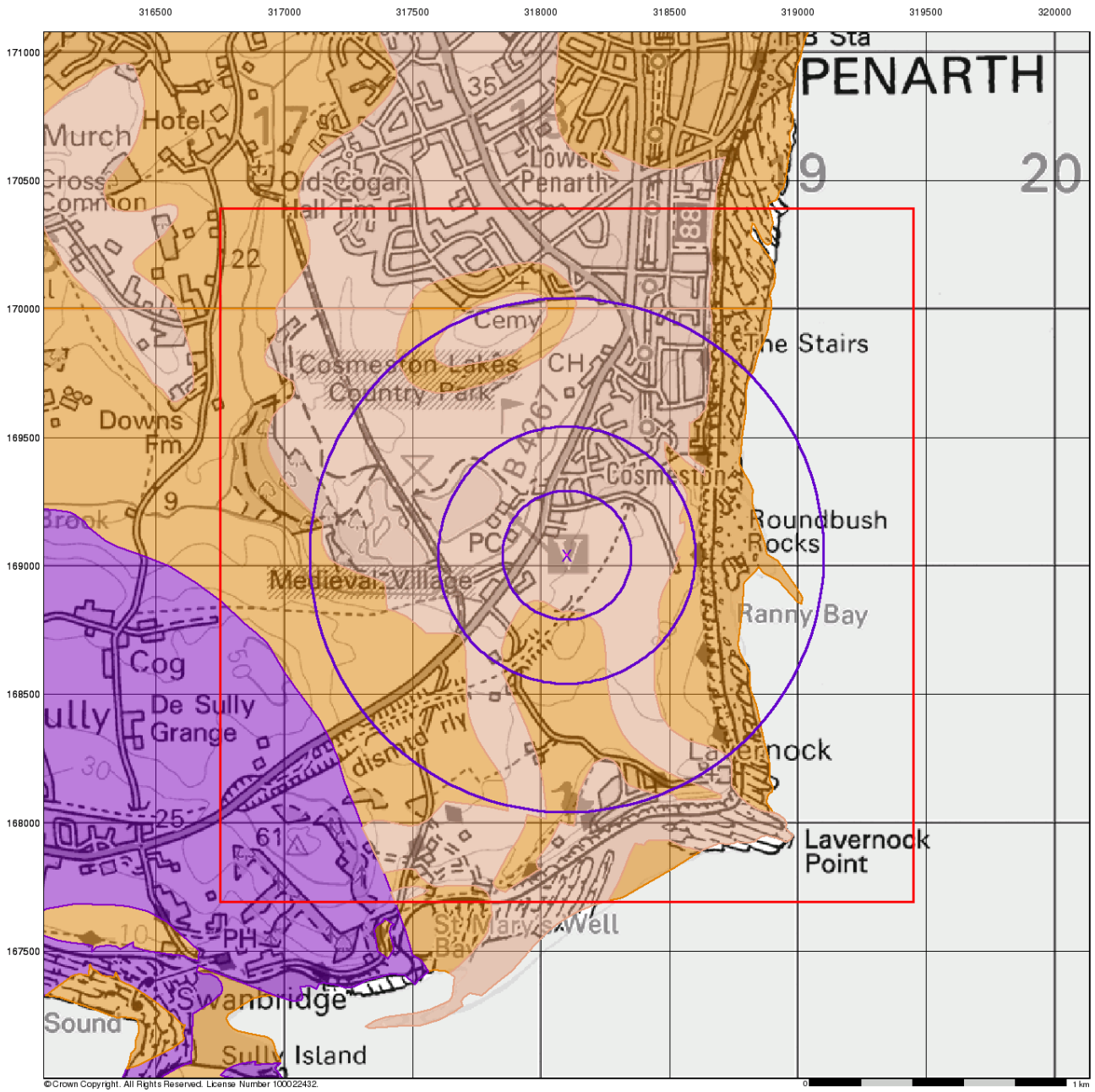
Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Cosmeston Farm, PENARTH, South Glamorgan, CF64 5UB

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



Bedrock Aquifer Designation

General

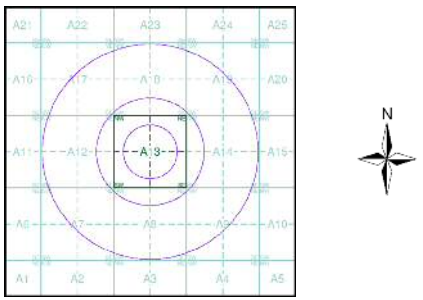
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A



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Search Buffer (m):	1000

Site Details

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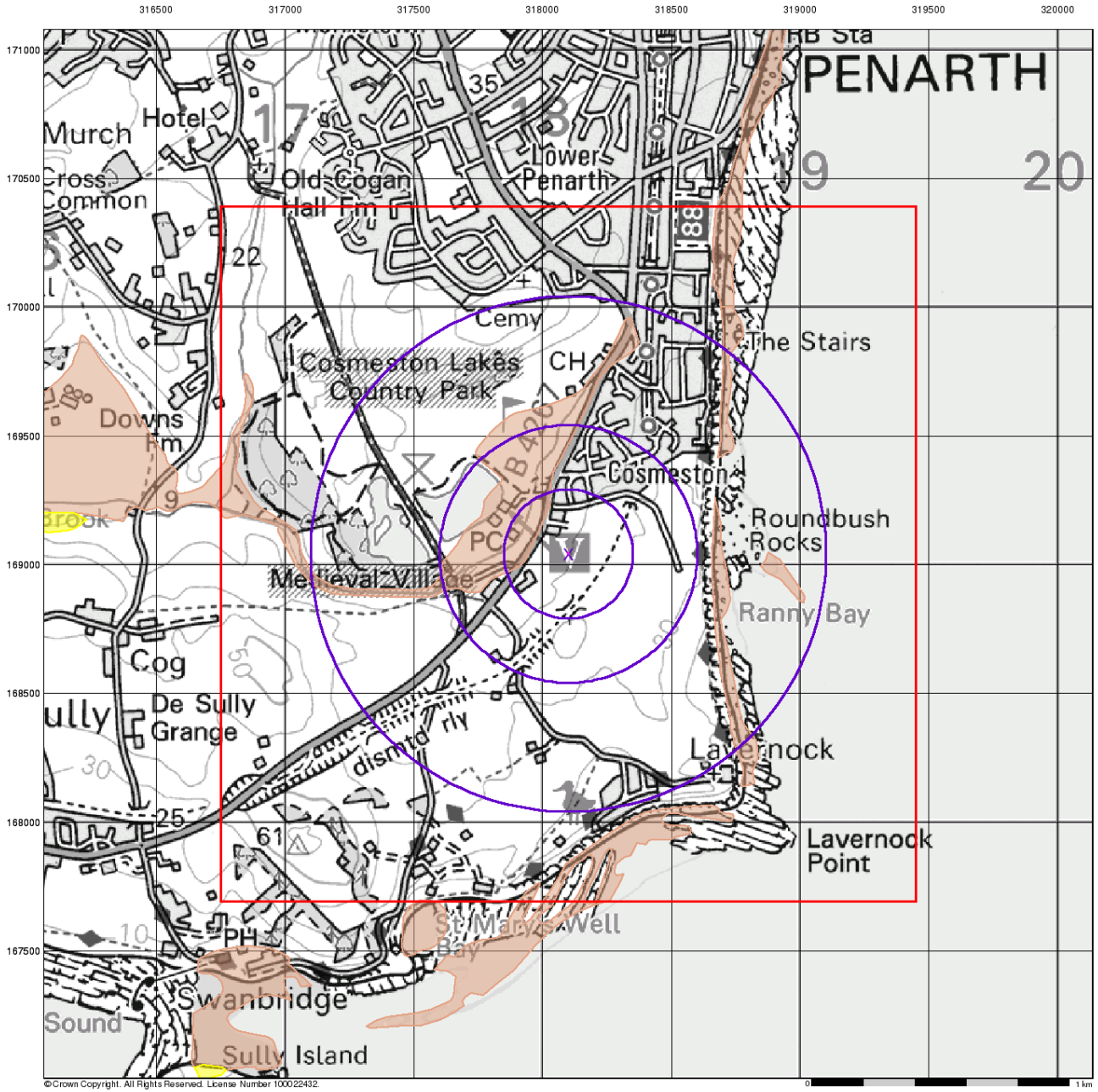

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Superficial Aquifer Designation

General

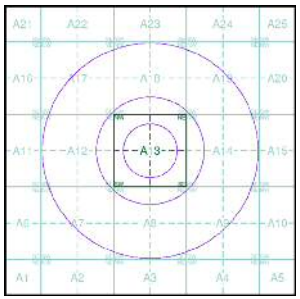
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A



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Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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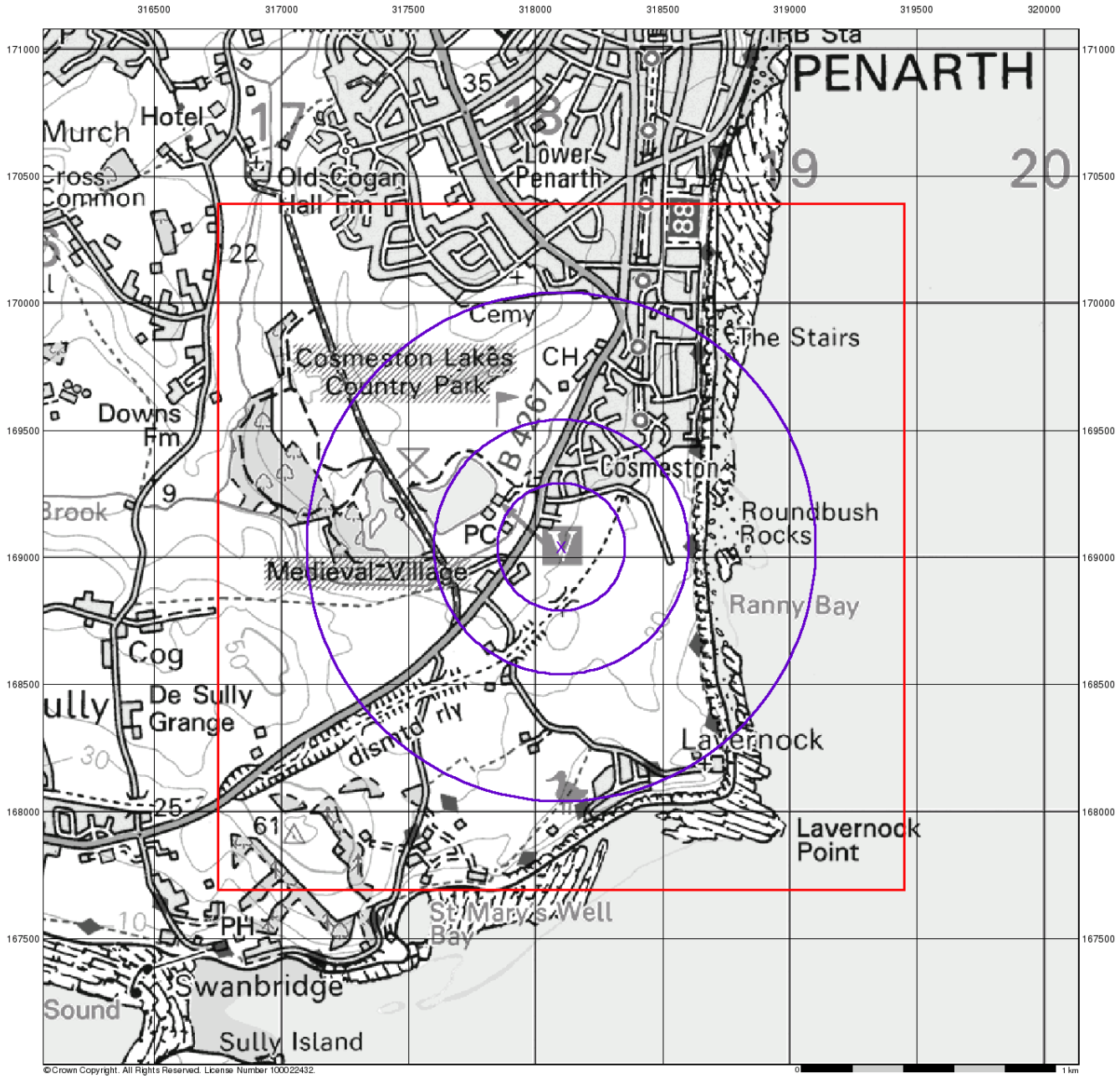
Landmark Information Group

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



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Source Protection Zones

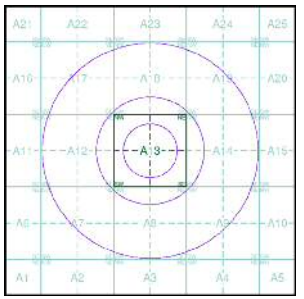
General

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

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)
- Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



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Search Buffer (m):	1000

Site Details

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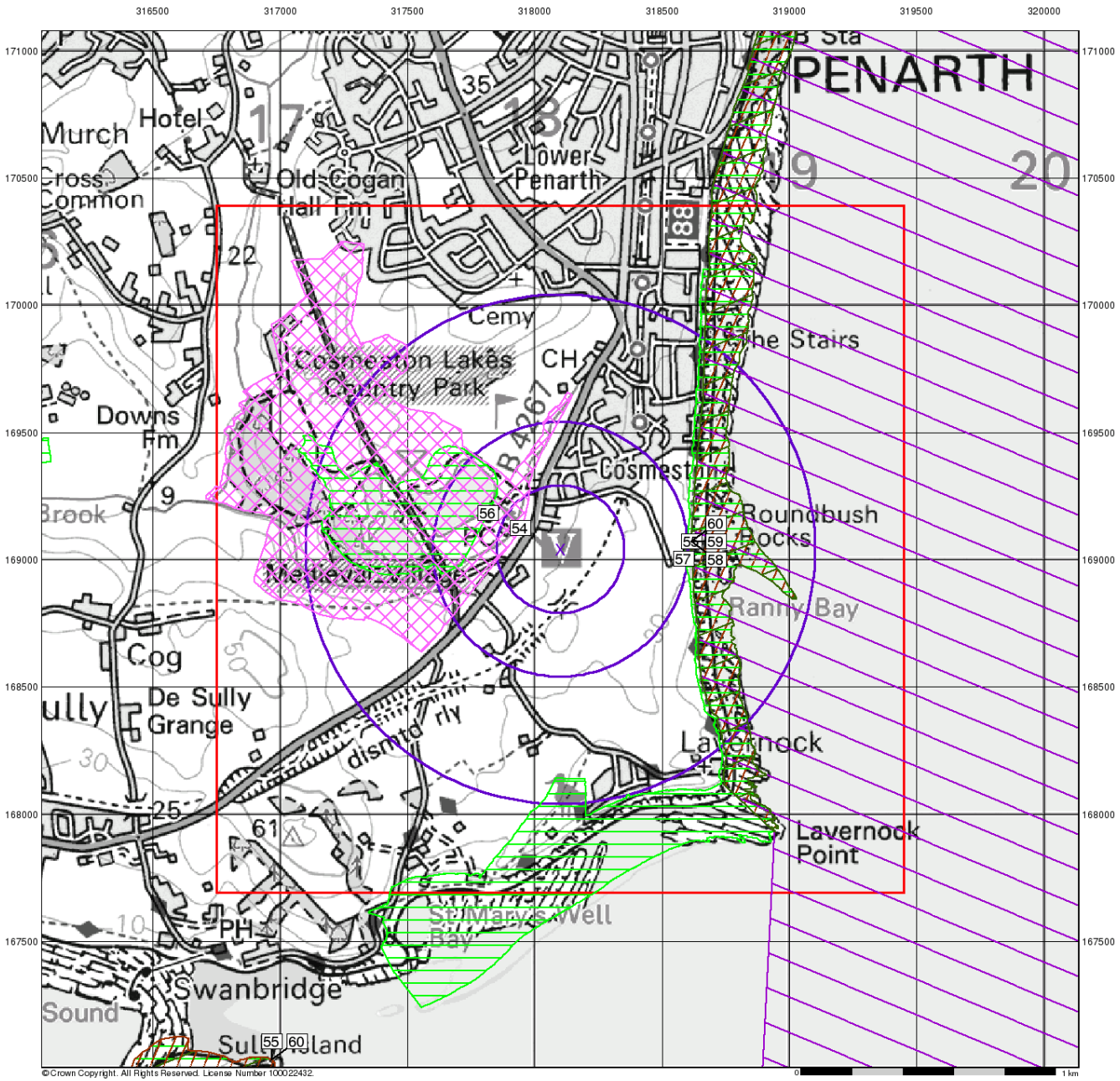

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Sensitive Land Uses

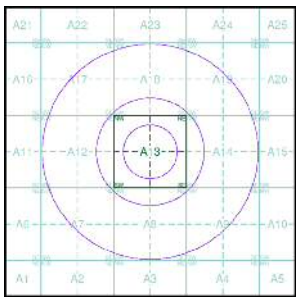
General

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

Sensitive Land Uses

- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area

Site Sensitivity Context Map - Slice A



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Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Cosmeston Farm, PENARTH, South Glamorgan, CF64 5UB

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

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
77053315_1_1

Customer Reference:
UA008386

National Grid Reference:
318100, 169040

Slice:
A

Site Area (Ha):
0.01

Search Buffer (m):
1000

Site Details:

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PENARTH
South Glamorgan
CF64 5UB

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Ms S Cork
Arcadis Consulting (UK) Ltd
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GU2 5AR

Contents

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Report Version v50.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
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Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
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Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 6		Yes		
Pollution Incidents to Controlled Waters	pg 6		2	1	
Prosecutions Relating to Authorised Processes					
Prosecutions Relating to Controlled Waters					
Registered Radioactive Substances					
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register					
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Water Industry Act Referrals					
Groundwater Vulnerability	pg 7	Yes	n/a	n/a	n/a
Bedrock Aquifer Designations	pg 7	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
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Extreme Flooding from Rivers or Sea without Defences	pg 7		Yes	n/a	n/a
Flooding from Rivers or Sea without Defences	pg 7		Yes	n/a	n/a
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Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
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Detailed River Network Offline Drainage	pg 11			Yes	n/a

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
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Licensed Waste Management Facilities (Locations)					
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Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
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BGS Urban Soil Chemistry Averages					
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Natural Cavities					
Non Coal Mining Areas of Great Britain				n/a	n/a
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Potential for Ground Dissolution Stability Hazards	pg 23	Yes		n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 23	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 23		Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 23		Yes	n/a	n/a
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Radon Potential - Radon Protection Measures			n/a	n/a	n/a

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Summary

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Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
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National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
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Sites of Special Scientific Interest	pg 25			2	1
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Special Protection Areas	pg 25				1

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Discharge Consents** Operator: Llanmoor Development Co Ltd Property Type: Undefined Or Other Location: Not Supplied Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0174701 Permit Version: 2 Effective Date: 20th October 1989 Issued Date: 20th October 1989 Revocation Date: 17th May 1993 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Sully Brook **Status: Consent expired** Positional Accuracy: Located by supplier to within 10m	A13NW (W)	161	2	317950 169100
1	**Discharge Consents** Operator: Llanmoor Development Co Ltd Property Type: Undefined Or Other Location: Not Supplied Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0174701 Permit Version: 1 Effective Date: 1st January 1901 Issued Date: 1st January 1901 Revocation Date: 19th October 1989 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Sully Brook **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 10m	A13NW (W)	161	2	317950 169100
1	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Cosmeston Park Ps Penarth, Pumping Station, Cosmeston Park, Penarth, Vale Of Glam Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0243301 Permit Version: 5 Effective Date: 31st March 2007 Issued Date: 29th March 2007 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Pumping Station - Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Sully Brook **Status: Varied by Application - (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A13NW (W)	189	2	317925 169114
1	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Cosmeston Park Ps Penarth, Pumping Station, Cosmeston Park, Penarth, Vale Of Glam Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0243301 Permit Version: 5 Effective Date: 31st March 2007 Issued Date: 29th March 2007 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Pumping Station - Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Sully Brook **Status: Varied by Application - (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A13NW (W)	189	2	317925 169114

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Pumping Station - Water Company Location: Cosmeston Ps Near Penarth , Cardiff Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0243301 Permit Version: 2 Effective Date: 13th January 1996 Issued Date: 12th January 1996 Revocation Date: 31st March 1997 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Sully Brook **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 10m	A13NW (NW)	203	2	317912 169120
1	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Pumping Station - Water Company Location: Cosmeston Ps Near Penarth , Cardiff Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0243301 Permit Version: 4 Effective Date: 31st March 2006 Issued Date: 31st March 2005 Revocation Date: 30th March 2007 Discharge Type: Sewage Discharges - Pumping Station - Water Company Discharge Environment: Saline Estuary Receiving Water: Sully Brook **Status: Modified (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A13NW (W)	205	2	317910 169120
1	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Pumping Station - Water Company Location: Cosmeston Ps Near Penarth , Cardiff Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0243301 Permit Version: 4 Effective Date: 31st March 2006 Issued Date: 31st March 2005 Revocation Date: 30th March 2007 Discharge Type: Sewage Discharges - Pumping Station - Water Company Discharge Environment: Saline Estuary Receiving Water: Sully Brook **Status: Modified (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A13NW (W)	205	2	317910 169120
1	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Pumping Station - Water Company Location: Cosmeston Ps Near Penarth , Cardiff Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: AN0243301 Permit Version: 3 Effective Date: 1st April 1997 Issued Date: 13th June 1995 Revocation Date: 30th March 2006 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Sully Brook **Status: New Consent, by Application (Water Resources Act 1991, Section 88)** Positional Accuracy: Located by supplier to within 100m	A13NW (W)	205	2	317910 169120

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Pumping Station - Water Company Location: Cosmeston Ps Near Penarth , Cardiff Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0243301 Permit Version: 1 Effective Date: 1st July 1995 Issued Date: 14th June 1994 Revocation Date: 12th January 1996 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Sully Brook **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 10m	A13NW (W)	205	2	317910 169120
2	**Discharge Consents** Operator: Glamorganshire Golf Club Property Type: Undefined Or Other Location: Glamorganshire Golf Club Lavernock, Lavernock Road Penarth Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0079001 Permit Version: 1 Effective Date: 1st August 1988 Issued Date: 1st August 1988 Revocation Date: 23rd September 1992 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Sully Brook **Status: Consent expired** Positional Accuracy: Located by supplier to within 100m	A13NW (NW)	327	2	317900 169300
3	**Discharge Consents** Operator: South Glamorgan County Council Property Type: Undefined Or Other Location: Not Supplied Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0143801 Permit Version: 2 Effective Date: 7th July 1989 Issued Date: 7th July 1989 Revocation Date: 16th January 1995 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Reen Connecting With The Sully **Status: Consent expired** Positional Accuracy: Located by supplier to within 100m	A13NW (NW)	339	2	317800 169200
3	**Discharge Consents** Operator: South Glamorgan County Council Property Type: Undefined Or Other Location: Not Supplied Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: An0143801 Permit Version: 1 Effective Date: 1st January 1901 Issued Date: 1st January 1901 Revocation Date: 6th July 1989 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Reen Connecting With The Sully **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 100m	A13NW (NW)	339	2	317800 169200

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
4	**Discharge Consents** Operator: Danehill Estates Limited Property Type: Domestic Property (Multiple) Location: Sutton Farm Lavernock Penarth, Lavernock, Vale Of Glamorgan, Cf64 5ul Authority: Natural Resources Wales Catchment Area: Not Supplied Reference: An0352501 Permit Version: 1 Effective Date: 26th November 2003 Issued Date: 26th November 2003 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Into Land Receiving Water: To Ground **Status: New Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 100m	A8SW (S)	749	2	318000 168300
5	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Construction & Repair Of Buildings Location: Penarth Brockhill Rise Development Authority: Natural Resources Wales Catchment Area: River Cadoxton Reference: AN0008801 Permit Version: 1 Effective Date: 12th December 1985 Issued Date: 12th December 1985 Revocation Date: Not Supplied Discharge Type: Trade Discharges - Site Drainage Discharge Environment: Freshwater Stream/River Receiving Water: Sully Brook **Status: New Consent, by Application (Water Resources Act 1991, Section 88)** Positional Accuracy: Located by supplier to within 100m	A18NE (N)	758	2	318220 169790
6	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Brockhill Rise & Lavernock Rd Sso'S, Penarth Authority: Natural Resources Wales Catchment Area: Not Supplied Reference: An0243501 Permit Version: 3 Effective Date: 31st March 2009 Issued Date: 25th March 2009 Revocation Date: Not Supplied Discharge Type: Public Sewage: Storm Sewage Overflow Discharge Environment: Saline Estuary Receiving Water: Severn Estuary **Status: Varied by Application - (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A19SW (NE)	894	2	318768 169635
6	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Brockhill Rise & Lavernock Rd Sso'S, Penarth Authority: Natural Resources Wales Catchment Area: Not Supplied Reference: An0243501 Permit Version: 3 Effective Date: 31st March 2009 Issued Date: 25th March 2009 Revocation Date: Not Supplied Discharge Type: Public Sewage: Storm Sewage Overflow Discharge Environment: Saline Estuary Receiving Water: Severn Estuary **Status: Varied by Application - (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A19SW (NE)	894	2	318768 169635

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
7	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Brockhill Rise & Lavernock Rd Sso'S, Penarth Authority: Natural Resources Wales Catchment Area: Not Given Reference: AN0243501 Permit Version: 2 Effective Date: 1st April 1997 Issued Date: 13th June 1995 Revocation Date: 30th March 2009 Discharge Type: Public Sewage: Storm Sewage Overflow Discharge Environment: Saline Estuary Receiving Water: Severn Estuary **Status: New Consent, by Application (Water Resources Act 1991, Section 88)** Positional Accuracy: Located by supplier to within 100m	A19SE (NE)	951	2	318830 169650
7	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Brockhill Rise & Lavernock Rd Sso'S, Penarth Authority: Natural Resources Wales Catchment Area: Not Supplied Reference: An0243501 Permit Version: 1 Effective Date: 1st July 1995 Issued Date: 17th August 1994 Revocation Date: 31st March 1997 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Severn Estuary **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 10m	A19SE (NE)	951	2	318830 169650
8	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Lower Penarth Outfall Authority: Natural Resources Wales Catchment Area: Boundary Of HA 58 & HA 59 Reference: An0037001 Permit Version: 3 Effective Date: 13th June 1995 Issued Date: 13th June 1995 Revocation Date: 1st April 1997 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Severn Estuary **Status: Consent expired** Positional Accuracy: Located by supplier to within 100m	A19NW (NE)	968	2	318700 169800
8	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Lower Penarth Outfall Authority: Natural Resources Wales Catchment Area: Boundary Of HA 58 & HA 59 Reference: An0037001 Permit Version: 2 Effective Date: 13th January 1993 Issued Date: 13th October 1992 Revocation Date: 12th June 1995 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Severn Estuary **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 100m	A19NW (NE)	968	2	318700 169800

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
8	**Discharge Consents** Operator: Dwr Cymru Cyfyngedig Property Type: Sewerage Network - Sewers - Water Company Location: Lower Penarth Outfall Authority: Natural Resources Wales Catchment Area: Boundary Of HA 58 & HA 59 Reference: An0037001 Permit Version: 1 Effective Date: 11th December 1987 Issued Date: 11th December 1987 Revocation Date: 12th January 1993 Discharge Type: Unspecified Discharge Environment: Not Supplied Receiving Water: Severn Estuary **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 100m	A19NW (NE)	968	2	318700 169800
9	**Local Authority Pollution Prevention and Controls** Name: Lavernock Road Service Station Location: Lavernock Road, PENARTH, South Glamorgan, CF64 5UP Authority: Vale Of Glamorgan County Borough Council, Environmental Health Department Permit Reference: VOG/23 Dated: 22nd December 1998 Process Type: Local Authority Air Pollution Control Description: PG1/14 Petrol filling station **Status: Authorised** Positional Accuracy: Automatically positioned to the address	A18NE (N)	710	3	318166 169748
	Nearest Surface Water Feature	A13NW (W)	186	-	317926 169108
10	**Pollution Incidents to Controlled Waters** Property Type: Building Sites Location: Cosmeston Country Park Authority: Environment Agency, Welsh Region Pollutant: Farm Effluent/Slurry Note: Not Supplied Incident Date: 18th May 1995 Incident Reference: 24114 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Unknown Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A13NW (W)	208	4	317900 169100
11	**Pollution Incidents to Controlled Waters** Property Type: Cattle Beef Farming: Yards Location: Cosmeston Country Park, PENARTH Authority: Environment Agency, Welsh Region Pollutant: Farm Effluent/Slurry Note: Accidental Spillage/Leakage Incident Date: 12th March 1991 Incident Reference: 143 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Leakage Incident Severity: Category 2 - Significant Incident Positional Accuracy: Located by supplier to within 100m	A13SW (SW)	245	4	317900 168900
12	**Pollution Incidents to Controlled Waters** Property Type: Not Given Location: Country Park Authority: Environment Agency, Welsh Region Pollutant: Oils - Diesel (Including Agricultural) Note: Inadequate Design Incident Date: 7th May 1997 Incident Reference: 32515 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Leakage Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A18SW (N)	372	4	318000 169400

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
13	**Water Abstractions** Operator: Glamorganshire Golf Club Licence Number: 21/58/11/0009 Permit Version: 100 Location: Borehole At Glamorganshire Golf Club Authority: Natural Resources Wales Abstraction: Golf Courses: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Not Supplied Authorised Start: 04 January Authorised End: 10 July Permit Start Date: 18th May 2004 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 100m	A18SW (N)	508	2	317923 169518
	Water Abstractions Operator: Mr & Mrs M Ahmad Licence Number: 21/58/11/0007 Permit Version: 100 Location: Well At Alhamra Authority: Environment Agency, Welsh Region Abstraction: General Farming And Domestic Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Not Supplied Authorised Start: 01 January Authorised End: 31 December Permit Start Date: 11th July 1994 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 100m	A21SW (NW)	1821	4	316640 170130
	Groundwater Vulnerability Soil Classification: Soils of Intermediate Leaching Potential (I1) - Soils which can possibly transmit a wide range of pollutants Map Sheet: Sheet 36 Mid Glamorgan Scale: 1:100,000	A13NW (W)	0	4	318099 169042
	Drift Deposits None				
	Bedrock Aquifer Designations Aquifer Designation: Secondary Aquifer - A	A13NW (W)	0	5	318099 169042
	Superficial Aquifer Designations No Data Available				
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A13NW (W)	176	2	317930 169090
	Flooding from Rivers or Sea without Defences Type: Extent of Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A13NW (W)	176	2	317930 169090
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				
14	**Detailed River Network Lines** River Type: Primary River River Name: Sully Brook Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: SULLY BROOK Water Course Reference: 1107	A13NW (W)	187	4	317926 169111

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
15	**Detailed River Network Lines** River Type: Secondary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NW (NW)	320	4	317814 169185
16	**Detailed River Network Lines** River Type: Secondary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NW (NW)	335	4	317901 169311
17	**Detailed River Network Lines** River Type: Tertiary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NW (NW)	336	4	317899 169311
18	**Detailed River Network Lines** River Type: Tertiary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13SW (W)	345	4	317767 168952
19	**Detailed River Network Lines** River Type: Tertiary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A12SE (W)	364	4	317746 168955
20	**Detailed River Network Lines** River Type: Primary River River Name: Not Supplied Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: SULLY BROOK Water Course Reference: 1107	A12SE (W)	367	4	317736 168992

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
21	**Detailed River Network Lines** River Type: Primary River River Name: Not Supplied Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: SULLY BROOK Water Course Reference: 1107	A12SE (W)	376	4	317728 168989
22	**Detailed River Network Lines** River Type: Secondary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SW (N)	390	4	317971 169410
23	**Detailed River Network Lines** River Type: Primary River River Name: Sully Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: SULLY BROOK Water Course Reference: 1107	A18SW (N)	390	4	317971 169410
24	**Detailed River Network Lines** River Type: Primary River River Name: Not Supplied Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: SULLY BROOK Water Course Reference: 1107	A12SE (W)	397	4	317708 168980
25	**Detailed River Network Lines** River Type: Secondary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NW (NW)	400	4	317848 169353
26	**Detailed River Network Lines** River Type: Tertiary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NW (NW)	400	4	317848 169353

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
27	**Detailed River Network Lines** River Type: Tertiary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A12NE (W)	411	4	317705 169155
28	**Detailed River Network Lines** River Type: Secondary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SW (NW)	434	4	317858 169402
29	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A12SE (W)	458	4	317658 168920
30	**Detailed River Network Lines** River Type: Secondary River River Name: Not Supplied Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A12SE (W)	466	4	317642 168951
31	**Detailed River Network Lines** River Type: Primary River River Name: Not Supplied Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: SULLY BROOK Water Course Reference: 1107	A12SE (W)	466	4	317642 168951
32	**Detailed River Network Lines** River Type: Primary River River Name: Sully Brook Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: SULLY BROOK Water Course Reference: 1107	A12SE (W)	478	4	317632 168947

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
33	**Detailed River Network Lines** River Type: Secondary River River Name: Not Supplied Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A12SE (W)	478	4	317632 168947
34	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A12SE (W)	491	4	317610 169007
35	**Detailed River Network Lines** River Type: Tertiary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A12SE (W)	491	4	317610 169007
36	**Detailed River Network Lines** River Type: Tertiary River River Name: Drain Hydrographic Area: D008 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Drain (ditch, Reen, Rhyne, Drain) Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A12SE (W)	495	4	317606 169014
37	**Detailed River Network Offline Drainage** River Type: Tertiary River Hydrographic Area: D008	A13SW (SW)	268	4	317973 168807

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
38	**BGS Recorded Landfill Sites** Site Name: Mile Road Location: Nr Cogan Hall Farm, PENARTH, South Glamorgan Authority: British Geological Survey, National Geoscience Information Service Ground Water: Information not available Surface Water: Information not available Geology: N/A Positional Accuracy: Positioned by the supplier Boundary Accuracy: Derived	A17SW (NW)	816	-	317359 169383
39	**Historical Landfill Sites** Licence Holder: Not Supplied Location: Cosmeston Name: Cosmeston No.1 - Old Tip Operator Location: Not Supplied Boundary Accuracy: As Supplied Provider Reference: EAHLD14494 First Input Date: 31st December 1977 Last Input Date: 31st December 1994 Specified Waste Type: Deposited Waste included Inert, Industrial, Commercial, Household and Special Waste EA Waste Ref: 0 Regis Ref: Not Supplied WRC Ref: 6950/0021 BGS Ref: Not Supplied Other Ref: Not Supplied	A13SE (SE)	111	2	318193 168983
40	**Historical Landfill Sites** Licence Holder: Not Supplied Location: Near Cogan Hall Farm, Penarth, South Glamorgan Name: Refuse Tip at Cosmeston Lakes Country Park Operator Location: Not Supplied Boundary Accuracy: As Supplied Provider Reference: EAHLD31248 First Input Date: Not Supplied Last Input Date: Not Supplied Specified Waste Type: Not Supplied EA Waste Ref: 0 Regis Ref: Not Supplied WRC Ref: Not Supplied BGS Ref: 457 Other Ref: Not Supplied	A17SE (NW)	595	2	317669 169452
	Local Authority Landfill Coverage Name: Vale Of Glamorgan County Borough Council - Has supplied landfill data		0	6	318099 169042
41	**Local Authority Recorded Landfill Sites** Location: B.C. Site, Cosmeston Farm, Lower Penarth Reference: Not Supplied Authority: Vale Of Glamorgan County Borough Council **Last Reported Status:** **Unknown** Types of Waste: Not Supplied Date of Closure: Not Supplied Positional Accuracy: Positioned by the supplier Boundary Quality: Moderate	A13SE (SE)	110	6	318183 168972

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Lias Group	A13NW (W)	0	5	318099 169042
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13NW (W)	0	5	318099 169042
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SW (S)	42	5	318099 169000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13NW (W)	100	5	318000 169042
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SW (SW)	108	5	318000 169000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13NW (NW)	139	5	317978 169109
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13NW (NW)	153	5	318000 169157

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SW (W)	187	5	317917 169000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SW (SW)	202	5	318012 168860
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SW (SW)	206	5	318000 168862
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A12NE (NW)	367	5	317761 169184
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A14SW (E)	402	5	318477 168905
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A14NW (E)	428	5	318527 169050

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A14SW (E)	429	5	318526 169000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SW (E)	485	5	318550 168865
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A12SE (W)	489	5	317616 168973
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SW (E)	516	5	318614 169024
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A12SE (SW)	519	5	317687 168727
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SW (E)	520	5	318617 169000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14NW (E)	562	5	318661 169042
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SW (E)	564	5	318661 169000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A7NE (SW)	607	5	317628 168660
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SW (E)	616	5	318713 169000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A19SW (NE)	616	5	318577 169430
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SW (NE)	692	5	318682 169415

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A19SW (NE)	706	5	318584 169554
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A12SW (W)	715	5	317393 168934
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A12SE (SW)	718	5	317445 168748
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A12SW (W)	719	5	317394 168904
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A12SW (W)	719	5	317394 168904
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SW (NE)	721	5	318645 169513

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A12SW (W)	724	5	317399 168861
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A18NW (NW)	734	5	317815 169719
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	752	5	318849 168993
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	757	5	318855 169000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A18NW (N)	772	5	318000 169807
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SW (NE)	801	5	318691 169581

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A8SE (S)	807	5	318255 168251
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A18NW (N)	809	5	317866 169816
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A7NW (SW)	849	5	317422 168531
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A8SW (S)	854	5	318000 168194
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A12SW (W)	879	5	317222 169000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A18NW (N)	892	5	318000 169928

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	911	5	319000 168908
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A9SW (SE)	929	5	318732 168362
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NW (NE)	948	5	318737 169743
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A18NW (N)	959	5	318099 170000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A18NE (N)	959	5	318134 170000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A18NW (N)	961	5	318025 170000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 40 - 60 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A18NW (N)	964	5	318000 170000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NW (NE)	977	5	318657 169843
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Sediment Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A12SW (W)	989	5	317112 169000
42	**BGS Recorded Mineral Sites** Site Name: Lower Cosmeston Farm Location: , Penarth, South Glamorgan Source: British Geological Survey, National Geoscience Information Service Reference: 161201 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Triassic Geology: St Mary'S Well Bay Member Commodity: Limestone Positional Accuracy: Located by supplier to within 10m	A13SE (SE)	158	5	318165 168899
43	**BGS Recorded Mineral Sites** Site Name: The Elms Location: , Penarth, South Glamorgan Source: British Geological Survey, National Geoscience Information Service Reference: 161198 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Triassic Geology: St Mary'S Well Bay Member Commodity: Limestone Positional Accuracy: Located by supplier to within 10m	A18SE (N)	350	5	318164 169385
44	**BGS Recorded Mineral Sites** Site Name: Downswood Location: , Penarth, Vale Of Glamorgan Source: British Geological Survey, National Geoscience Information Service Reference: 4472 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Triassic - Jurassic Geology: St Mary'S Well Bay Member Commodity: Limestone Positional Accuracy: Located by supplier to within 10m	A13SE (SE)	361	5	318269 168724

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
45	**BGS Recorded Mineral Sites** Site Name: Upper Cosmeston Location: , Penarth, South Glamorgan Source: British Geological Survey, National Geoscience Information Service Reference: 161200 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Triassic Geology: St Mary'S Well Bay Member Commodity: Limestone Positional Accuracy: Located by supplier to within 10m	A13NE (NE)	379	5	318384 169291
46	**BGS Recorded Mineral Sites** Site Name: Cosmeston Location: , Penarth, South Glamorgan Source: British Geological Survey, National Geoscience Information Service Reference: 161199 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Triassic Geology: St Mary'S Well Bay Member Commodity: Limestone Positional Accuracy: Located by supplier to within 10m	A12NE (NW)	601	5	317563 169313
47	**BGS Recorded Mineral Sites** Site Name: Sutton Location: , Lavernock, Penarth, South Glamorgan Source: British Geological Survey, National Geoscience Information Service Reference: 161260 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Triassic Geology: St Mary'S Well Bay Member Commodity: Limestone Positional Accuracy: Located by supplier to within 10m	A8SW (S)	828	5	317833 168259
48	**BGS Recorded Mineral Sites** Site Name: Cosmeston Location: , Penarth, Vale Of Glamorgan Source: British Geological Survey, National Geoscience Information Service Reference: 4470 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Triassic - Jurassic Geology: St Mary'S Well Bay Member Commodity: Limestone Positional Accuracy: Located by supplier to within 10m	A17SW (NW)	943	5	317285 169516
	BGS Measured Urban Soil Chemistry No data available				
	BGS Urban Soil Chemistry Averages No data available				
	Coal Mining Affected Areas In an area that might not be affected by coal mining				
	Non Coal Mining Areas of Great Britain No Hazard				
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	0	5	318099 169042
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	139	5	317978 169109
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	0	5	318099 169042
	Potential for Compressible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SE (E)	31	5	318128 169034

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Compressible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SE (SE)	133	5	318212 168972
	Potential for Compressible Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	139	5	317978 169109
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	0	5	318099 169042
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	202	5	318012 168860
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	0	5	318099 169042
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	202	5	318012 168860
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	233	5	318097 168809
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	0	5	318099 169042
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SE (E)	31	5	318128 169034
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SE (SE)	133	5	318212 168972
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	139	5	317978 169109
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	0	5	318099 169042
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	139	5	317978 169109
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	202	5	318012 168860
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	0	5	318099 169042
	Radon Potential - Radon Affected Areas Affected Area: The property is in a lower probability radon area, as less than 1% of homes are above the action level Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	0	5	318099 169042

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
49	**Contemporary Trade Directory Entries** Name: Etc Location: 198, Lavernock Road, Penarth, South Glamorgan, CF64 5UP Classification: Catering Equipment **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A18SW (N)	387	-	318064 169427
49	**Contemporary Trade Directory Entries** Name: Pat Jerome Location: Lavernock Rd, Penarth, South Glamorgan, CF64 5UP Classification: Garage Services **Status: Active** Positional Accuracy: Manually positioned to the road within the address or location	A18SW (N)	409	-	318050 169448
50	**Contemporary Trade Directory Entries** Name: Venus Ironing Service Location: 45, Cosmeston Drive, Penarth, South Glamorgan, CF64 5FA Classification: Ironing & Home Laundry Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A18SE (N)	392	-	318233 169410
51	**Contemporary Trade Directory Entries** Name: Meter & Instrument Services Location: Fort Road, Lavernock, Penarth, South Glamorgan, CF64 5UL Classification: Testing, Inspection & Calibration Equipment Manufacturers **Status: Active** Positional Accuracy: Automatically positioned to the address	A8NW (SW)	572	-	317813 168547
52	**Contemporary Trade Directory Entries** Name: Lavernock Road Service Station Location: Lavernock Road, Penarth, South Glamorgan, CF64 5UP Classification: Garage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A18NE (N)	715	-	318166 169754
53	**Fuel Station Entries** Name: Lavernock Road Service Station Location: Lavernock Road, Copsmeston, PENARTH, South Glamorgan, CF64 5UP Brand: Texaco Premises Type: Not Applicable **Status: Obsolete** Positional Accuracy: Automatically positioned to the address	A18NE (N)	715	-	318166 169753

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
54	**Local Nature Reserves** Name: Cosmeston Lakes Country Park Multiple Area: N Area (m2): 1047712.62 Source: Vale Of Glamorgan County Borough Council Designation Date: 1st May 2013	A13NW (NW)	176	6	317944 169124
55	**Ramsar Sites** Name: Severn Estuary (Wales) Multiple Areas: Y Total Area (m2): 68891898.01 Source: Natural Resources Wales Reference: UK11081 Designation Date: 11th July 1995	A14NW (E)	516	2	318614 169071
56	**Sites of Special Scientific Interest** Name: Llynnoedd Cosmeston / Cosmeston Lakes Multiple Areas: N Total Area (m2): 255517.86 Source: Natural Resources Wales Reference: 51833was Designation Details: Biological Designation Date: 21st February 1985 Date Type: Notified	A13NW (NW)	317	2	317815 169182
57	**Sites of Special Scientific Interest** Name: Penarth Coast Multiple Areas: N Total Area (m2): 875270.43 Source: Natural Resources Wales Reference: 9833wvf Designation Details: Mixed Biological And Geological Designation Date: 1st January 1965 Date Type: Notified	A14SW (E)	486	2	318585 169040
58	**Sites of Special Scientific Interest** Name: Severn Estuary Multiple Areas: Y Total Area (m2): 68537733.72 Source: Natural Resources Wales Reference: 46133wgx Designation Details: Biological Designation Date: 1st January 1976 Date Type: Notified	A14NW (E)	516	2	318614 169071
59	**Special Areas of Conservation** Name: Severn Estuary (Wales) Multiple Areas: N Total Area (m2): 267698780.64 Source: Natural Resources Wales Reference: UK0013030 **Status: Designated**	A14NW (E)	516	2	318614 169071
60	**Special Protection Areas** Name: Severn Estuary (Wales) Multiple Areas: Y Total Area (m2): 68891897.65 Source: Natural Resources Wales Reference: UK9015022 Designation Date: 11th July 1995	A14NW (E)	516	2	318614 169071

Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices		
Vale Of Glamorgan County Borough Council - Environmental Health Department	April 2014	Annual Rolling Update
Cardiff Council - Pollution Control Division	September 2014	Annual Rolling Update
Discharge Consents		
Environment Agency - Welsh Region	August 2014	Quarterly
Natural Resources Wales	November 2015	Quarterly
Enforcement and Prohibition Notices		
Environment Agency - Welsh Region	March 2013	As notified
Integrated Pollution Controls		
Environment Agency - Welsh Region	October 2008	Not Applicable
Integrated Pollution Prevention And Control		
Environment Agency - Welsh Region	October 2015	Quarterly
Natural Resources Wales	October 2015	Quarterly
Local Authority Integrated Pollution Prevention And Control		
Cardiff Council - Pollution Control Division	January 2013	Annual Rolling Update
Vale Of Glamorgan County Borough Council - Environmental Health Department	June 2014	Annual Rolling Update
Local Authority Pollution Prevention and Controls		
Cardiff Council - Pollution Control Division	January 2013	Annual Rolling Update
Vale Of Glamorgan County Borough Council - Environmental Health Department	June 2014	Annual Rolling Update
Local Authority Pollution Prevention and Control Enforcements		
Cardiff Council - Pollution Control Division	January 2013	Annual Rolling Update
Vale Of Glamorgan County Borough Council - Environmental Health Department	June 2014	Annual Rolling Update
Nearest Surface Water Feature		
Ordnance Survey	July 2012	Quarterly
Pollution Incidents to Controlled Waters		
Environment Agency - Welsh Region	December 1998	Not Applicable
Prosecutions Relating to Authorised Processes		
Environment Agency - Welsh Region	March 2013	As notified
Natural Resources Wales	March 2013	As notified
Prosecutions Relating to Controlled Waters		
Environment Agency - Welsh Region	March 2013	As notified
Natural Resources Wales	March 2013	As notified
River Quality		
Environment Agency - Head Office	November 2001	Not Applicable
River Quality Biology Sampling Points		
Environment Agency - Head Office	July 2012	Annually
River Quality Chemistry Sampling Points		
Environment Agency - Head Office	July 2012	Annually
Substantiated Pollution Incident Register		
Environment Agency - South West Region - Wessex Area	October 2015	Quarterly
Environment Agency Wales - South East Area	October 2015	Quarterly
Natural Resources Wales	October 2015	Quarterly
Water Abstractions		
Natural Resources Wales	April 2015	Quarterly
Environment Agency - Welsh Region	July 2015	Quarterly
Natural Resources Wales	October 2015	Quarterly
Water Industry Act Referrals		
Environment Agency - Welsh Region	October 2015	Quarterly
Natural Resources Wales	October 2015	Quarterly
Groundwater Vulnerability		
Environment Agency - Head Office	April 2015	Not Applicable

Agency & Hydrological	Version	Update Cycle
Drift Deposits		
Environment Agency - Head Office	January 1999	Not Applicable
Bedrock Aquifer Designations		
British Geological Survey - National Geoscience Information Service	October 2012	As notified
Superficial Aquifer Designations		
British Geological Survey - National Geoscience Information Service	January 2015	As notified
Source Protection Zones		
Natural Resources Wales	July 2015	Quarterly
Environment Agency - Head Office	October 2015	Quarterly
Extreme Flooding from Rivers or Sea without Defences		
Environment Agency - Head Office	August 2015	Quarterly
Natural Resources Wales	May 2015	Quarterly
Flooding from Rivers or Sea without Defences		
Environment Agency - Head Office	August 2015	Quarterly
Natural Resources Wales	May 2015	Quarterly
Areas Benefiting from Flood Defences		
Environment Agency - Head Office	August 2015	Quarterly
Flood Water Storage Areas		
Environment Agency - Head Office	August 2015	Quarterly
Flood Defences		
Environment Agency - Head Office	August 2015	Quarterly
Detailed River Network Lines		
Environment Agency - Head Office	March 2012	Annually
Detailed River Network Offline Drainage		
Environment Agency - Head Office	March 2012	Annually
Surface Water 1 in 30 year Flood Extent		
Natural Resources Wales	October 2013	As notified
Surface Water 1 in 100 year Flood Extent		
Natural Resources Wales	October 2013	As notified
Surface Water 1 in 1000 year Flood Extent		
Natural Resources Wales	October 2013	As notified
Surface Water Suitability		
Natural Resources Wales	October 2013	As notified

Waste	Version	Update Cycle
BGS Recorded Landfill Sites		
British Geological Survey - National Geoscience Information Service	June 1996	Not Applicable
Historical Landfill Sites		
Natural Resources Wales	November 2015	Quarterly
Integrated Pollution Control Registered Waste Sites		
Environment Agency - Welsh Region	October 2008	Not Applicable
Licensed Waste Management Facilities (Landfill Boundaries)		
Environment Agency - South West Region - Wessex Area	August 2014	Quarterly
Environment Agency Wales - South East Area	August 2014	Quarterly
Licensed Waste Management Facilities (Locations)		
Environment Agency - South West Region - Wessex Area	October 2015	Quarterly
Environment Agency Wales - South East Area	October 2015	Quarterly
Natural Resources Wales	October 2015	Quarterly
Local Authority Landfill Coverage		
Cardiff Council	May 2000	Not Applicable
Vale Of Glamorgan County Borough Council	May 2000	Not Applicable
Local Authority Recorded Landfill Sites		
Cardiff Council	May 2000	Not Applicable
Vale Of Glamorgan County Borough Council	May 2000	Not Applicable
Registered Landfill Sites		
Environment Agency Wales - South East Area	March 2003	Not Applicable
Registered Waste Transfer Sites		
Environment Agency Wales - South East Area	March 2003	Not Applicable
Registered Waste Treatment or Disposal Sites		
Environment Agency Wales - South East Area	March 2003	Not Applicable
Hazardous Substances	**Version**	**Update Cycle**
Control of Major Accident Hazards Sites (COMAH)		
Health and Safety Executive	June 2015	Bi-Annually
Explosive Sites		
Health and Safety Executive	June 2015	Bi-Annually
Notification of Installations Handling Hazardous Substances (NIHHS)		
Health and Safety Executive	November 2000	Not Applicable
Planning Hazardous Substance Enforcements		
Vale Of Glamorgan County Borough Council - Planning Department	October 2014	Annual Rolling Update
Cardiff Council - Regulatory Services	October 2015	Annual Rolling Update
Planning Hazardous Substance Consents		
Vale Of Glamorgan County Borough Council - Planning Department	October 2014	Annual Rolling Update
Cardiff Council - Regulatory Services	October 2015	Annual Rolling Update

Geological	Version	Update Cycle
BGS 1:625,000 Solid Geology British Geological Survey - National Geoscience Information Service	January 2009	Not Applicable
BGS Estimated Soil Chemistry British Geological Survey - National Geoscience Information Service	January 2010	Annually
BGS Recorded Mineral Sites British Geological Survey - National Geoscience Information Service	November 2015	Bi-Annually
Coal Mining Affected Areas The Coal Authority - Mining Report Service	March 2014	As notified
Mining Instability Ove Arup & Partners	October 2000	Not Applicable
Non Coal Mining Areas of Great Britain British Geological Survey - National Geoscience Information Service	July 2014	Not Applicable
Potential for Collapsible Ground Stability Hazards British Geological Survey - National Geoscience Information Service	June 2015	Annually
Potential for Compressible Ground Stability Hazards British Geological Survey - National Geoscience Information Service	June 2015	Annually
Potential for Ground Dissolution Stability Hazards British Geological Survey - National Geoscience Information Service	June 2015	Annually
Potential for Landslide Ground Stability Hazards British Geological Survey - National Geoscience Information Service	June 2015	Annually
Potential for Running Sand Ground Stability Hazards British Geological Survey - National Geoscience Information Service	June 2015	Annually
Potential for Shrinking or Swelling Clay Ground Stability Hazards British Geological Survey - National Geoscience Information Service	June 2015	Annually
Radon Potential - Radon Affected Areas British Geological Survey - National Geoscience Information Service	July 2011	As notified
Radon Potential - Radon Protection Measures British Geological Survey - National Geoscience Information Service	July 2011	As notified
Industrial Land Use	**Version**	**Update Cycle**
Contemporary Trade Directory Entries Thomson Directories	November 2015	Quarterly
Fuel Station Entries Catalist Ltd - Experian	August 2015	Quarterly

Sensitive Land Use	Version	Update Cycle
Areas of Adopted Green Belt Cardiff Council	November 201	As notified
Areas of Unadopted Green Belt Cardiff Council	November 201	As notified
Areas of Outstanding Natural Beauty Natural Resources Wales	October 2015	Bi-Annually
Environmentally Sensitive Areas The National Assembly for Wales - GI Services (Department of Planning & Countryside)	August 2008	Annually
Forest Parks Forestry Commission	April 1997	Not Applicable
Local Nature Reserves Cardiff Council Vale Of Glamorgan County Borough Council	October 2015 October 2015	Bi-Annually Bi-Annually
Marine Nature Reserves Natural Resources Wales	October 2015	Bi-Annually
National Nature Reserves Natural Resources Wales	October 2015	Bi-Annually
Nitrate Sensitive Areas Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	October 2015	Not Applicable
Nitrate Vulnerable Zones The National Assembly for Wales - GI Services (Department of Planning & Countryside)	October 2005	Annually
Ramsar Sites Natural Resources Wales	October 2015	Bi-Annually
Sites of Special Scientific Interest Natural Resources Wales	October 2015	Bi-Annually
Special Areas of Conservation Natural Resources Wales	October 2015	Bi-Annually
Special Protection Areas Natural Resources Wales	October 2015	Bi-Annually

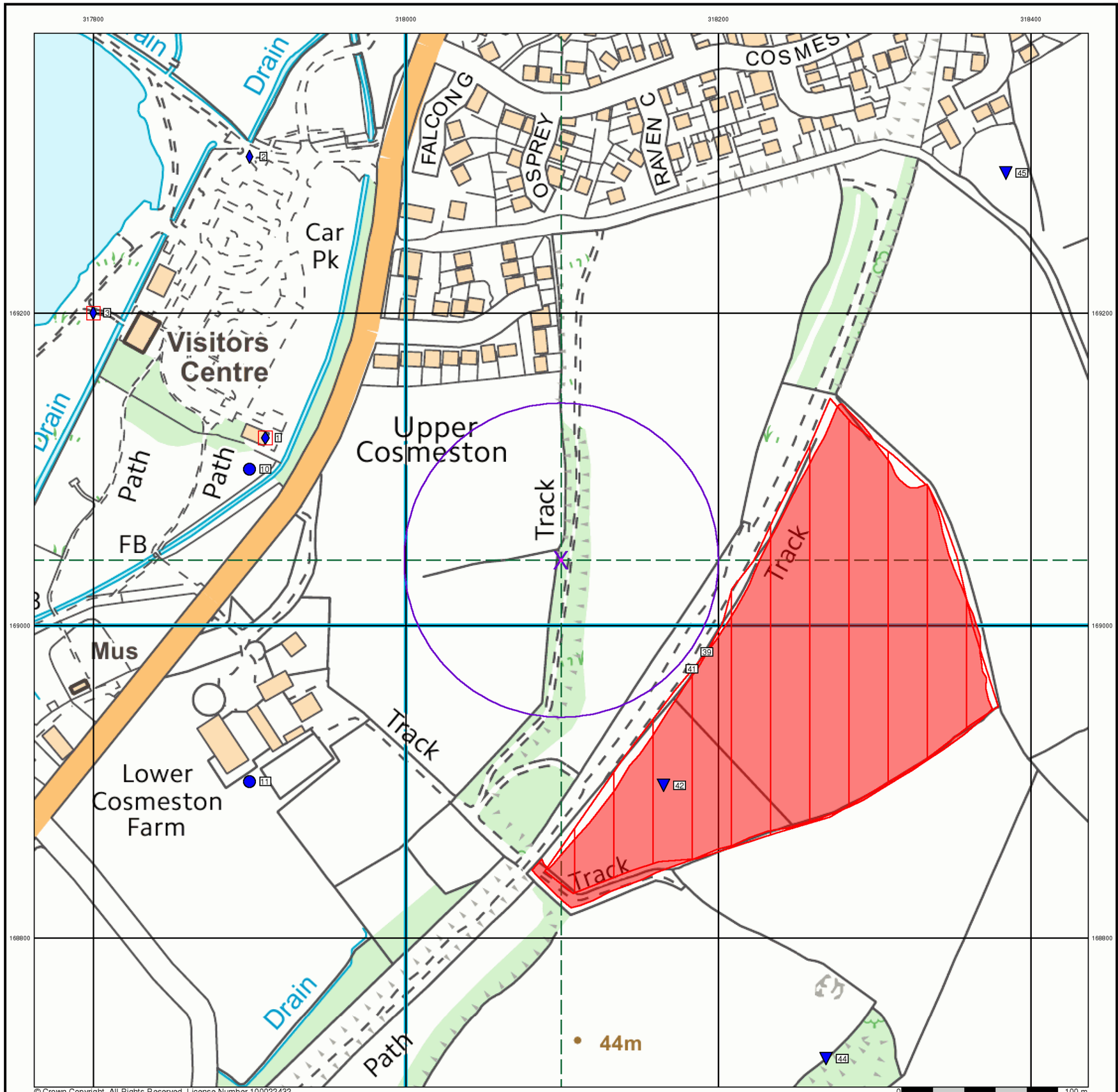
Data Suppliers

A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	
Environment Agency	
Scottish Environment Protection Agency	
The Coal Authority	
British Geological Survey	
Centre for Ecology and Hydrology	
Natural Resources Wales	
Scottish Natural Heritage	
Natural England	
Public Health England	
Ove Arup	
Peter Brett Associates	

Contact	Name and Address	Contact Details
2	**Natural Resources Wales** Ty Cambria, 29 Newport Road, Cardiff, CF24 0TP	Telephone: 0300 065 3000 Email: enquiries@naturalresourceswales.gov.uk
3	**Vale Of Glamorgan County Borough Council - Environmental Health Department** Civic Offices, Holton Road, Barry, CF63 4RU	Telephone: 01446 700111 Fax: 01446 745566 Website: www.valeofglamorgan.gov.uk
4	**Environment Agency - National Customer Contact Centre (NCCC)** PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 03708 506 506 Email: enquiries@environment-agency.gov.uk
5	**British Geological Survey - Enquiry Service** British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
6	**Vale Of Glamorgan County Borough Council** Civic Offices, Holton Road, Barry, South Glamorgan, CF63 4RU	Telephone: 01446 700111 Fax: 01446 745566 Website: www.valeofglamorgan.gov.uk
-	**Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards** Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	**Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Please note that the Environment Agency / Natural Resources Wales / SEPA have a charging policy in place for enquiries.



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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Geological

- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry

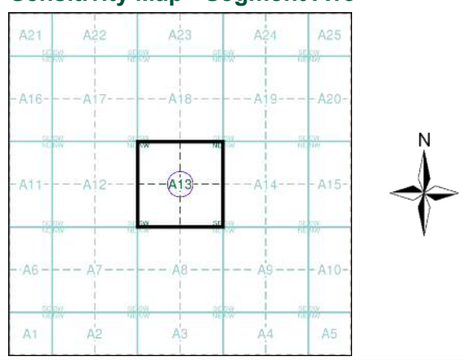
Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Site Sensitivity Map - Segment A13



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Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01

Site Details

Cosmeston Farm, PENARTH, South Glamorgan, CF64 5UB

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- Explosive Site
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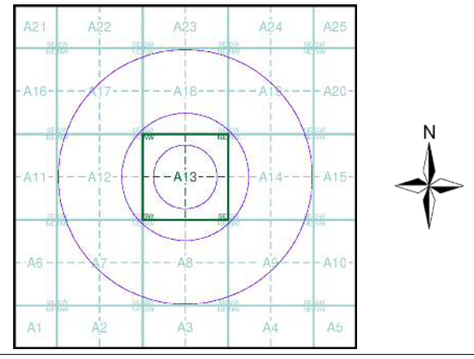
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Site Sensitivity Map - Slice A



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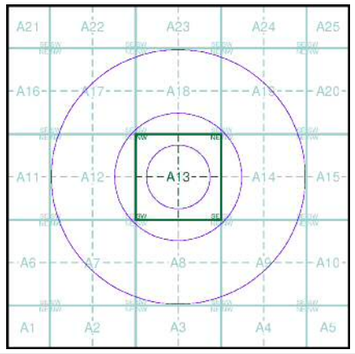
General

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

Agency and Hydrological (Flood)

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

Flood Map - Slice A



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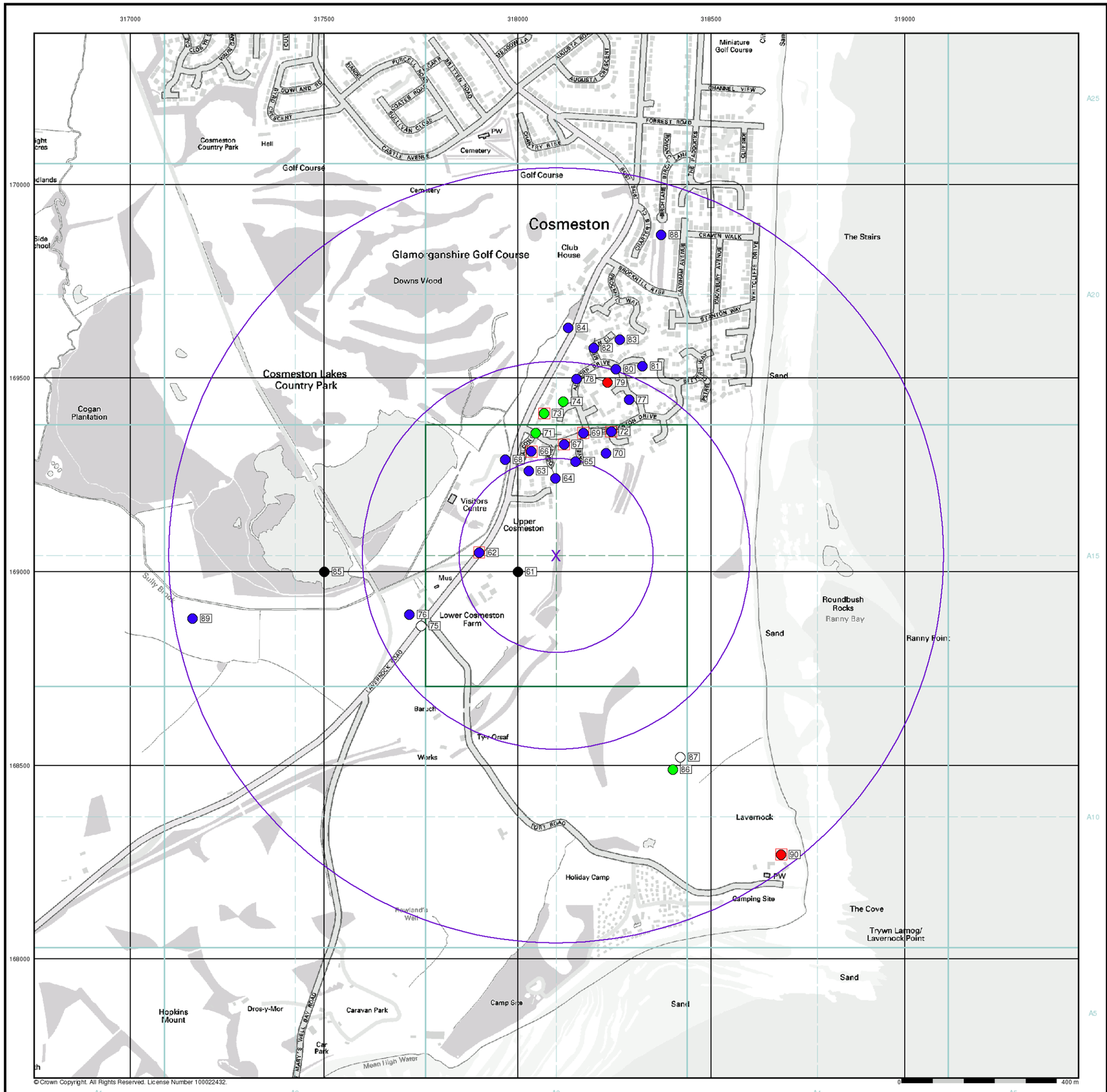

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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

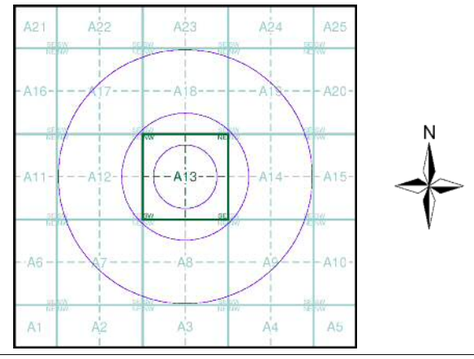
Agency and Hydrological (Boreholes)

- BGS Borehole Depth 0 - 10m
- BGS Borehole Depth 10 - 30m
- BGS Borehole Depth 30m +
- Confidential
- Other

For Borehole information please refer to the Borehole .csv file which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.

Borehole Map - Slice A



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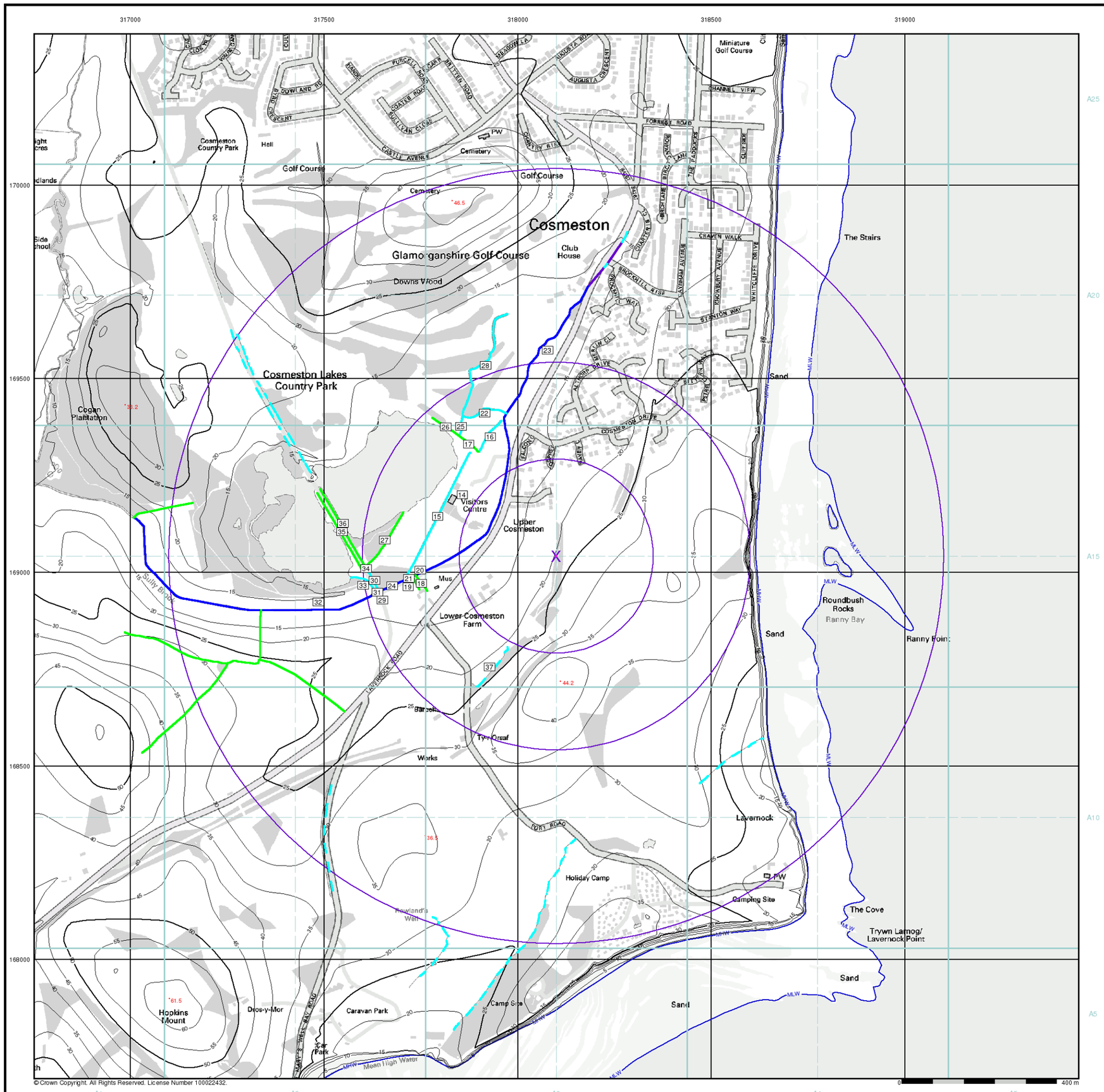

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General

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

Detailed River Network Data

- Primary River
- Secondary River
- Tertiary River
- Canal
- Canal Tunnel
- Undefined River
- Lake/Reservoir
- Offline Drainage Feature
- Extended Culvert (greater than 50m)
- Underground River (inferred)
- Underground River (local knowledge)
- Downstream of High Water Mark
- Downstream of Seaward Extension
- Not assigned River feature

Contours (height in metres)

Standard Contour 105 100 95

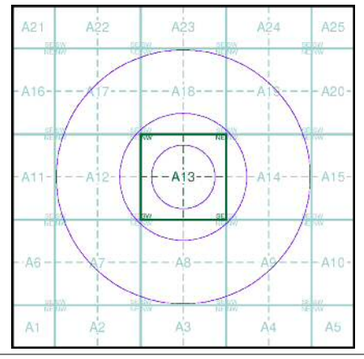
Master Contour

Spot Height *167.3

MLW Mean Low Water

MHW Mean High Water

EA/NRW Detailed River Network Map - Slice A



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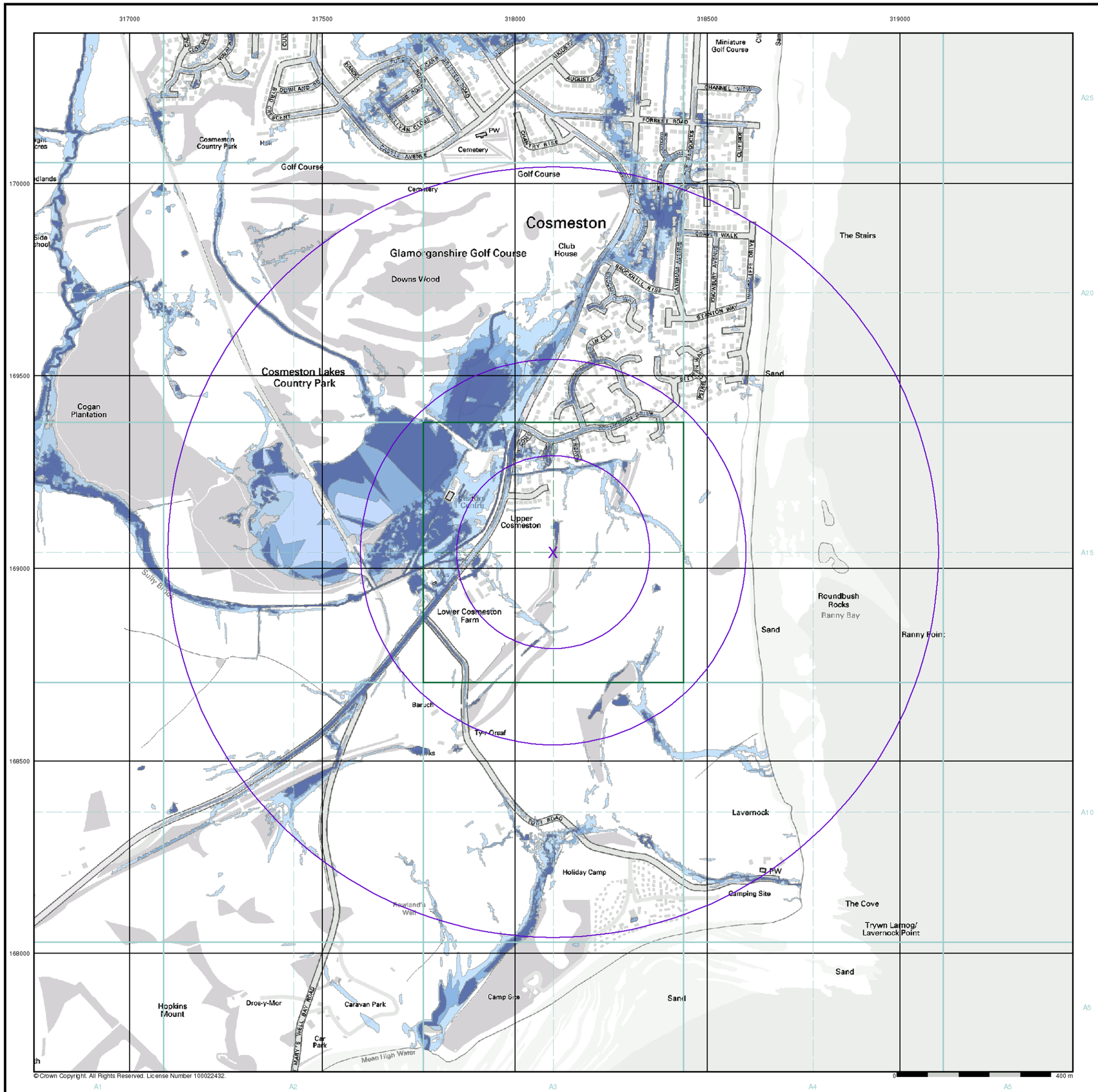

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General

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

Risk of Flooding from Surface Water

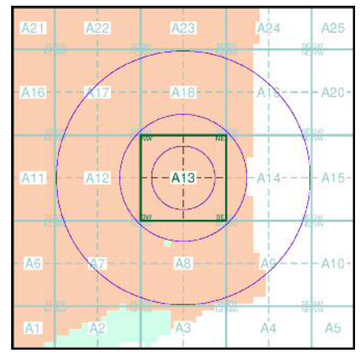
- High - 30 Year Return
- Medium - 100 Year Return
- Low - 1000 Year Return

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



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APPENDIX C

Historical Maps

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
Pylon
Electricity Transmission Line
Sloping Masonry
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
Mud
Sand
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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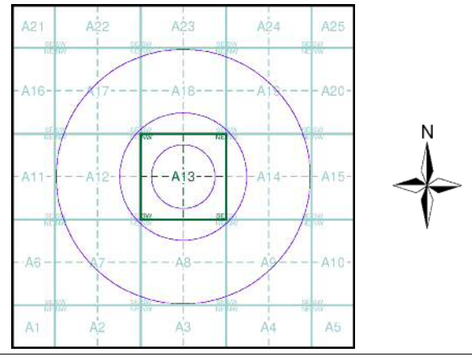
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Glamorganshire	1:10,560	1885	2
Glamorganshire	1:10,560	1901	3
Glamorganshire	1:10,560	1921 - 1922	4
Glamorganshire	1:10,560	1922	5
Glamorganshire	1:10,560	1922	6
Glamorganshire	1:10,560	1938 - 1947	7
Glamorganshire	1:10,560	1947	8
Historical Aerial Photography	1:10,560	1947	9
Historical Aerial Photography	1:10,560	1947	10
Ordnance Survey Plan	1:10,000	1964 - 1965	11
Ordnance Survey Plan	1:10,000	1972 - 1974	12
Ordnance Survey Plan	1:10,000	1984 - 1989	13
Ordnance Survey Plan	1:10,000	1996	14
10K Raster Mapping	1:10,000	2006	15
VectorMap Local	1:10,000	2015	16

Historical Map - Slice A



Order Details

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Customer Ref: UA008386
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Site Area (Ha): 0.01
Search Buffer (m): 1000

Site Details

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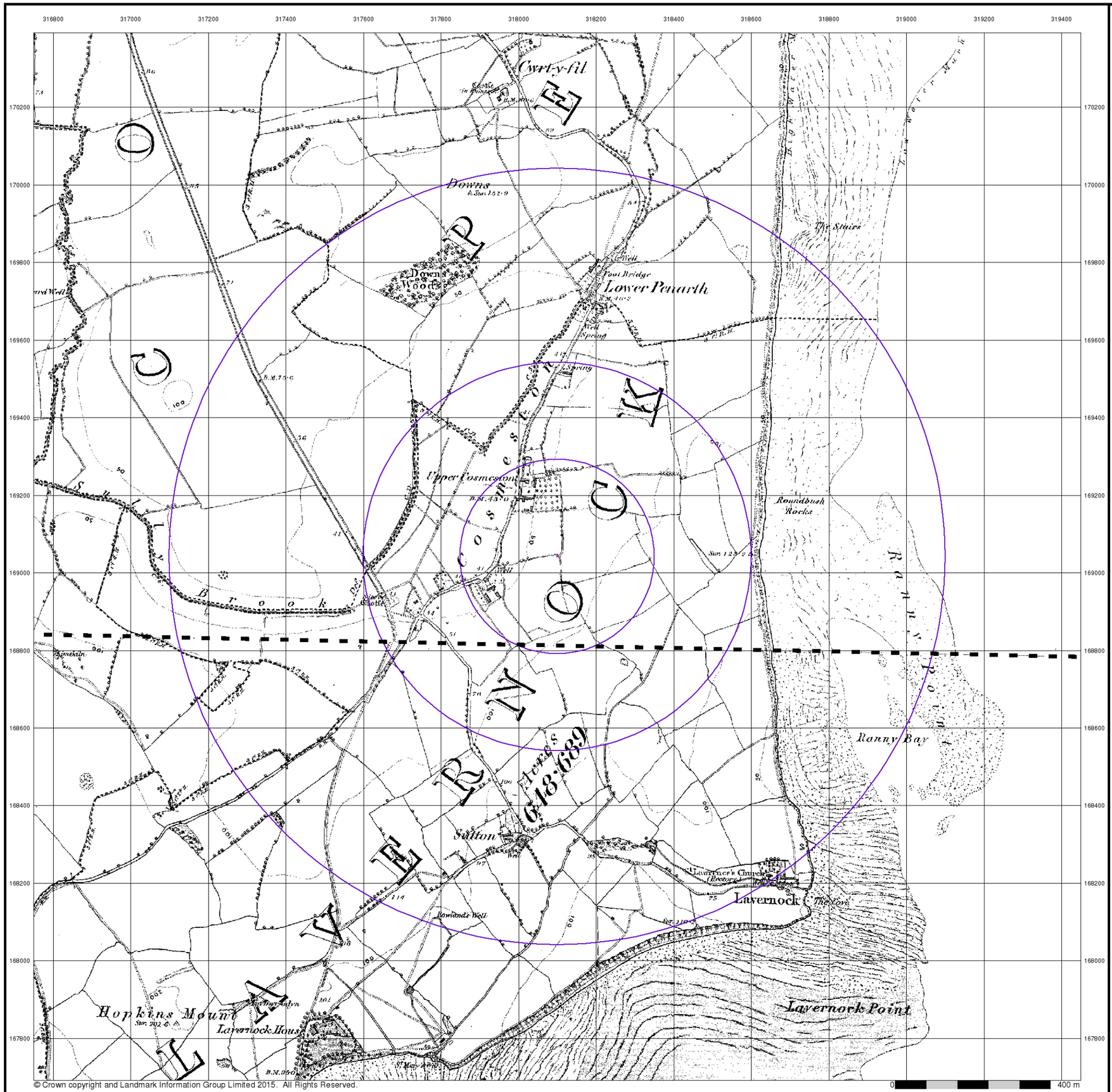

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Glamorganshire

Published 1885

Source map scale - 1:10,560

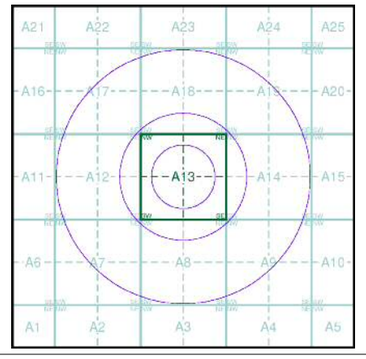
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some 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)

04700
1885
1:10,560

05100
1885
1:10,560

Historical Map - Slice A



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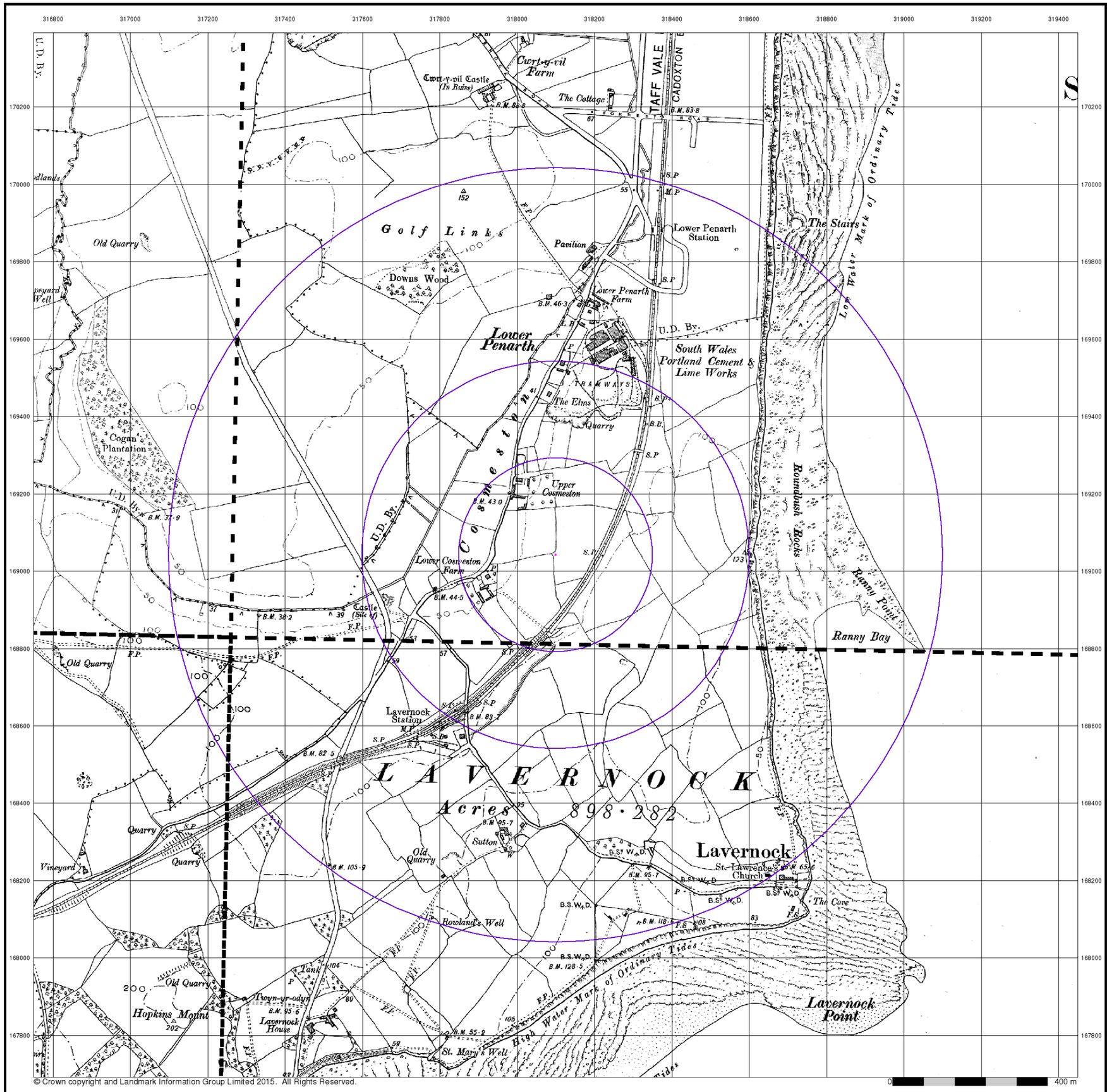

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Glamorganshire

Published 1901

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.

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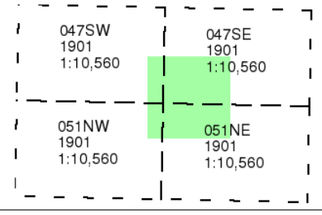
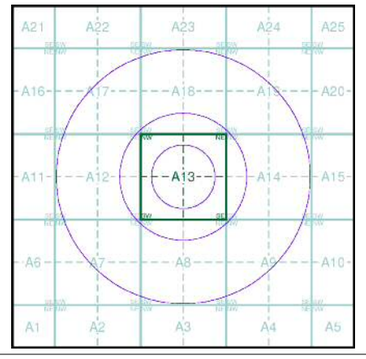


Historical Map - Slice A



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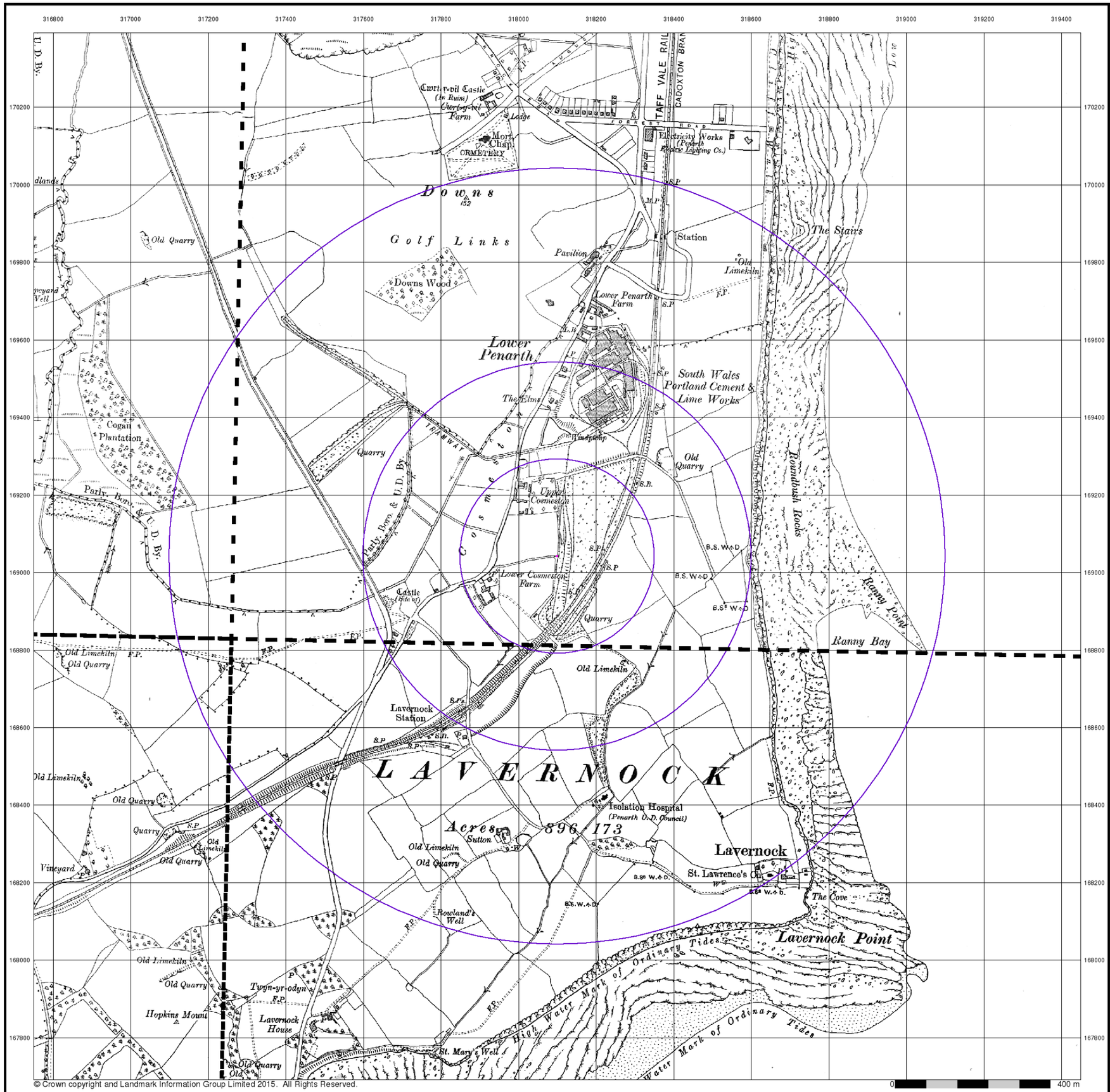

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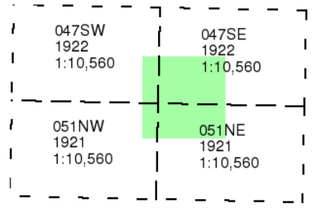
Glamorganshire

Published 1921 - 1922

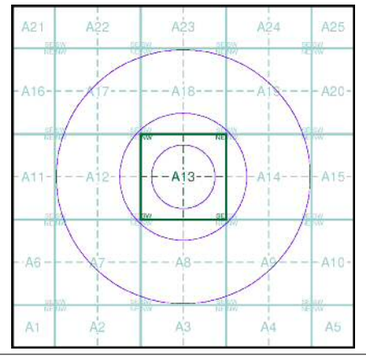
Source map scale - 1:10,560

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:	77053315_1_1
Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Cosmeston Farm, PENARTH, South Glamorgan, CF64 5UB

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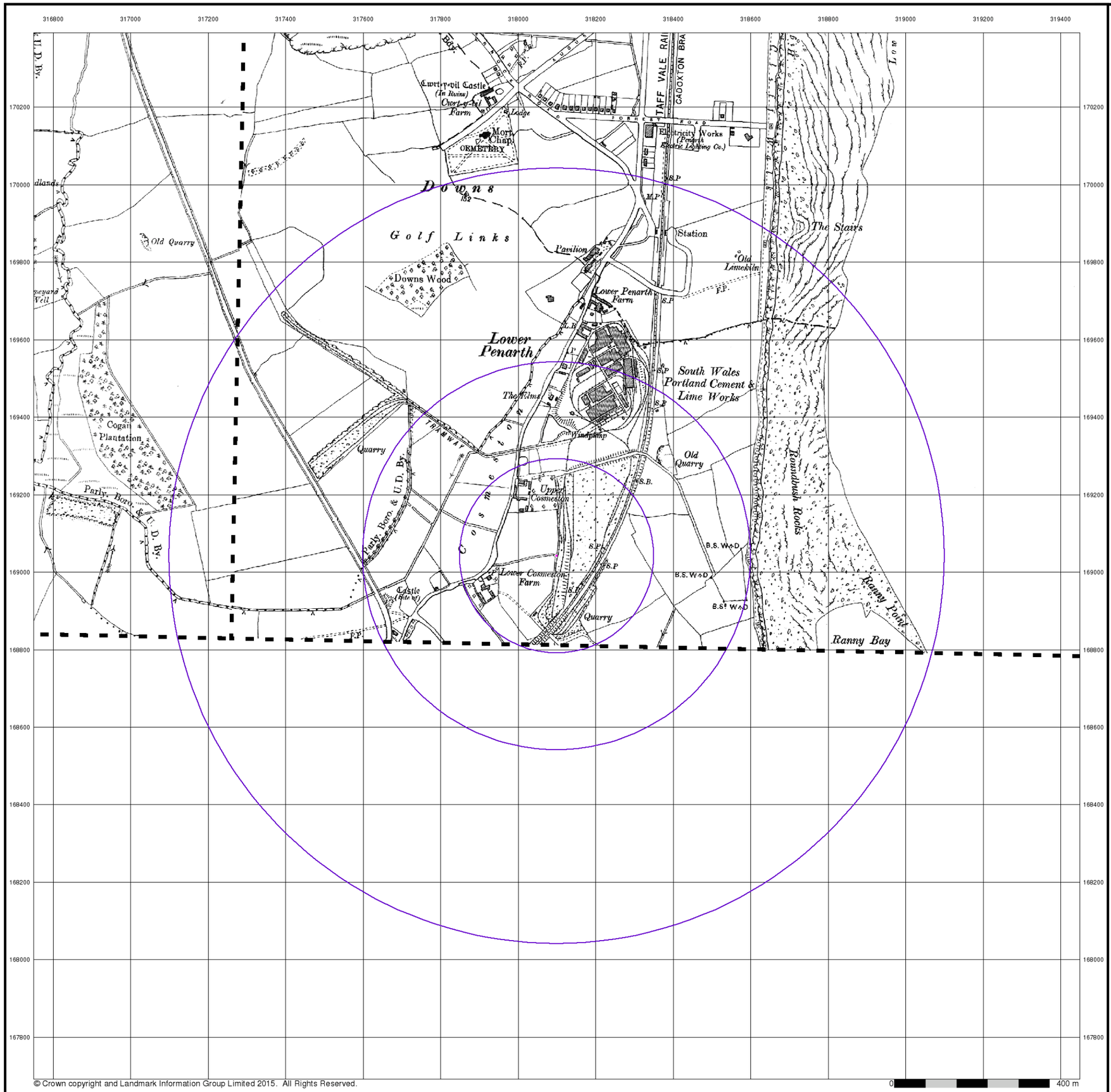

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0 400 m

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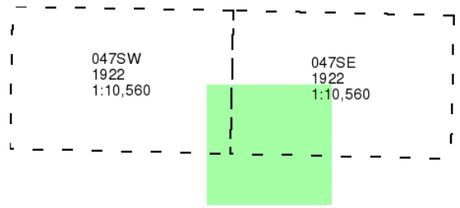
Glamorganshire

Published 1922

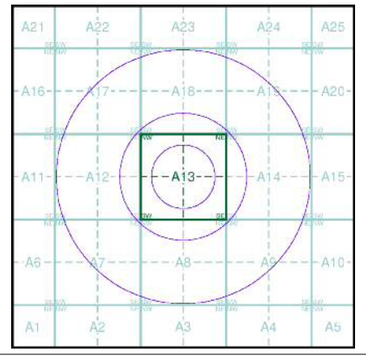
Source map scale - 1:10,560

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

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Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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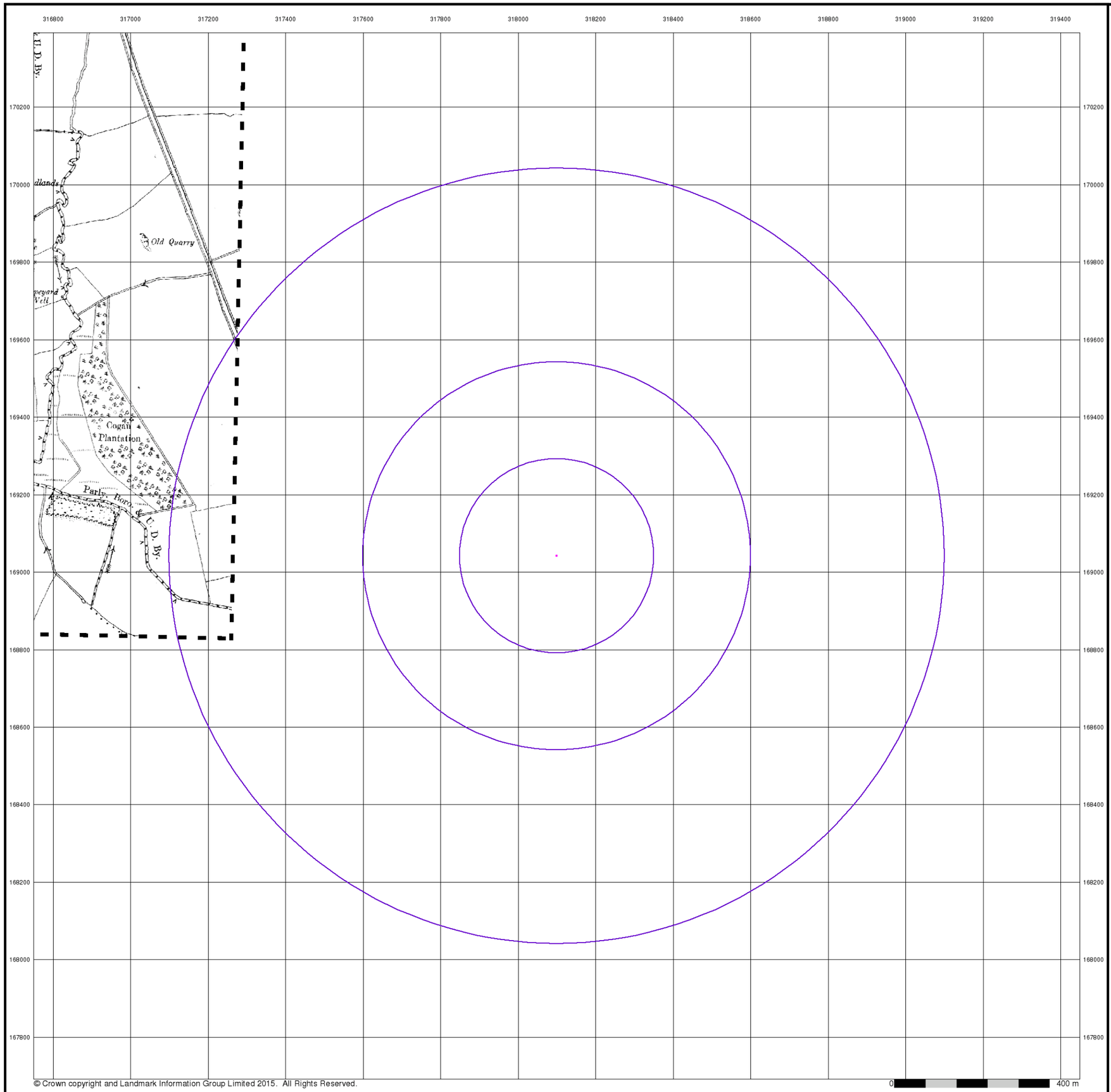

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Glamorganshire

Published 1922

Source map scale - 1:10,560

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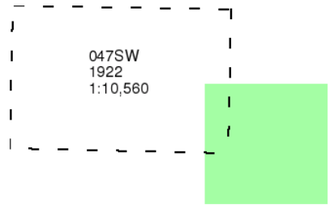
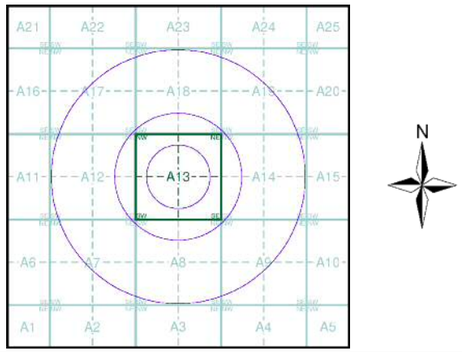
Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

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Glamorganshire

Published 1938 - 1947

Source map scale - 1:10,560

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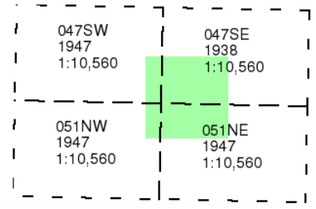
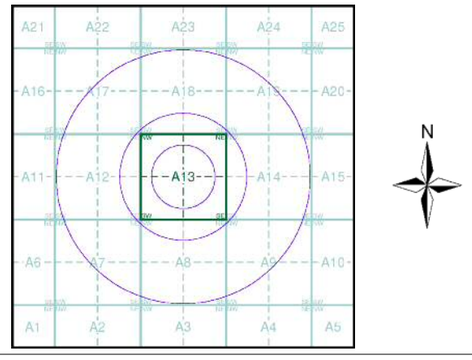
Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	77053315_1_1
Customer Ref:	UA008386
National Grid Reference:	318100, 169040
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Search Buffer (m):	1000

Site Details

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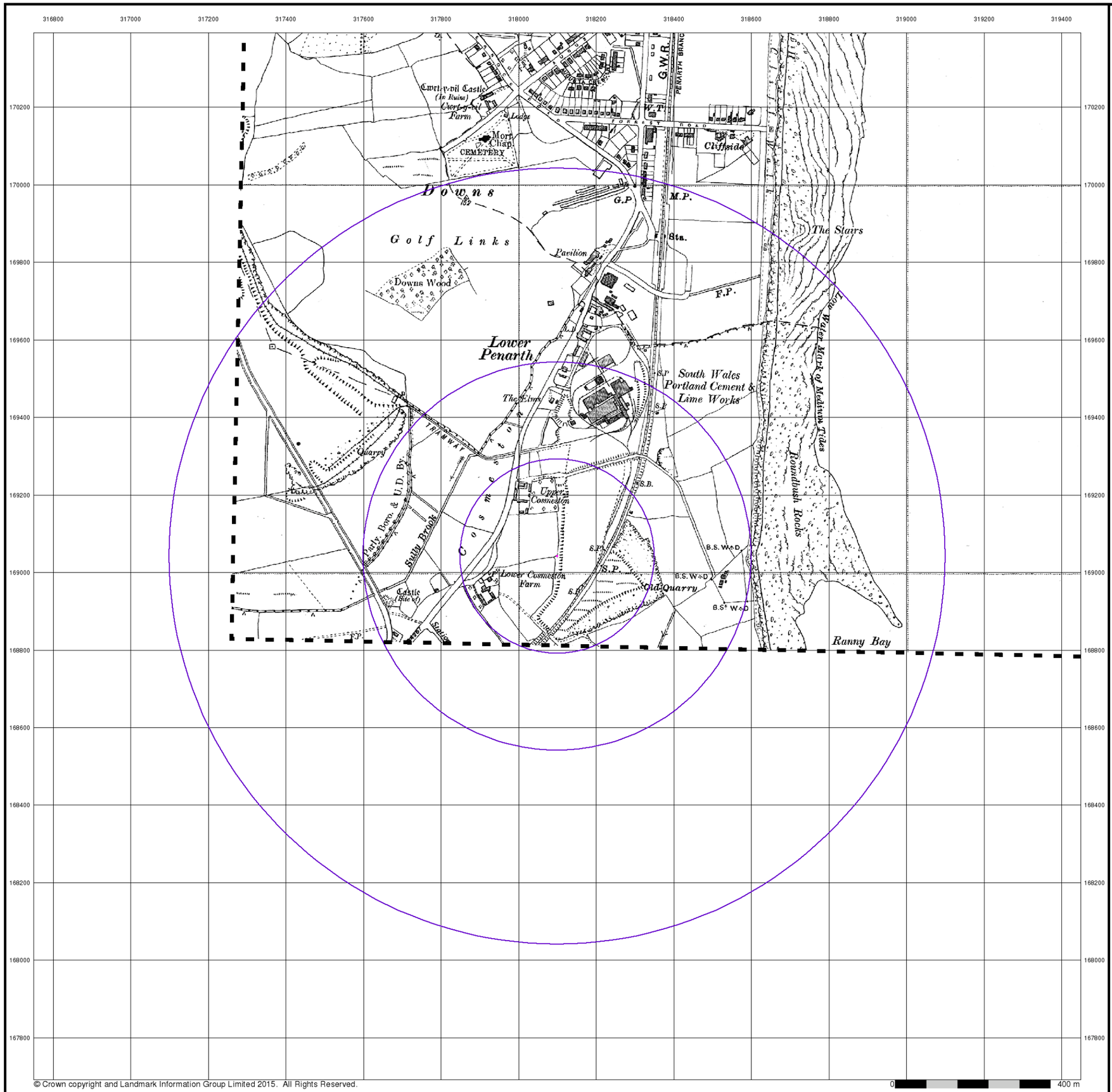

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Glamorganshire

Published 1947

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.

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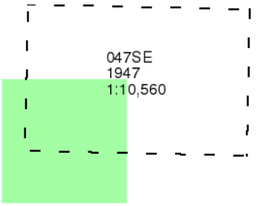
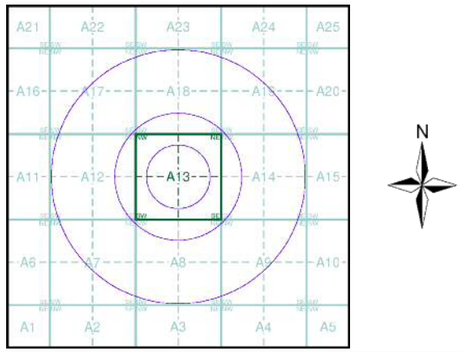


Historical Map - Slice A



Order Details

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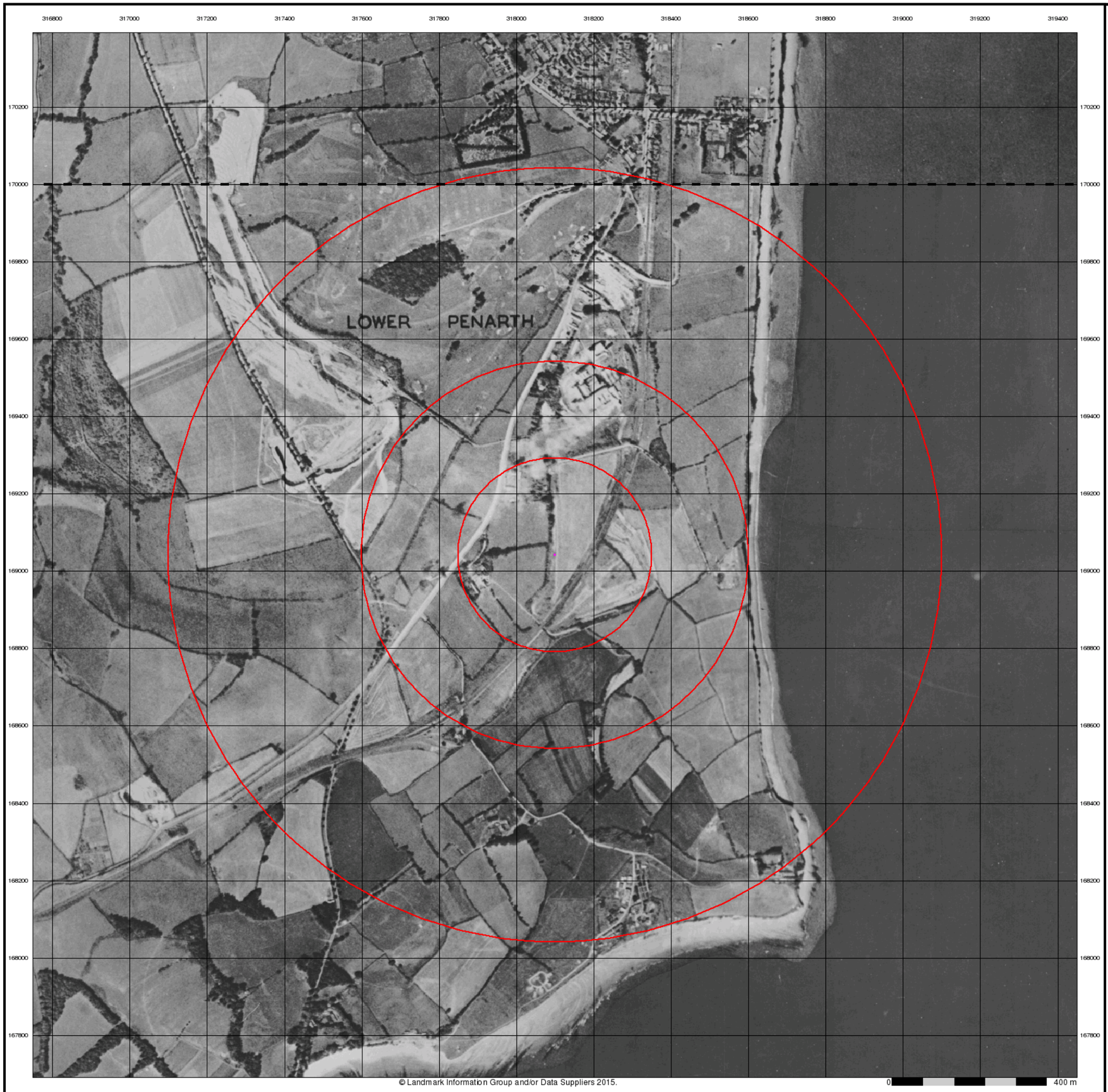

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Historical Aerial Photography

Published 1947

Source map scale - 1:10,560

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

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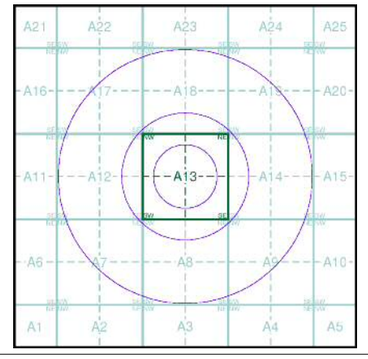
Map Name(s) and Date(s)

ST17SE
1947
1:10,560

ST16NE
1947
1:10,560

Historical Aerial Photography - Slice A



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Order Details

Order Number:	77053315_1_1
Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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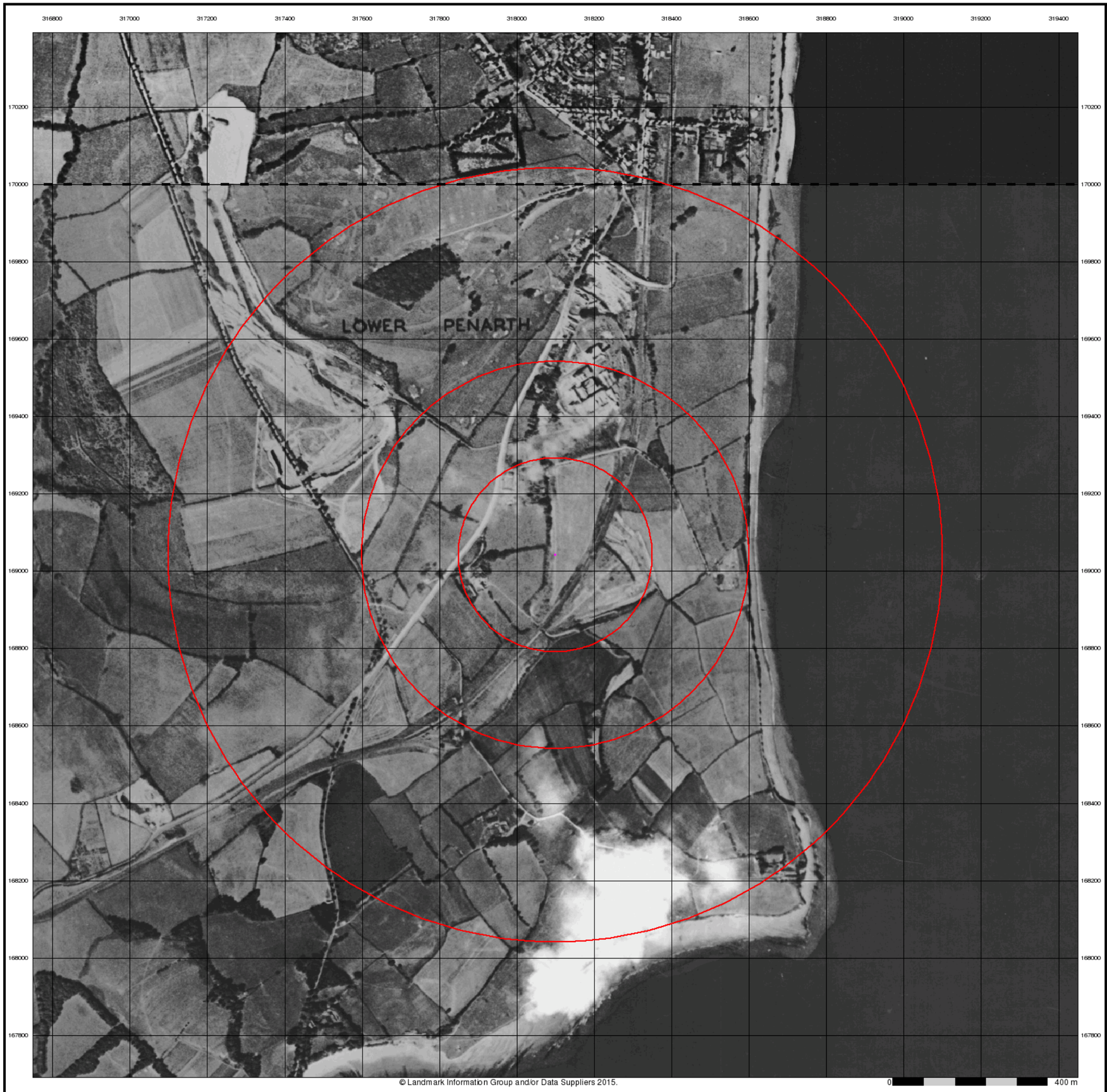

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Historical Aerial Photography

Published 1947

Source map scale - 1:10,560

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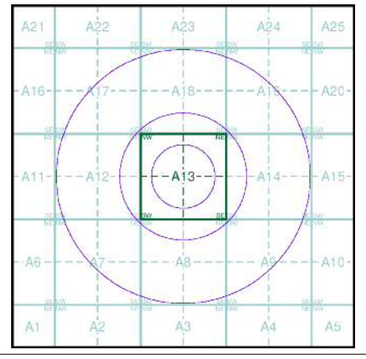
Map Name(s) and Date(s)

ST17SE
1947
1:10,560

ST16NE
1947
1:10,560

Historical Aerial Photography - Slice A



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Order Details

Order Number:	77053315_1_1
Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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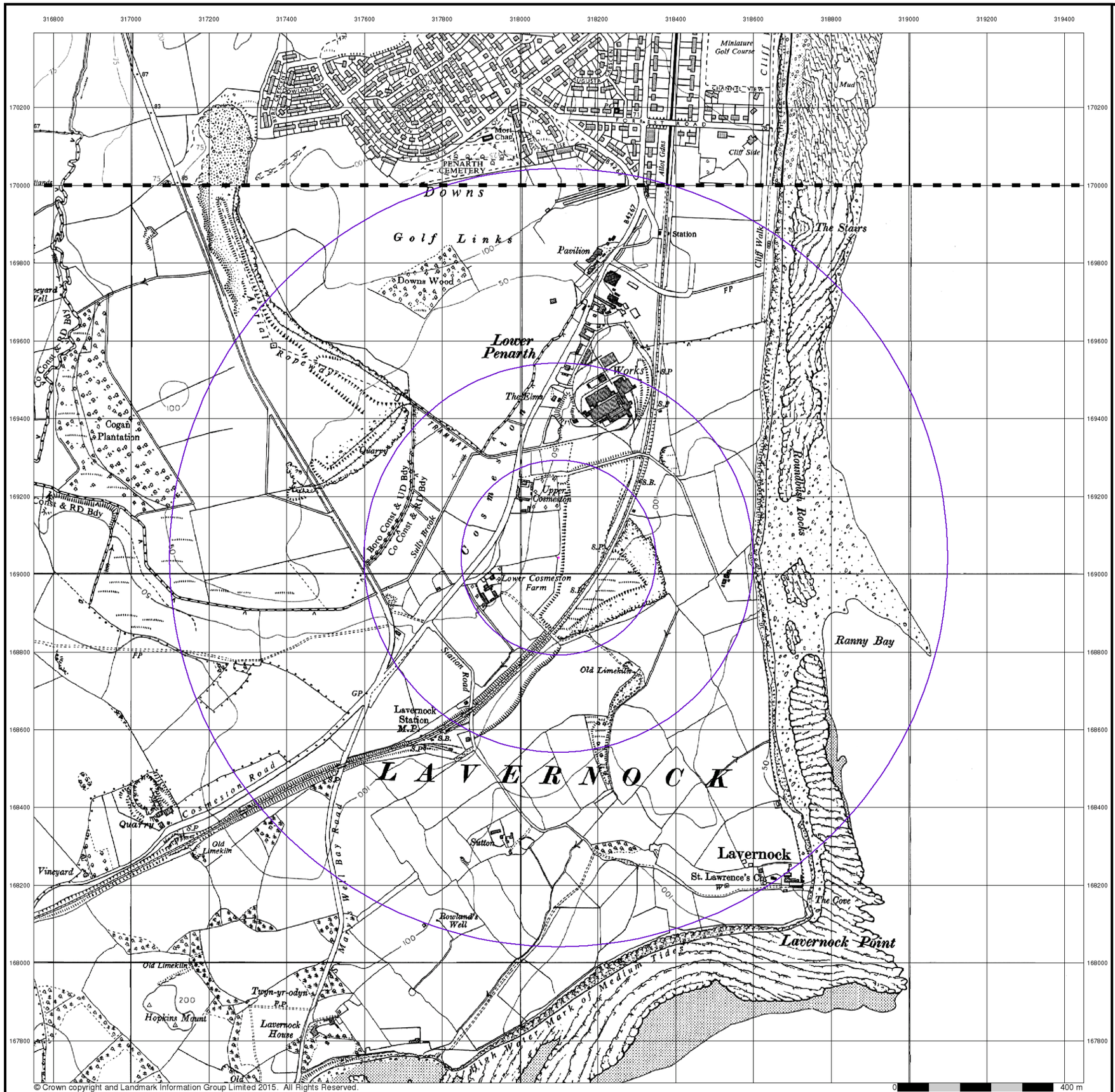

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Ordnance Survey Plan

Published 1964 - 1965

Source map scale - 1:10,000

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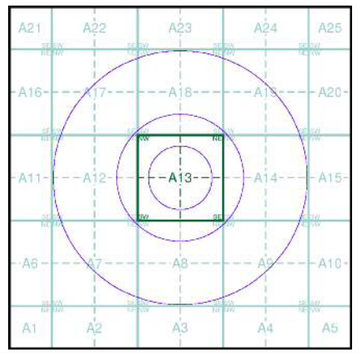
Map Name(s) and Date(s)

ST17SE
1965
1:10,560

ST16NE
1964
1:10,560

Historical Map - Slice A



Order Details

Order Number:	77053315_1_1
Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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Ordnance Survey Plan

Published 1972 - 1974

Source map scale - 1:10,000

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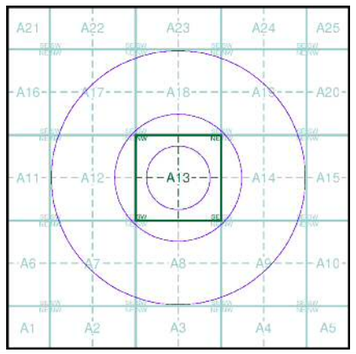
Map Name(s) and Date(s)

ST17SE
1974
1:10,000

ST16NE
1972
1:10,000

Historical Map - Slice A



Order Details

Order Number:	77053315_1_1
Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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Ordnance Survey Plan

Published 1984 - 1989

Source map scale - 1:10,000

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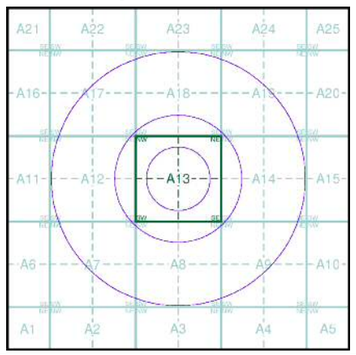
Map Name(s) and Date(s)

ST17SE
1984
1:10,000

ST16NE
1989
1:10,000

Historical Map - Slice A



Order Details

Order Number:	77053315_1_1
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Site Details

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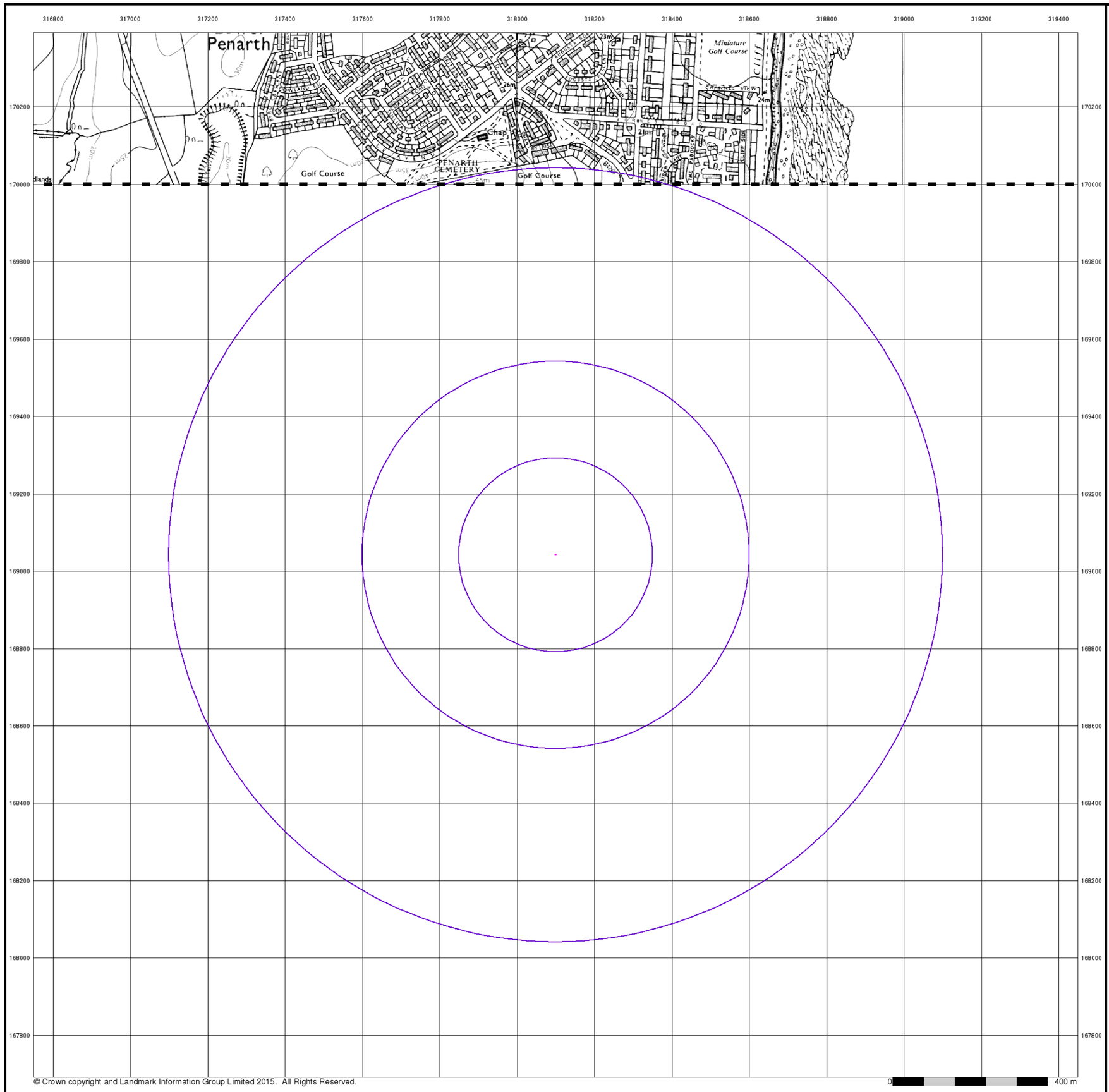

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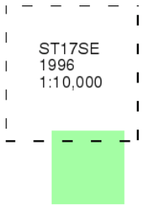
Ordnance Survey Plan

Published 1996

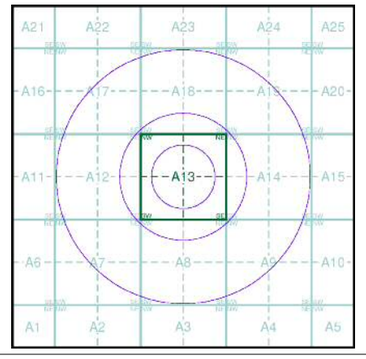
Source map scale - 1:10,000

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.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

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Site Details

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10k Raster Mapping

Published 2006

Source map scale - 1:10,000

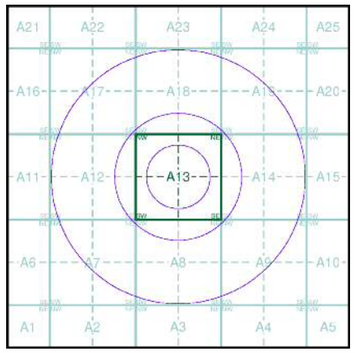
The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks 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)

ST17SE
2006
1:10,000

ST16NE
2006
1:10,000

Historical Map - Slice A



Order Details

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Site Details

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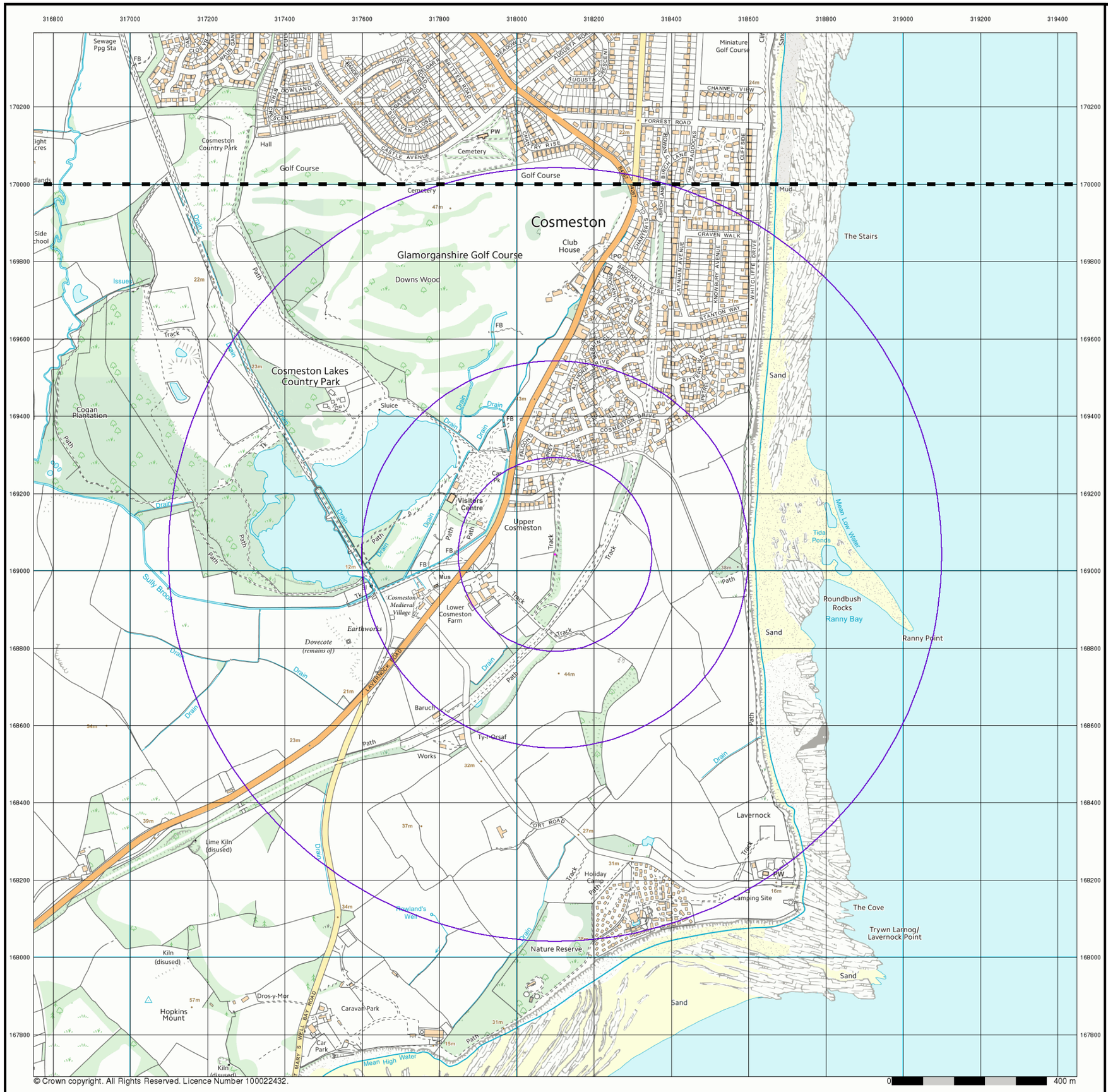

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VectorMap Local

Published 2015

Source map scale - 1:10,000

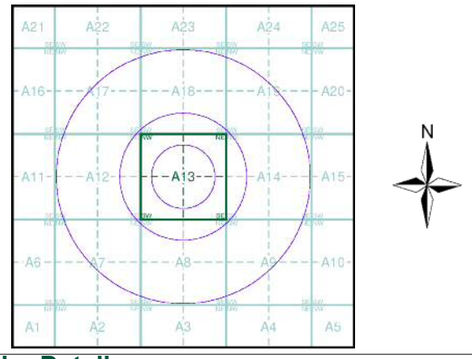
VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)

ST17SE
2015
Variable

ST16NE
2015
Variable

Historical Map - Slice A



Order Details

Order Number:	77053315_1_1
Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

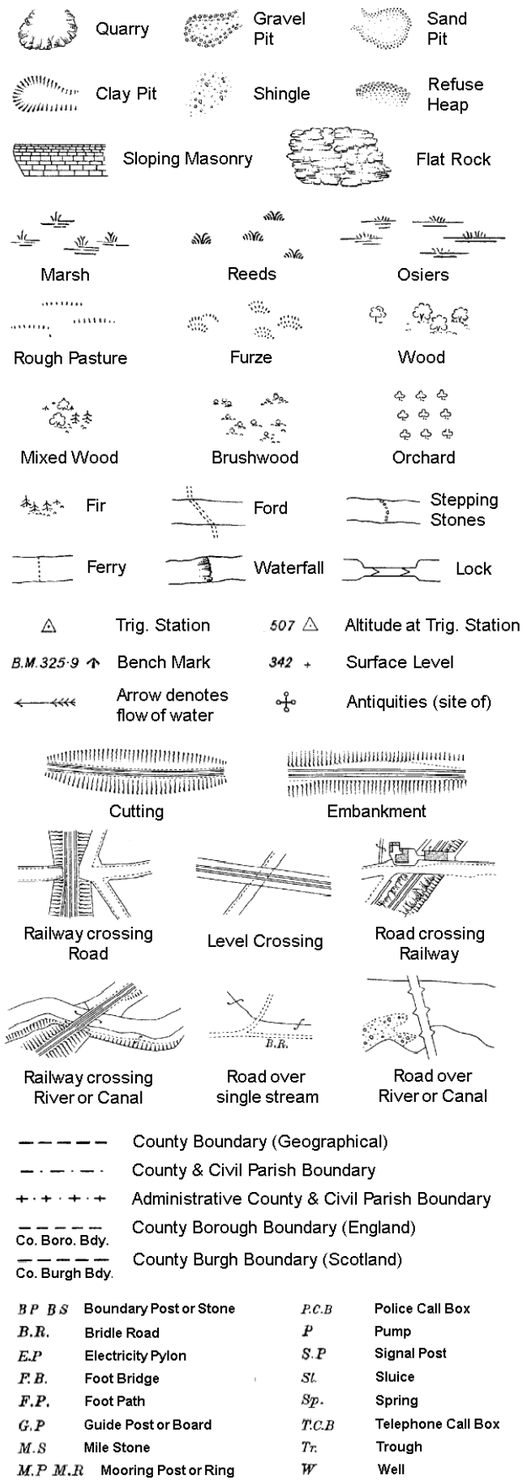
Cosmeston Farm, PENARTH, South Glamorgan, CF64 5UB

Landmark® Information Group

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

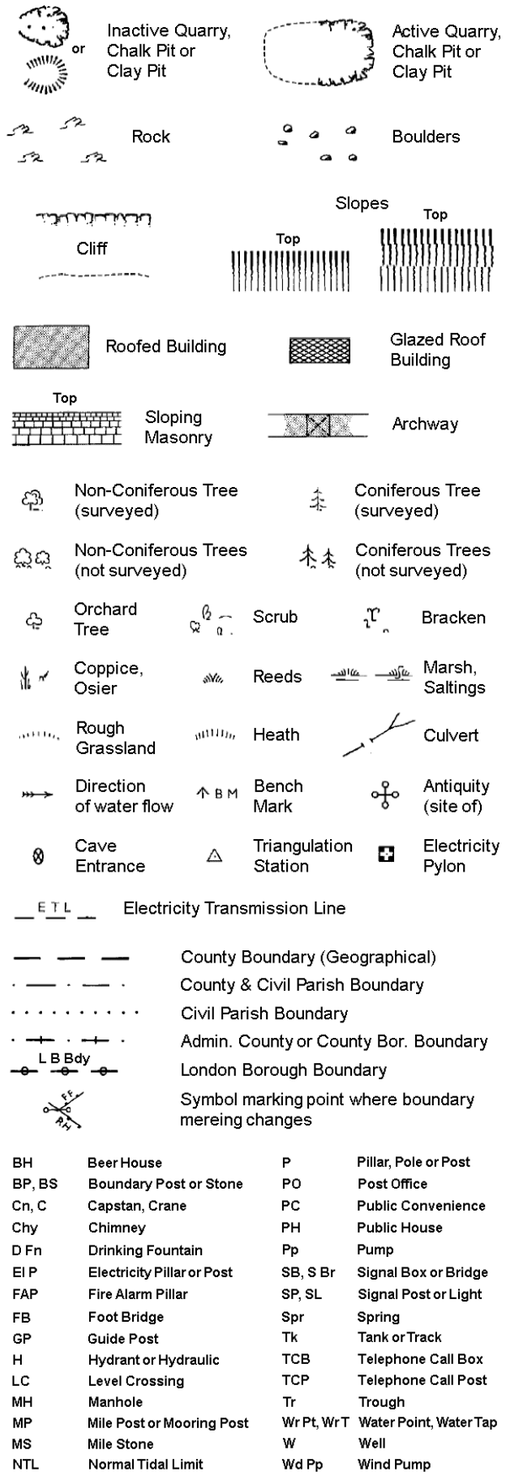
Historical Mapping Legends

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



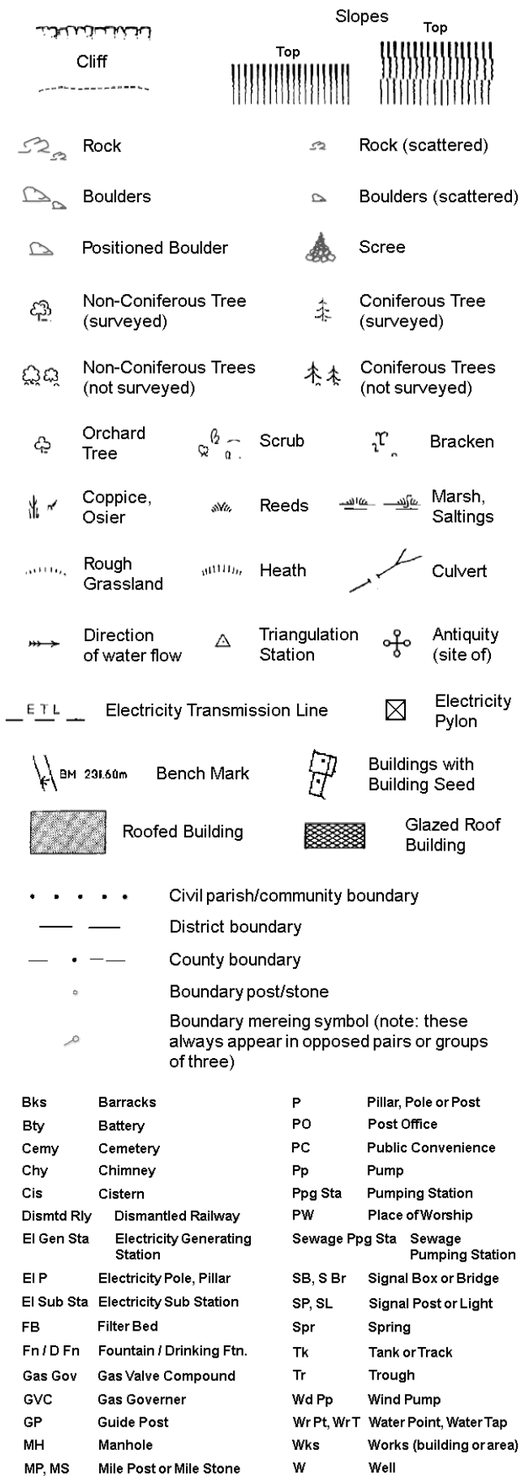
B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

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



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



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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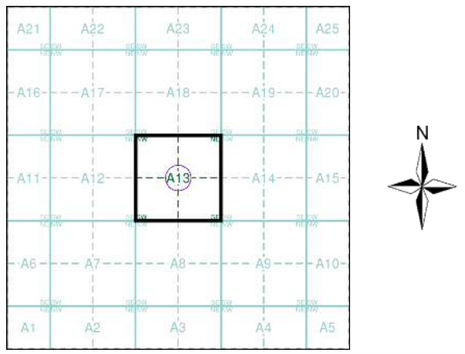
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Glamorganshire	1:2,500	1879 - 1890	2
Glamorganshire	1:2,500	1900	3
Glamorganshire	1:2,500	1920	4
Glamorganshire	1:2,500	1940	5
Ordnance Survey Plan	1:2,500	1968 - 1970	6
Additional SIMs	1:2,500	1977 - 1988	7
Ordnance Survey Plan	1:1,250	1987	8
Additional SIMs	1:2,500	1989	9
Large-Scale National Grid Data	1:1,250	1993	10
Large-Scale National Grid Data	1:2,500	1993	11

Historical Map - Segment A13



Order Details

Order Number: 77053315_1_1
Customer Ref: UA008386
National Grid Reference: 318100, 169040
Slice: A
Site Area (Ha): 0.01
Search Buffer (m): 100

Site Details

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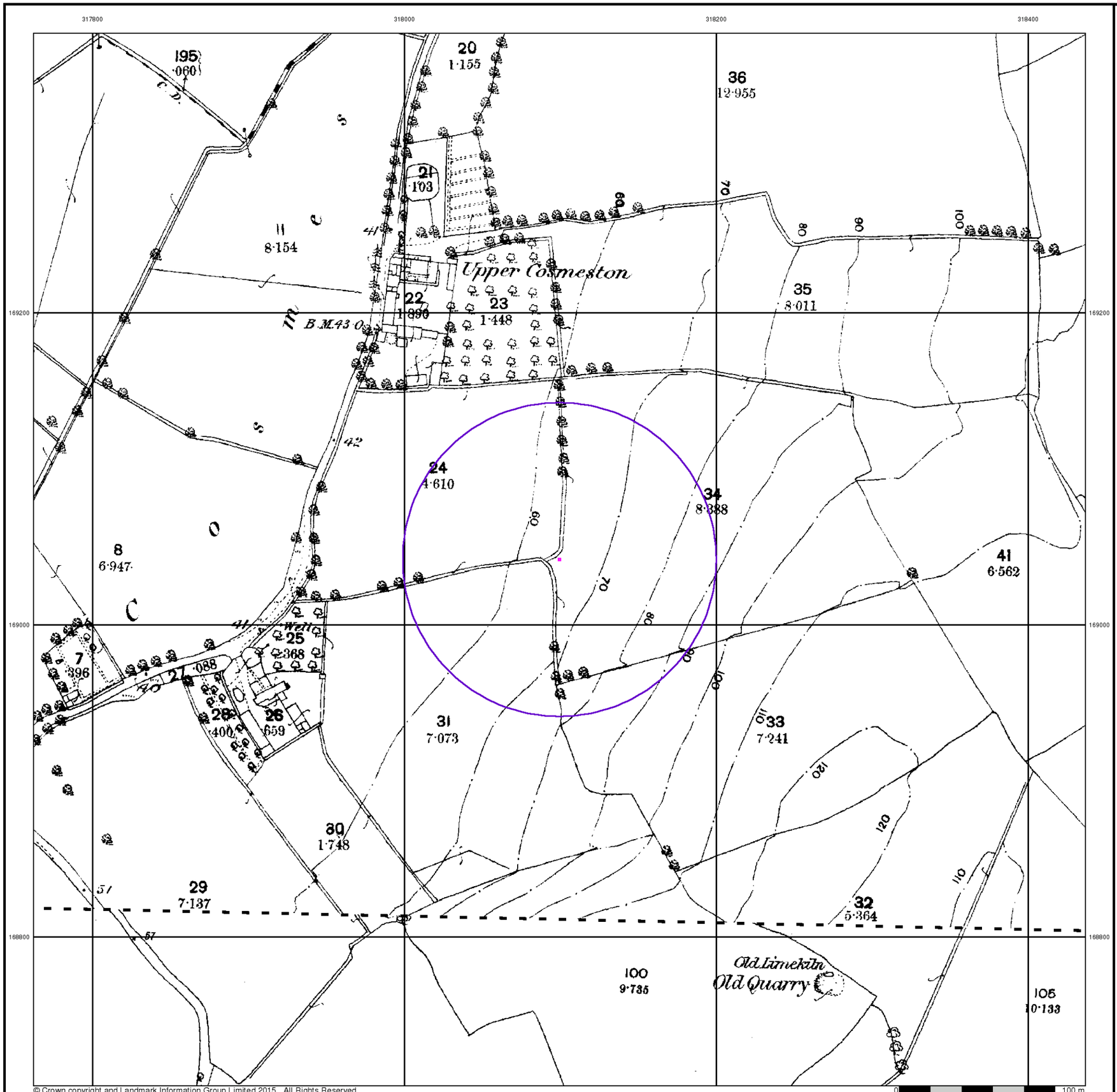

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Glamorganshire

Published 1879 - 1890

Source map scale - 1:2,500

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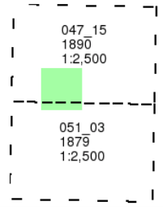
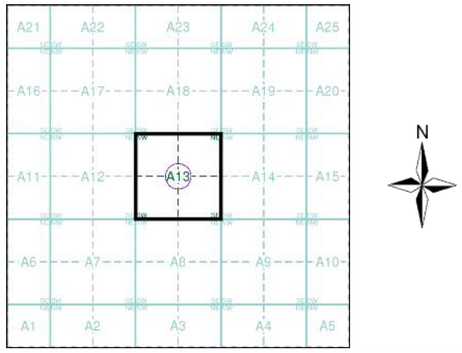
Map Name(s) and Date(s)



Historical Map - Segment A13



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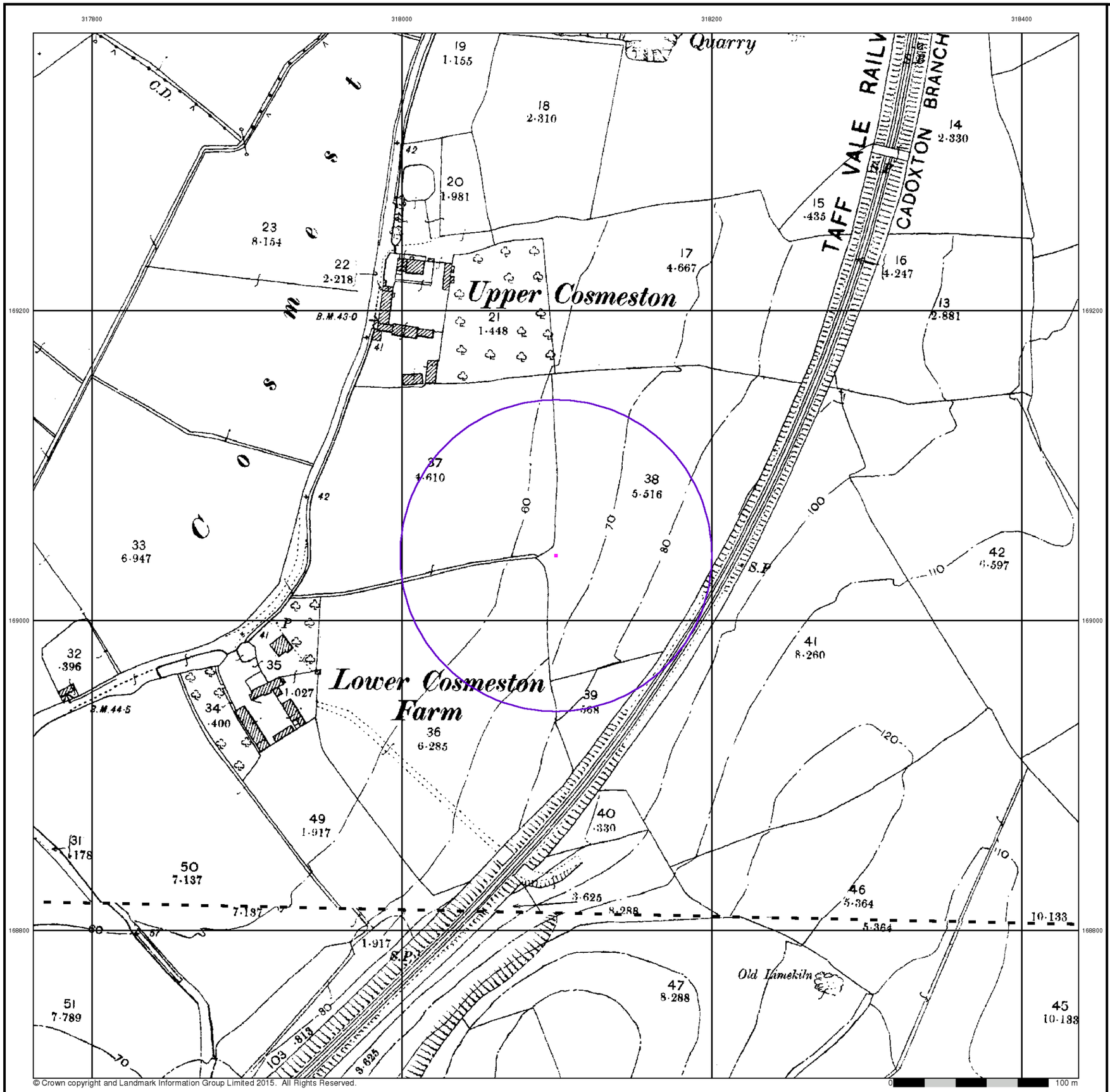

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Glamorganshire

Published 1900

Source map scale - 1:2,500

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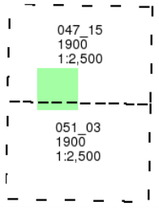
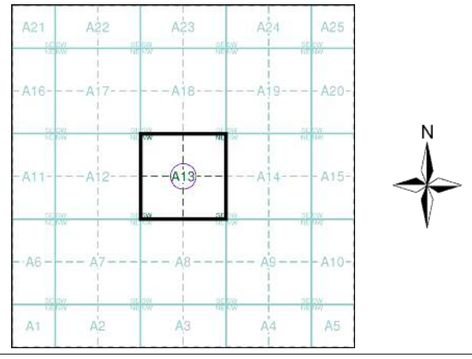


Historical Map - Segment A13



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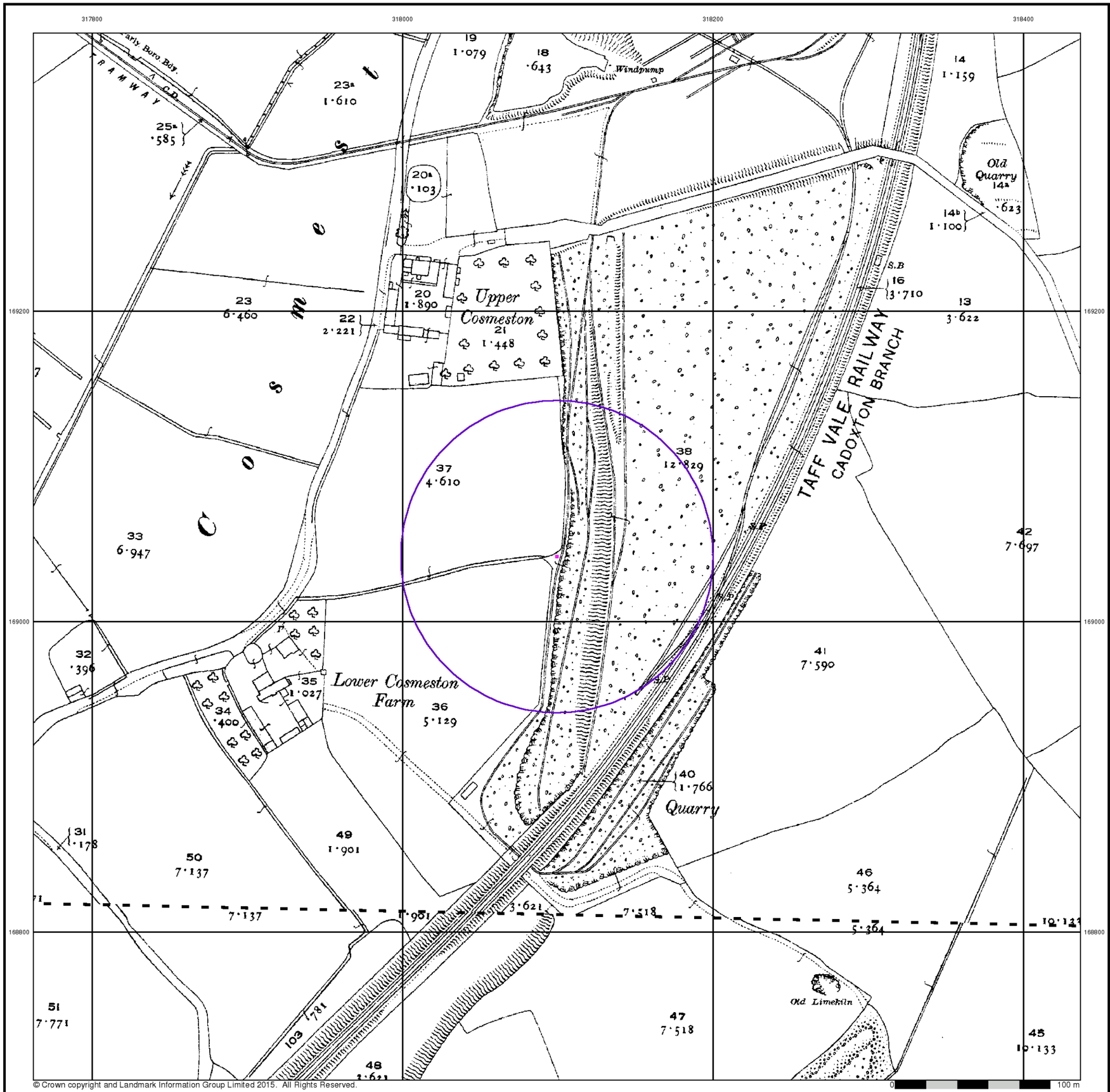

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Glamorganshire

Published 1920

Source map scale - 1:2,500

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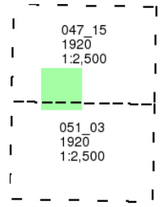
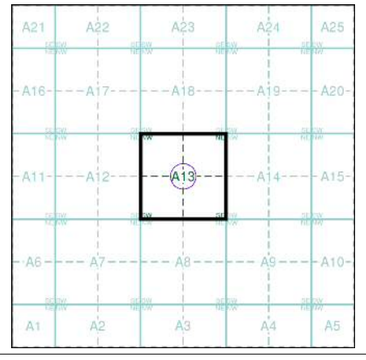


Historical Map - Segment A13



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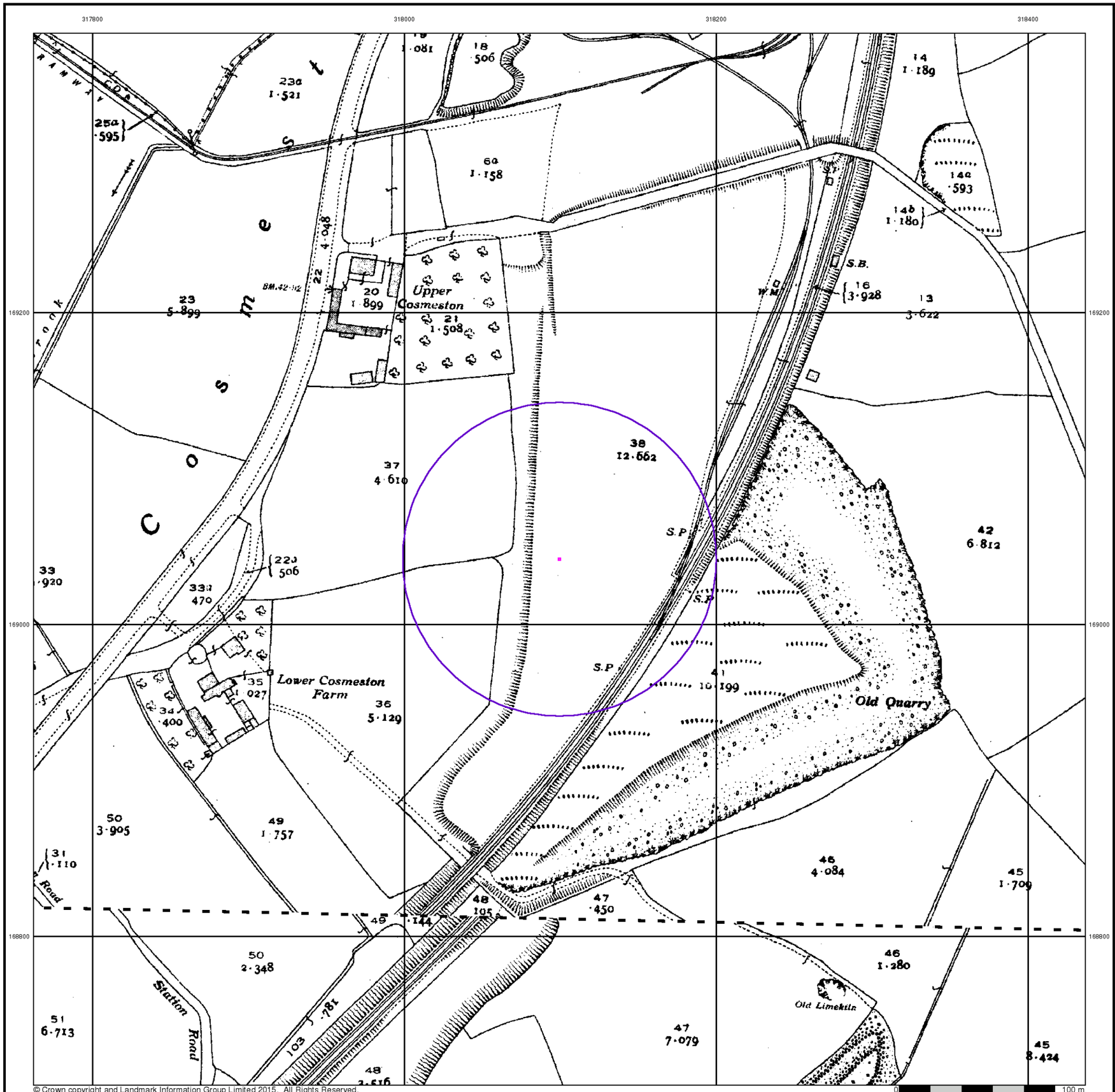

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Glamorganshire

Published 1940

Source map scale - 1:2,500

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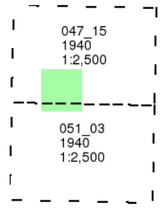
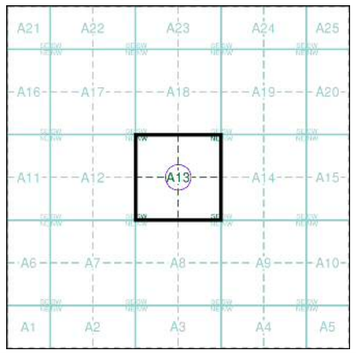
Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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Customer Ref:	UA008386
National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	100

Site Details

Cosmeston Farm, PENARTH, South Glamorgan, CF64 5UB

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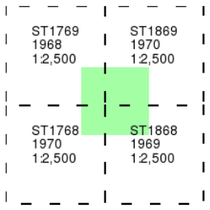
Ordnance Survey Plan

Published 1968 - 1970

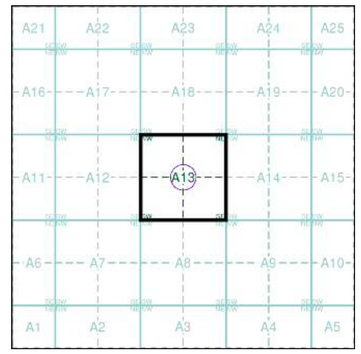
Source map scale - 1:2,500

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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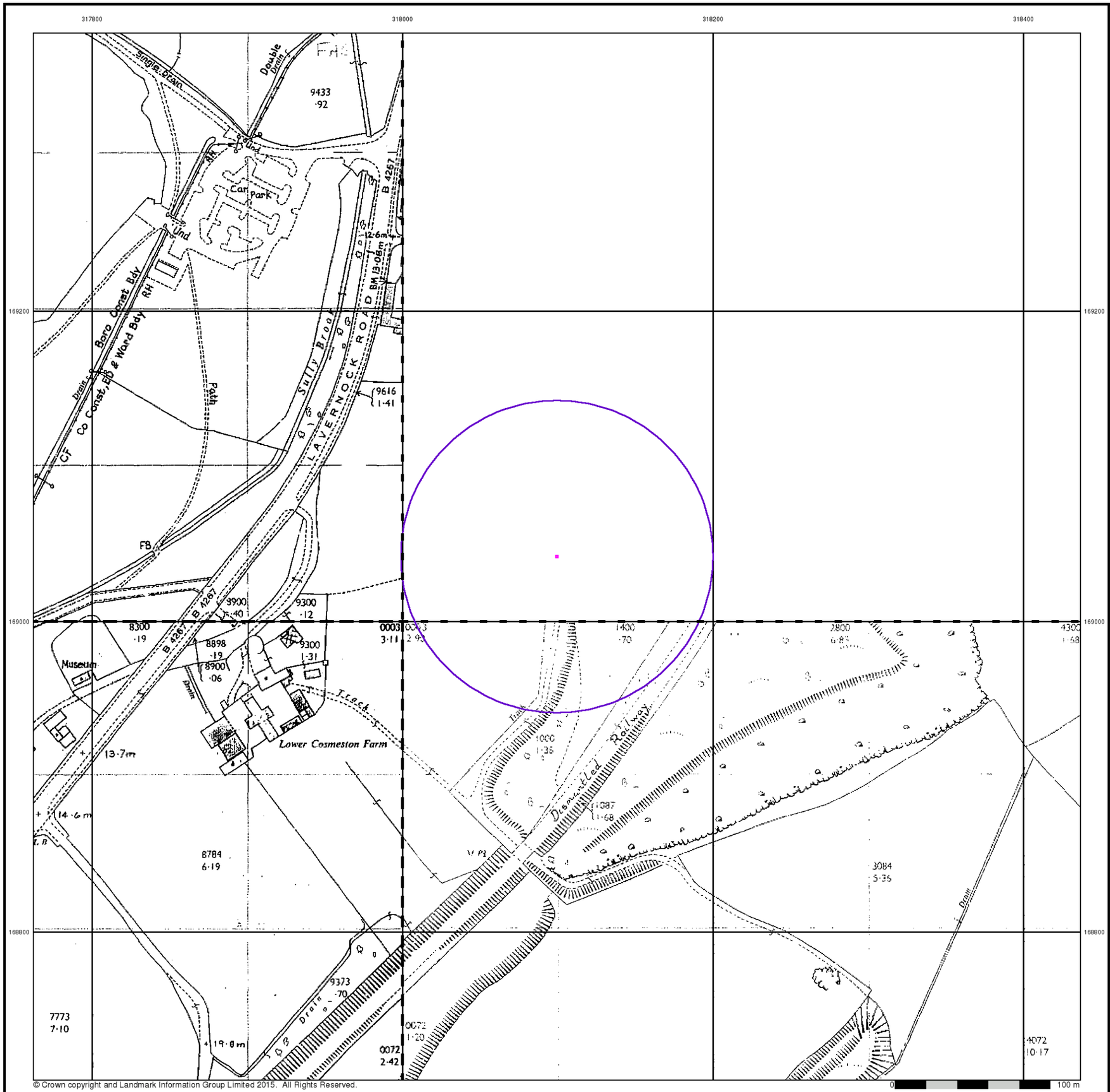

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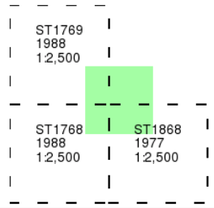
Additional SIMs

Published 1977 - 1988

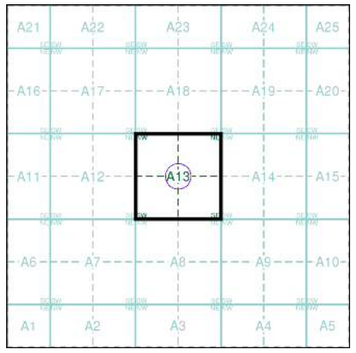
Source map scale - 1:2,500

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)



Historical Map - Segment A13



Order Details

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National Grid Reference:	318100, 169040
Slice:	A
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Cosmeston Farm, PENARTH, South Glamorgan, CF64 5UB

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Ordnance Survey Plan

Published 1987

Source map scale - 1:1,250

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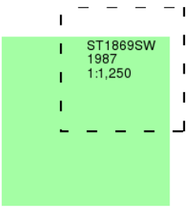
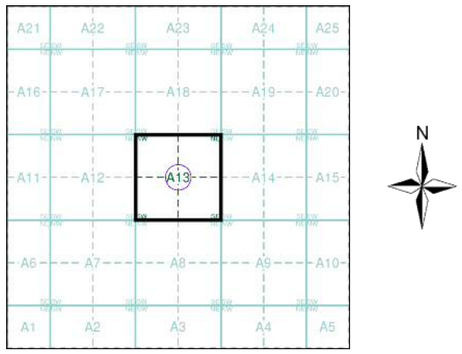


Historical Map - Segment A13



Order Details

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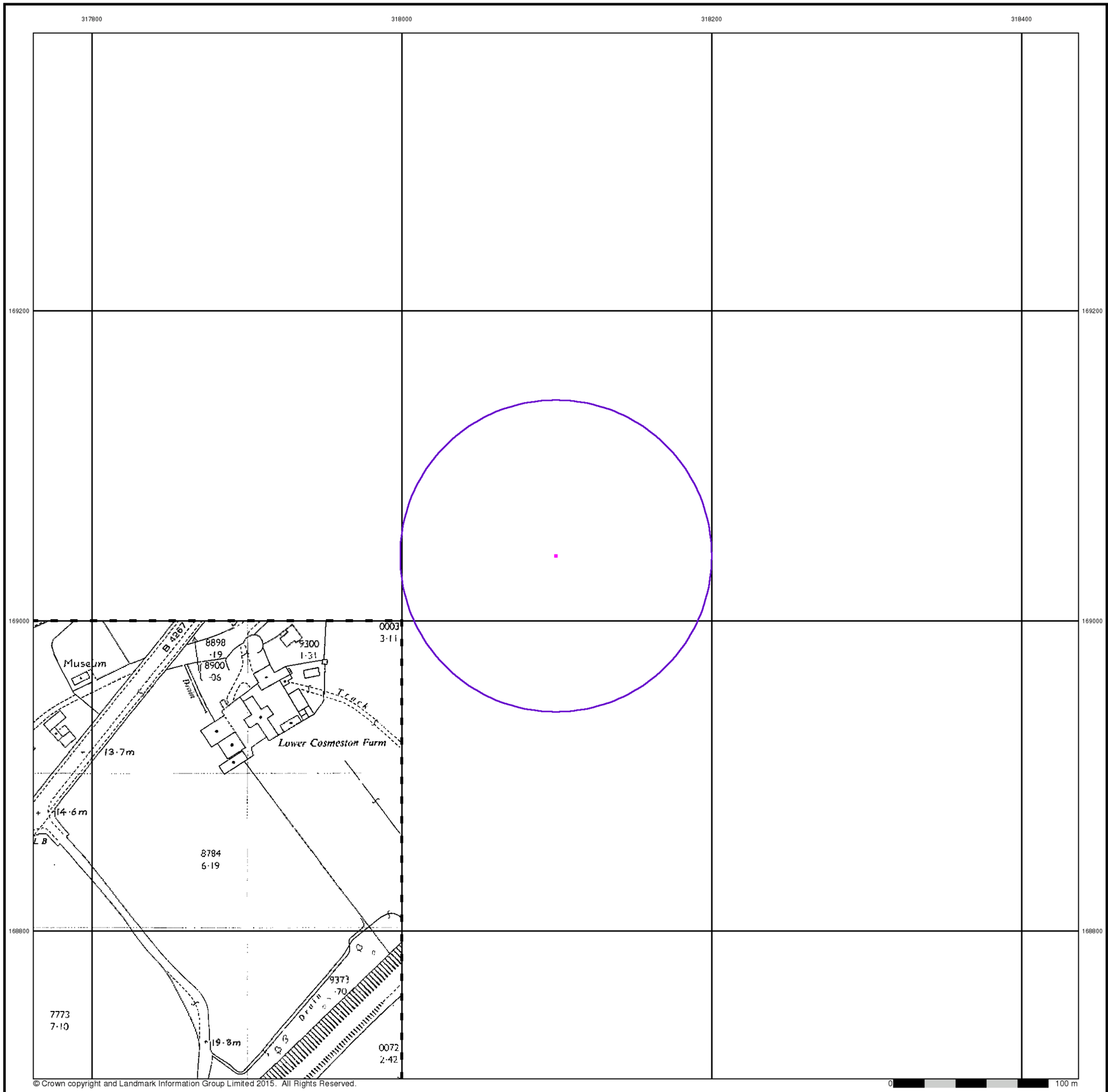

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Additional SIMs

Published 1989

Source map scale - 1:2,500

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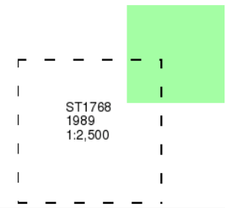
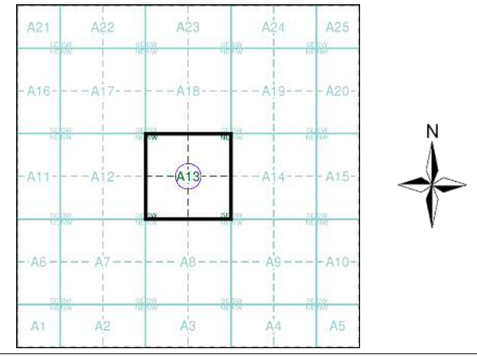
Map Name(s) and Date(s)



Historical Map - Segment A13



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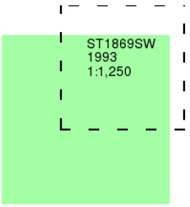
Large-Scale National Grid Data

Published 1993

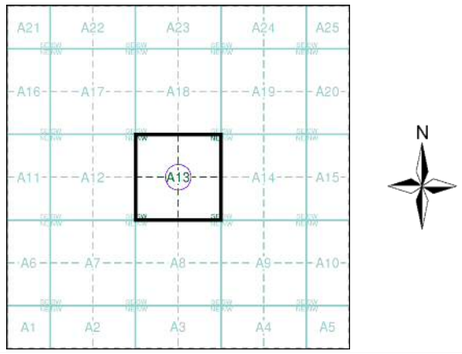
Source map scale - 1:1,250

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

Map Name(s) and Date(s)



Historical Map - Segment A13



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Large-Scale National Grid Data

Published 1993

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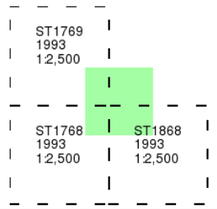
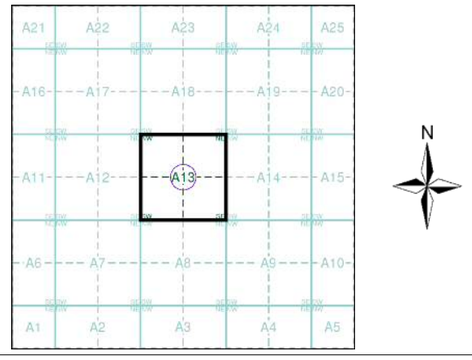


Historical Map - Segment A13



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National Grid Reference:	318100, 169040
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	100

Site Details

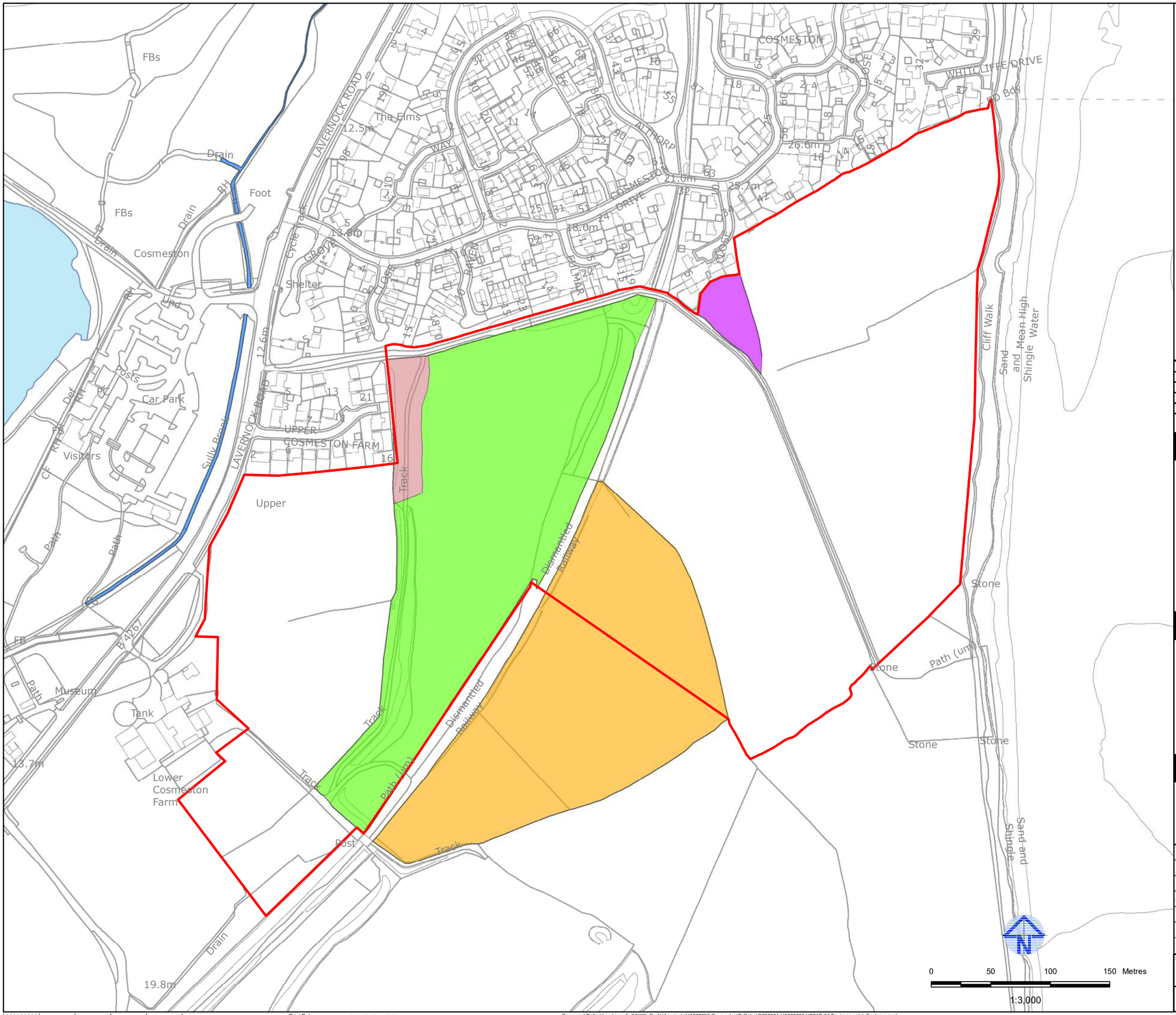
Cosmeston Farm, PENARTH, South Glamorgan, CF64 5UB

Landmark Information Group

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

APPENDIX D

Plan showing Historic and Environmental Features



NOTES:

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Legend:

- Redline Boundary
- Cosmeston Lake
- Infilled Quarry (Summer Paddock)
- Historic Landfill Site
- Historic Infilled Quarry
- Spoil Heaps
- Sully Brook

REV	Date	Description	Drawn	Check	Approv
REV	16/07/2018	First issue	DD	AP	GF

Client

Llywodraeth Cymru
The Welsh Government

PROJECT:

COSMESTON

Llywodraeth Cymru
Welsh Government

Site

Cosmeston Farm
Penarth

Client

Welsh Government
Cathays Park
Cardiff
CF10 3NQ
Phone (English): 0300 0603300
Phone (Welsh): 0300 0604400
http://gov.wales

ARCADIS Design & Consultancy for natural and built assets

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TITLE:

ENVIRONMENTAL FEATURES

Designed	A.PUGH	Date: 16 MAR 18	Signed
Drawn	D.DELGADO	Date: 16 MAR 18	Signed
Checked	A.PUGH	Date: 16 MAR 18	Signed
Approved	G.FLOWER	Date: 16 MAR 18	Signed
Scale:	1:3,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	UA008386

Suitability Description:

Issued for information

Figure Number: UA008386-AFS-GLR-1001

Revision: 01

50mm on Original

Print Date: 2018-07-16 14:56:38

Document Path: \\hc-ukr-wx-fs-04\WX_Proj\UAprojects\UA008386 Cosmeston\D-Calcs\GIS\0004-UA008386-UP31D-01-Environmental_Features.mxd

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APPENDIX E

Screening Values

Soil Screening Values

Compound name	Soil Screening Values (mg/kg)
	Residential with plants
Arsenic	37
Boron	290
Cadmium	11
Chromium	910
Chromium (hexavalent)	6
Copper	2400
Lead	220
Mercury	40
Nickel	130
Selenium	250
Zinc	3700
Free Cyanide	27
Total Cyanide	27
pH	6-9
PAH compounds (1% SOM)	
Acenaphthylene	170
Anthracene	2400
Benzo(a)anthracene	7.2
Benzo(a)pyrene	2.2
Benzo(b)fluoranthene	2.6
Benzo(k)fluoranthene	77
Benzo(ghi)perylene	32
Acenaphthene	210
Chrysene	15
Di-benzo(a,h)anthracene	0.24
Fluoranthene	280
Fluorene	170
Indeno(1,2,3-cd)pyrene	27
Naphthalene	2.3
Phenanthrene	95
Pyrene	620
Total Phenols (monohydric)	280
TPH Fractions (1%SOM)	
Aliphatic C5-6	42
Aliphatic C6-8	100

Compound name	Soil Screening Values (mg/kg)
	Residential with plants
Aliphatic 8-10	27
Aliphatic 10-12	130 (48)[vap]
Aliphatic 12-16	1100 (24) [sol]
Aliphatic 16-35	65000 (8.48) [f,sol]
Aliphatic 35-44	65000 (8.48) [f,sol]
Aromatic C5-7	70
Aromatic C7-8	130
Aromatic C8-10	34
Aromatic C10-12	74
Aromatic C12-16	140
Aromatic 16-21	260
Aromatic C21-35	1100
Aromatic C35-44	1100

Water Quality Standards

Compound Name	DWS (ug/l)	EQS (ug/l)
Arsenic	10	50
Boron	1000	2000
Cadmium	5	0.08
Chromium (III)	50	4.7
Chromium (hexavalent)	50	3.4
Copper	2000	*19.19
Lead	10	*6
Mercury	1	0.05
Nickel	20	*14.98
Selenium	10	10
Zinc	3000	*21.98
pH	6-9	6-9
Naphthalene	2	2
Benzo(a)pyrene	0.01	0.00017
Benzo(b)fluoranthene	0.025	-
Benzo(k)fluoranthene	0.025	-
Benzo(ghi)perylene	0.025	-
Indeno(1,2,3-cd)pyrene	0.025	-
TPH	10	10

* based on bioavailability. EQS value calculated using the PNEC tool.

APPENDIX F

Conceptual Model – Risk Information

CONCEPTUAL SITE MODEL

General

The aim of the initial conceptual model and risk assessment is to provide a preliminary identification of the risks to controlled waters, proposed future site users and the surrounding area posed by any contamination present on site. The assessment is based on identification of 'contaminant linkages', i.e. contaminant-pathway-receptor relationships. This approach accords with the guidance that accompanies Part 2A of the Environmental Protection Act of 1990 where land is considered to be contaminated when 'significant harm' is occurring, or where there is the 'significant possibility of significant harm' or where significant pollution of controlled waters is being, or is likely to be caused. In such cases the pollution linkage itself is defined as being 'significant'.

A source of contamination and a pathway to receptors must be present for there to be a risk. The preliminary risk assessment assesses the strength of the link between the source, the pathway and the receptor.

- **Source** - Contaminant that has potential to cause harm to environmental receptors. In a wider sense, sources can include particular ground conditions, for example the existence of redundant footings, which have the potential to impact on development proposals.
- **Pathway** - The route by which the source is brought into contact with the receptor. This can include the transport of contamination via groundwater, wind-blown dust, vapours, excavation and deposition etc.
- **Receptor** - Human beings, other living organisms, physical systems and built structures that could be affected by the source. A receptor will only be affected if a pathway from the source to the receptor is present. Groundwater and surface water systems can be considered as receptors in their own right as their quality is regulated by the statutory bodies, as well as being pathways for contaminant migration to other receptors.

ENVIRONMENTAL RISK ASSESSMENT

Qualitative Methodology

The risk assessment considers the potential sources, receptors and pathways identified in the Conceptual Site Model.

The environmental assessment has been undertaken with due regard to Contaminated Land Guidance Documents issued by the Department of the Environment Food and Rural Affairs (DEFRA). The Guidance requires a risk-based approach; with the potential environmental risk assessed qualitatively using the 'source-pathway-target' pollutant linkage concept contained in Part 2A of the Environment Protection Act. Unless specifically stated as relating to 'Contaminated Land' as defined in the Environmental Protection Act 1990 (as amended), references to 'contamination' and 'contaminants' relate in general terms to the presence of potentially hazardous substances, in, on or under the subject site.

Based on information presented in

- CIRIA C552 (2001) Contaminated Land Risk Assessment: A guide to good practice; and
- NHBC / EA/ CIEH (2008) R&D Publication 66: (Volume 1) Guidance for the Safe Development of Housing on Land Affected by Contamination
- DEFRA (2012) Environmental Protection Act 1990: Part 2A. Contaminated Land Statutory Guidance

Risk assessment considers the identified sources, the potential receptors and the pathways linking them together.

The designation of risk is based upon the consideration of both:

a **the severity of the potential consequence -** this takes into account both the potential severity of the hazard and the sensitivity of the receptor

b **the magnitude of probability** (i.e. likelihood) - this takes into account both the presence of the hazard and receptor and the integrity of the pathway

Severity (consequence) can be defined as the adverse effects (or harm) arising from a defined hazard, which impairs the quality of human health or the environment in the short or longer term. Definitions of different categories of severity are detailed in Table 1 below.

Probability can be defined as the chance of a particular event occurring in a given period of time. Definitions of different categories of probability are detailed in Table 2 below.

A pollutant linkage must first be established before tests for probability and consequence are applied. If there is no pollutant linkage then there is no potential risk.

Table 1 - Classification of Potential Consequence (Severity)

Classification	Human Health	Controlled Water	Built Environment[1]	Ecosystems[2]
Severe	Short term (acute) risk to human health. Concentrations present likely to result in "significant harm" as defined by Part 2A.	Substantial pollution of sensitive water resources.	Catastrophic damage to buildings, structures or the environment, including building collapse.	Major damage to aquatic or other ecosystem, which is likely to result in a substantial adverse change or irreversible change in its functioning or harm to a species of special interest.
Medium	Chronic damage to human health. Concentrations present that could result in significant harm.	Pollution of sensitive water resources or small scale pollution of sensitive water resources	Significant damage to buildings, structures or the environment making it unsafe to occupy, or damage that may impair a scheduled ancient monument.	Significant damage to aquatic or other ecosystems or organism forming part of an ecosystem, which could endanger the long term maintenance of a population at that location.
Mild	Slight short term health effects to humans. Exposure to human health unlikely to lead to significant harm.	Pollution to non-sensitive water resources	Minor damage to sensitive buildings, structures, services or the environment.	Minor or short lived damage to aquatic or other ecosystems.
Minor	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.)	Insubstantial pollution to non-sensitive water resources	Easily repairable effects of damage to buildings or structures	Harm (although not necessarily significant harm which may result in financial loss or expenditure to resolve e.g. loss of plants in a landscape scheme).

1. Property includes crops including timber, produce grown domestically (gardens or allotments for consumption), livestock, other owned or domesticated animals or wild animals which are subject to shooting or fishing rights. It also includes buildings, meaning any structure or erection, but does not include plant or machinery within a building or buried services.

2. Where ecological system effects relate to a Site of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Marine Nature Reserve (MNR), and areas of Special Protection for Birds, a "European site", or any habitat or site afforded protection under the Wildlife & Countryside Act 1981 and The Conservation of Habitats and Species Regulations 2010, i.e. candidate Special Areas of Conservation, potential Special Protection Areas and listed Ramsar sites.

Table 2 Classification of Probability

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

High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an even will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an even could occur. However it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Table 3 Classification of Risk

Once the severity and probability have been classified for a pollutant linkage they can be compared to produce a risk category from very high risk to very low risk as shown in the matrix below.

Consequence	Risk			
Severe	Moderate/Low	Moderate	High	Very High
Medium	Low	Moderate/Low	Moderate	High
Mild	Very Low	Low	Moderate/Low	Moderate
Minor	Very Low	Very Low	Low	Moderate/Low
Probability	Unlikely	Low	Likely	High

Table 4 Risk Classification Descriptions

Risk Term	Description
Very High Risk	There is a high probability that significant harm could arise to a designated receptor from an identified hazard at the site without appropriate remedial action or there is evidence that significant harm to a designated receptor is already occurring.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remedial action. Remediation works may be necessary in the short-term and are likely over the longer term.

Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However it is either relatively unlikely that any such harm would be severe or if any harm were to occur it is more likely that such harm would be relatively mild. Some remediation work may be required in the longer term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely, at worst, that this harm if realised would normally be mild. Any subsequent remediation works are likely to be relatively limited.
Very Low Risk	It is a low possibility that harm could arise to a receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.

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