

Geo-environmental Site Assessment

Health and Life Sciences Project

University of Reading

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Quality information

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1. Introduction

1.1 Reason for Report

AECOM Ltd (AECOM) has carried out a Geo-environmental Assessment on behalf of the University of Reading (UoR) (the Client), of the proposed Health and Life Sciences (HLS) development area (the Site) at and around the existing Engineering building.

AECOM has reviewed readily available information on the geo-environmental characteristics of the site, reviewed site specific site investigation records and undertaken a site walkover reconnaissance, including supplementary gas monitoring, to characterise the site in order to make an assessment of the potential contaminated land ground-related risks associated with the proposed redevelopment.

1.2 Report Objectives

This report has been prepared in general accordance with the procedures in the Model Procedures for the Management of Land Contamination, CLR 11 (DEFRA/EA, 2004), BS 5930:2015 Code of Practice for Ground Investigations (BSI), and BS 10175:2011: +A1 2013: Investigation of Potentially Contaminated Sites – Code of Practice (BSI), to:

- Describe the environmental setting of the site;
- Describe the findings of a site reconnaissance;
- Summarise the history of the site;
- Summarise the underlying soils, geology and hydrogeology;
- Summarise the findings of ground investigation works;
- Provide a Conceptual Site Model for the prevailing ground conditions;
- Present a site characterisation and evaluation of potential land contamination risks;

The report concludes with recommendations for undertaking further works, as required.

1.3 Sources of Information

This report has been prepared using a combination of published records, site investigation reports and site walkover observations. The records include statutory records and historical mapping supplied within a Landmark Envirocheck Report, published geological and hydrogeological mapping, and historical borehole records from both the online British Geological Survey (BGS) archives and from recent site investigation works conducted at the site.

Key sources of information are listed below, with copies provided as supporting appendices:

Landmark (2017) Envirocheck Report Ref: 115805868_1_1 (**Appendix A**)

Geotechnical Engineering Limited Interpretative Report on Ground Investigation (ref 31710, May 2016) (**Appendix B**)

Geotechnical Engineering Limited, Supplementary Ground Gas Risk Assessment (ref 32362, October 2016) (**Appendix C**)

A complete listing of all information sources is included in the Reference section.

1.4 Proposed Development

It is understood that the proposed development of the Health and Life Sciences building (HLS) for the University of Reading will comprise a new biological sciences and science research facility on the site of the Engineering building, the latter of which is to be demolished.

It is understood that the Engineering Building will be demolished in its entirety while the areas of the adjacent Systems Engineering building to be demolished include the link corridor, lecture theatre and common room.

1.5 Limitations of the Report

The opinions expressed in this report and the comments and recommendations given are based on a desk assessment of readily available information from the Landmark Envirocheck Report, Environment Agency (EA) and British Geological Society; supplemented by site information, including the findings of site investigation and monitoring works undertaken by Geotechnical Engineering Limited (GEL) in 2016, AECOM walkover and supplementary round of ground gas monitoring conducted by AECOM in March 2017 for an assessment of the geo-environmental status of the site.

The information, views and conclusions drawn are based, in part, on information supplied to AECOM by other parties. AECOM has proceeded in good faith on the assumption that this information is accurate. AECOM accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate supplied to AECOM from others.

Reference to historical Ordnance Survey (OS) maps provides invaluable information regarding land use history. However, it should be noted that historical evidence will be incomplete for the period pre-dating the first edition and between successive maps.

Any risks identified in this report are perceived risks, based on the information reviewed and therefore partially based on conjecture from available information.

The comments made on gas and groundwater conditions are based on observations made during historical site work and the monitoring programme. It should be noted that groundwater levels might vary owing to seasonal or other effects.

Contaminated Land is defined under Part IIA of the Environmental Protection Act 1990 (EPA) and that definition is reproduced in later sections of this report.

As the material encountered and samples obtained during on-site investigations represent only a small proportion of the materials present on-site, there may be other conditions prevailing at the site which have not been revealed by this investigation and which have therefore not been taken into account in this report. Where suspect materials are encountered during future site works, additional specialist advice should be sought to assess whether the new information will materially affect the recommendations currently given and whether further measures are needed.

It should also be noted that the effects of ground and water borne contamination on the environment are constantly under review, and authoritative guidance values are potentially subject to change. The conclusions presented herein are based on the guidance available at the time this report was prepared, and no liability can be accepted for the retrospective effects of any changes or amendments to the legislation or guidance.

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2. Site Location and Description

2.1 Location

The Health and Life Sciences (HLS) project represents a new biological sciences and science research facility building development for the University of Reading.

The building will be located on the eastern fringe of the Whiteknights campus, off Pepper Lane, on the site of the current Engineering Building. The site is located at National Grid Reference SU 7352, 7151 or the Campus post code RG6 6UR. A site location plan is provided as Figure 1.

2.2 Site Setting

The area of investigation comprises the former Engineering Building and immediate surround on the University of Reading Whiteknights Campus. The area is approximately 0.56 hectares (ha) in size (Figure 2).

The existing building is roughly T-shaped in plan, comprising a four-storey brick structure at the northern end with a single storey element extending to the south. The current site topography falls in a northerly direction (southwest to northeast) at a nominal gradient of approximately 1 in 45 between survey levels of 70.0 metres above Ordnance Datum (mAOD) along the southern boundary and 68.2mAOD adjacent to the proposed building entrance.

The current building is bound by a tarmacadam surfaced car park to the east with the entrance at its southern end. The area to the north and south is mainly surfaced with grass with pedestrian pathways and a number of semi-mature/mature trees. A block-paved pathway is located west of the building.

Table 2.1: Features Surrounding the Site

Direction	Summary
North	A grassed area including a number of semi-mature/mature trees with university campus buildings beyond.
South	A grassed area including a number of semi-mature/mature trees beyond which are a campus access road with a recently remediated above-ground storage tank area immediately beyond.
East	Tarmacadam surfaced car park to the east with campus access road beyond.
West	A block-paved pathway and the computer science building (to which the engineering building is attached via a corridor) are located west of the current Engineering building.

2.3 Site Reconnaissance

A walkover survey of the site was undertaken on the 1st March 2017.

The aim of the visit was to identify the range of activities carried out on the site and any obvious potential sources of ground contamination. In addition supplementary gas monitoring of existing boreholes was carried out.

The principal observations made during the visit are summarised below with a photographic record of the visit is included as **Appendix D**.

2.3.1 Observations

Engineering Building

Access to the Engineering building was controlled by an asbestos remediation contractor. Some parts of the building were sealed for removal works and could not be accessed, including the northern half of the building. The engineer was accompanied by Sean Callaghan of the University Estate Management team as a visitor to the site into areas cleared of asbestos (southern half).

The ground floor workshop has been cleared of all plant and machinery, an intact floor was observed and no visual or olfactory evidence of contamination was noted (Photo 1). Ground floor rooms had utility floor ducts from which asbestos shuttering has been removed. The remaining concrete channels were dry and no visual olfactory

evidence of contamination was noted (Photo 2). Redundant fuse boards were noted on the north wall (Photo 3). The electricity room in the basement was not accessible, though Mr Callaghan confirmed there was no transformer present in the building.

The Plant room in the south basement was inspected. All plant is mounted on raised concrete plinths and a small amount of water on the floor, a potential minor plant leak, was observed. No visual olfactory evidence of contamination was noted (Photo 4).

Immediate Surrounding

Access to the site surround was controlled by Francis Construction and their sub-contractor Willis and Sons. The area is currently undergoing subsurface utility re-routing and installations. The site supervisor and site manager both confirmed that BH02 to the north of the Engineering building had been excavated as part of the utility works (Photo 6). The location of BH03 in former Car Park 12 was within the contractor compound occupied by cabins, vehicles and spoil heaps of broken out tarmac and imported ballast and sand. Despite scraping clear the area indicated for BH03 on the GEL plan, using an excavator and small grading bucket, the well could not be located. BH01 and BH04 were located and sampled as described in the section below.

Discussion with the site manager for the utility works provided anecdotal evidence that the ground to 3m below ground level (bgl) where excavated appeared clean with no visual olfactory evidence of contamination. Service runs were excavated between approximately 1m bgl in Made Ground to 3m bgl into clayey deposits (interpreted as Head deposits). Photos 9-11 present current views of the surroundings of the Engineering Building.

Surface Water on-site

The closest surface water features to the Engineering building were identified on site. These include a pond 210m east (Photo 12), a dry drainage ditch 150m east of the site (Photos 13-14), a spring observed as apparently dry (Photo 15) and Whiteknights Lake to the north/north east (Photos 16-17). The closest discharge consent for cooling waters (surrendered) is shown at Whiteknights Lake (Photo 18).

Surface Water off-site

A dry drainage ditch (interpreted as hydraulically up-gradient) was located approximately 190m south east of the site on the south side of Pepper Lane adjacent to houses (Photo 19). A pond was located within school grounds 225m south west of the site (Photo 20).

2.3.2 Supplementary Gas Monitoring

BH01 (Photo 5) and BH04 (Photo 8) were located and sampled using a GFM435 Landfill gas Analyser and a Phocheck Tiger PID. The wells were then dipped using an oil/water interface probe. The conditions were overcast, slightly breezy with low (<1000mb) and falling barometric pressures. As such can be considered a worst case. The results are presented in Table 2.2 below.

Table 2.2 Gas Monitoring Results (AECOM, 1st March 2017)

Borehole	Evidence of contamination	Methane peak (%)	Carbon Dioxide peak (%)	Oxygen - minimum (%)	Flow - steady (l/hr)	Carbon monoxide (ppm)	Hydrogen sulphide (ppm)	PID (ppm)	Water level (m bgl)	Atmospheric Pressure (mb)
BH01	None	0.0	2.0	18.0	<0.1	0	0	0.0	4.11	994
BH02	Borehole excavated as part of subsurface utility re-routing and installation.									
BH03	Borehole could not be located within former carpark – currently contractor compound. The contractor scraped away spoil piles of tarmac and imported sand at and around the borehole location as indicated on the GEL plan; however it was concluded that the borehole is covered by spoil at another location or by a site cabin.									
BH04	None – bentonite swelling covering gas tap - cleared	0.0	3.6	14.7	<0.1	0	0	0.0	3.54	991

2.4 Information from Statutory Authorities Etc

2.4.1 Landmark Envirocheck Report

Table 2.2 summarises information contained in the Landmark Envirocheck Report. The report collates data from a variety of sources including the Environment Agency (EA) and the British Geological Survey (BGS).

All data suppliers are referenced in the report.

Table 2.2: Summary of Statutory Information

Subject			Number present			Details
			On site	0-250m	250-500m	
Agency and Hydrological						
BGS Groundwater Flooding Susceptibility	Yes	Yes	Yes	Three entries for the site state “Limited potential for groundwater flooding to occur and the Potential for groundwater flooding of property situated below ground level (two entries)”.		
				Five entries within 250m of the site as follows: Potential for groundwater flooding to occur at surface (72m NE) Potential for groundwater flooding of property situated below ground level (106m NW and 201m SE) Limited potential for groundwater flooding to occur (84m W and 190m W) A further eleven entries between 267m NW and 498m SE are identified to have “Potential or Limited Potential of flooding”.		
Contaminated Land Register Entries and Notices	0	0	0			
Discharge Consents	0	0	1	The nearest entry relates to a revoked consent for trade discharge of cooling water from the Plant Science, Food Studies and Chemistry department to a pond 286m to the north east. Revoked in December 2015. An additional five entries are located between 553m north and 942m south of the site, all of which are revoked.		
Enforcement and Prohibition Notices	0	0	0			
Integrated Pollution Controls	0	0	0			
Integrated Pollution Prevention and Control	0	0	0			
Local Authority Integrated Pollution Prevention and Control	0	0	0			
Local Authority Pollution Prevention and Controls	0	0	0	Two entries greater than 500m from the site for PG1/14 Petrol Filling Station 907m NE and PG6/46 Dry Cleaning 978m NW.		
Local Authority Pollution Prevention and Enforcements	0	0	0			

Subject	Number present			Details
	On site	0-250m	250-500m	
Pollution Incidents to Controlled Waters	0	2	0	The nearest entry relates to a 'Category 2 – Significant Incident' located 185m west in 1999. The cause of the incident is not detailed and the pollutant is classified as unknown chemicals. At 210m NE of the site one additional incident has been recorded as miscellaneous pollutant and classified as a 'Category 3- Minor Incident'. Five incidents are reported between 592m and 785m of the site and are all classified as 'Category 3- Minor Incidents'.
Prosecutions Relating to Authorised Processes	0	0	0	
Prosecutions Relating to Controlled Waters	0	0	0	
Registered Radioactive Substances	0	0	0	Two entries both for the University of Reading, 646m NE (superseded) and 805m NW (Authorised).
Substantiated Pollution Incident Register	0	0	0	
Waste				
The Envirocheck report indicates that both Reading Unitary Council and Wokingham District Council have 'supplied landfill data' for the site, though no further details are provided. The potential for In-filled land (Non -Water) is reported in the 1995 mapping, 929m north of the site as 'Unknown Filled Ground (Pit, quarry etc)' The potential for In-filled land (Water) is reported in five entries at the following distances from the site (and mapping dates); 424m south (1962), 647m east (1931), 661m east (1931), 825m south east (1962) and 917m east (1931) as 'Unknown Filled Ground (Pond, marsh, river, stream, dock etc)'.				
Hazardous Substances				
The Envirocheck report does not list any entries for hazardous substances.				
Industrial Land Use				
Contemporary Trade Directory Entries	0	3	2	The nearest entry is Kinsella James located 67m south of the site relating to boiler repairs, classified as inactive. The nearest active entry to the site is located 116m north east of the site relating to the laboratories of the Reading Science Centre.
Fuel Station Entries	0	0	0	A single Open entry relates to a Petrol Station 908m north east of the site.

2.5 Sensitive Land Uses

The Sensitive Land Uses Map of the Envirocheck Report indicates no sensitive land uses on site or within 250m of the site.

A Nitrite Vulnerable Zone is reported 384m south west of the site (Surface Water).

One Ancient Woodland, 'Redhatch Copse', is located 825m south east of the site.

2.6 Unexploded Ordnance

According to regional unexploded bomb (UXB) mapping published by Zetica for West Berkshire, the site lies within a zone that experiences a low risk of UXB.

3. Development History

3.1 Review of Historical Mapping

The historical Ordnance Survey (OS) maps obtained with the Landmark Envirocheck report date from 1887 to 2017. Table 3.1 summarises a review of the mapping.

Year [scale]	Features on-site	Features off site
1877 [1:1,250] 1883 [1:10,560]	The site comprises open land, lightly forested. The site crosses a county boundary.	The surround area is predominantly agricultural and woodlands. There are roads 100m to the north (unnamed) and south west (Pepper Lane) of the site. There are buildings and woodland 150m to the north of the site, associated with Whiteknights Park. There are some drainage routes associated with this area. Blandford Lodge with associated buildings is situated 250m north west. 'The Wilderness' and 'Home Farm' with associated buildings are situated 300m and 600m to the south east of the site. 'Briggins' with associated buildings is situated 250m to the south of the site. 320m to the north east of site is a waterway that links with Whiteknights Lake 500m to the north. There is a gravel pit 500m to the south and 900m to the north of the site. The south of reading is approximately 1kilometere (km) north of the site. There is a waterway emerging 875m to the south west of the site, flowing west. There is a potential pond 850m to the west of site. The village of Earley is located approximately 900m to the north east.
1899 [1:1,250]	No significant changes in land use noted.	Swimming bath located 100m to the south west of the site. Reservoir situated 820m to the south west of the site. No other significant changes in land use noted.
1900 [1:10,560]	No significant changes in land use noted.	No significant change in land use is noted.
1901 [1:10,560]	No significant changes in land use noted.	No significant change in land use is noted.
1911-1912 [1:1,250]	No significant changes in land use noted.	Sewage tank noted 90m to the east of the site. Housing developments 800m to the north and north east and 500m to the south west of the site. No other significant change in land use is noted.
1913 [1:10,560]	No significant changes in land use noted.	No significant changes in land use noted.

Year [scale]	Features on-site	Features off site
1931-1936 [1:2,500]	No significant change in layout is noted.	Large housing development to the west and south of the site. A hospice has been built 370m to the south of the site.
1938 [1:10,560]	No significant changes in land use noted.	No significant changes in land use noted.
1948 [Aerial Photo]	No significant changes in land use noted.	No significant changes in land use noted.
1958 [1:1,250] 1959 [1:1,250]	No significant changes in land use noted.	A boiler house with associated tanks is indicated 20m to the south east A pipeline is recorded as passing within 5m of the south west boundary of the site. This pipeline links to a track 225m to the north west of the site. Sewage tank to the east of site marked as disused. Faculty of Letters marked 270m to the north west of the site. Further development to the north west of the site around Blandford Lodge and >500m to the east and south of the site. Development marked as offices 360m to the east of the site. Housing development >500m to the west of the site increases in size. Allotment gardens are labelled 900m to the north east
1962 [1:10,000]	No significant changes in land use noted.	No significant changes in land use noted.
1967 – 70 [1:1,250]	Two building are indicated on site, labelled “Applied Physical Science Laboratory” and “Instrument Workshop”.	Buildings associated with University of Reading have been built to the north.
1973 [1,10,000] 1974 [1:1,250]	No significant change in layout is noted.	Further buildings associated with University of Reading have been built on the site and to the north, west and east, adjacent to the site. A disused tank is indicated 100m to the east. Further housing development >250m to the south and south east of the site. A spring is labelled 280m to the east of the site, feeding into Whiteknights Lake. Three drains are marked >320m to the east. The allotments 900m to the north east of the site have been turned into a school and playing field.
1976 [1:1,250] 1979 [1:10,000]	No significant change in layout is noted.	Further buildings related to Reading University have been built surrounding all sides of the site. Drain marked 150m to the east of the site.

Year [scale]	Features on-site	Features off site
1990 [1:10,000] 1987-93 [1:1,250]	No significant change in layout is noted. The former "Applied Physical Science Laboratory" is now labelled as "Laboratory"	Additional buildings within 250m of the site, associated with the University of Reading. Square building constructed 320m to the south east of the site. Reservoir 830m to the south of the site is labelled as covered and adjacent to a pumping station. Meteorological station located 500m to the north east of the site.
1993 [1:10,000]	No significant change in layout is noted. The buildings within the site are now connected to the Department of Cybernetics to the west of the site.	Boiler room with four associated tanks are situated 10m to the south of the site. Adjacent buildings within 50m of the site are labelled as Department of Cybernetics, Accelerator Building, Boiler Room, University Cottages, Mathematics Laboratory and Department of Food Studies. Gas governor is labelled 130m to the west and 320m to the south east of the site. There is an electrical substation 290m to the north west of the site, adjacent to Blandford Lodge and 250m north of the site next to the students union. This map does not extend to 1km from the site.
1995 [1:10,000]	No significant change in layout is noted.	No significant changes in land use noted.
1999 [1:10,000] Aerial Photo	No significant change in layout is noted. The aerial photo shows the east of the used as a car park.	Pond noted 200m to the south west of the site, 200m to the south east of the site, 320m north of the site and 500m south of the site. Drains and issues are marked within the housing development, 500-1000m south of the site and 500-1000m west of the site.
2003 [1:10,000]	No significant change in layout is noted.	No significant changes in land use noted.
2006 [1:10,000]		Building development within the offices located 450m to the east of the site. Overall area has not changed. Building development to 950m to the north east of the site.
2009 [1:10,000]	No significant change in layout is noted.	No significant changes in land use noted.
2013 [1:10,000]	An extension to the north west corner of the building is recorded.	Further development associated with the University of Reading is noted between 100m and 500m north of the site including the extension of current buildings and construction of new buildings. Continued development of the housing area 800m to the east/north east of the site and 550m to the south west of the site.
2017	No significant change in layout is noted.	No significant changes in land use noted.

Year [scale]	Features on-site	Features off site
[1:10,000] Aerial Photo		

3.2 Summary of Findings

The historical Ordnance Survey (OS) maps obtained within the Landmark Envirocheck report date between 1884 to present indicate that the site has been occupied by agricultural land from the earliest mapping until circa 1967 when the site underwent development for the University of Reading. A building, later marked as laboratory and instrument workshops, was built and later extended between 2009 and 2013. The site has remained part of the University of Reading since its development around 1973.

The surrounding area was originally defined by agricultural land. The surrounding area has been developed with mostly residential housing and offices. The University of Reading has expanded, on and around the site, from around 1973 to present. The immediate surroundings of the site now mainly comprise other university buildings. Whiteknights Lake and associated watercourses are present throughout mapping to the east of the site. Circa 1958 a boiler house with associated tanks is indicated 20m to the south.

4. Geology, Hydrogeology and Hydrology

4.1 Geology

4.1.1 Published Records

The 1:50,000 scale geological map of the area produced by the BGS (Sheet 268, Reading) and the BGS online 'Geology of Britain viewer' indicate the site is underlain by the geological succession summarised in Table 4.1.

Table 4.1: Geological Succession from Published Mapping

Period	Group	Geological Stratum
Quaternary	Superficial Deposits	HEAD –gravel, sand and clay.
Quaternary	Superficial Deposits	Boyn Hill Gravel Member – sand and gravel with possible lenses of silt, clay or peat.
Palaeogene	Thames	London Clay Formation – Clay, silt and sand. The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay.

4.1.2 Made Ground

Made Ground is not noted in any BGS mapping however it is noted as within some of the BGS borehole logs for the site and was reported within the Trial Pits and Boreholes completed in 2016; refer to section 4.1.7 below.

4.1.3 Superficial Deposits

Head deposits are indicated to underlie the site. This is described by the BGS as "Polymict deposit comprising gravel, sand and clay depending on upslope source. Poorly sorted and poorly stratified deposits formed mostly by solifluction and/or hillwash and soil creep. Essentially comprises sand and gravel, locally with lenses of silt, clay or peat and organic material". The typical thickness of this deposit is not stated.

The Boyn Hill Gravel Member is shown to the north, east and west of the site and was considered likely to be present beneath head deposits – confirmed during site investigation (refer to Section 4.1.7). This is described by the BGS as "Poorly sorted, stratified gravel and locally tabular cross-bedded sand beds. Gravel assemblage is characterised by abundant angular flint (77-81%), sparse rounded flint (5-10%), sparse vein quartz (4-7%), sparse quartzite (1.5-5%), sparse Greensand chert (2.5-4%) and less than 1% of other types". This formation is typically encountered at thicknesses of up to 9m, at an average of 5m.

4.1.4 London Clay Formation

The London Clay Formation is described by the BGS as comprising "bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occurs in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels". This formation is typically encountered at thicknesses of up to 150m.

4.1.5 Soil Chemistry

BGS Soil Chemistry datasets detail the topsoil concentrations of five potentially harmful elements (PHEs): Arsenic (As), Cadmium (Cd), Chromium (Cr), Nickel (Ni) and Lead (Pb), as presented within the Envirocheck report. Elevated concentrations of these PHEs can exist because of natural geological conditions or possible human contamination.

The following BGS estimated soil chemistry levels are attributed to the site:

Arsenic <15mg/kg, Cadmium <1.8mg/kg, Chromium 60-90mg/kg, Nickel 15-30mg/kg, Lead <100mg/kg.

4.1.6 Ground Stability Records

The Envirocheck report suggests that there is a very low risk of collapsible ground, landslide ground and running sand ground hazards.

There is a low to very low risk of shrinking or swelling clay ground hazards.

Compressible ground and the potential for ground dissolution are not identified as hazards.

4.1.7 Exploratory Hole Records

The BGS maintains an archive of historical exploratory hole logs throughout the UK. AECOM has searched the database and a summary of those which are considered to provide useful information on the ground profile at the site is given below.

The following BGS boreholes (SU77SW352 and 353) located in proximity to the north of the existing engineering building (National Grid co-ordinates SU 73514, 71562 and SU73539,71567 respectively) recorded the following general ground sequence:

“Topsoil” to a depth of 0.38m below ground level (bgl);

“Firm, brown and mottled brown and grey, sandy CLAY with some fine and medium gravel” to 1.68m bgl (Head deposits);

“Dense to very dense, brown, clayey SAND and GRAVEL” to 4.27m bgl (Boyn Hill Gravel Member);

“Stiff, brown, silty CLAY” to 4.57m bgl (London Clay Formation);

“Stiff, fissured, grey, silty CLAY” to 6.10m bgl (London Clay Formation).

The geological profile is supported by the existing borehole records in the vicinity of the Engineering building. The boreholes are generally shallow and include soil descriptions only.

The borehole log data (from five logs surrounding the Engineering building area) show a ground profile to depths of 10m. Ground water strikes occurred at between 2m-5m depth. However, it was not apparent whether this was perched ground water or the water table.

During the 2016 GEL Site Investigation four groundwater monitoring wells were installed. Table 4.2 below presents a summary of the ground conditions reported in the borehole logs appended with GEL report 31710 (May 2016) (**see Appendix B**).

Table 4.2: Geotechnical Engineering Ltd Exploratory Holes

Borehole Ref NGR Depth Date Elevation	Stratum	Description	Depth to Top of Stratum (m bgl)	Thickness (m)	Groundwater
BH01 473518, 171482 18m bgl April 2016 69.5mAOD	Made Ground	Grass over soft to firm dark brown slightly sandy gravelly clay. Gravel is subangular to rounded fine to coarse flint.	0.0	0.5	Groundwater not encountered during drilling. Monitoring levels 3.5m to 4.34m bgl
	Head Deposits	Firm light brown or orange-brown slightly gravelly sandy clay. Gravel is subangular to rounded fine to medium flint.	0.5	3.25	
	Boyn Hill Gravel Member	Medium dense light brown slightly clayey medium and coarse sand over very sandy fine to coarse flint gravel to 5m. Underlain by very stiff light brown slightly sandy clay to 5.8m. Dense light brown	3.25	6.2	

Borehole Ref NGR Depth Date Elevation	Stratum	Description	Depth to Top of Stratum (m bgl)	Thickness (m)	Groundwater
		gravelly fine to coarse sand to 6.2m			
	London Clay Formation	Stiff dark brownish grey silty clay with rare shell fragments. From 9m, stiff dark grey silty clay with frequent fine sand sized selenite. From 15m, Very stiff dark grey silty clay with frequent fine and medium gravel sized pockets of light grey fine sand.	6.2	18	
BH02 473544, 171549 18m bgl April 2016 68.1mAOD	Made Ground	Grass over dark brown slightly gravelly clayey medium and coarse sand. Gravel is angular and subangular brick and flint. From 1m, very soft light brown slightly gravelly sandy clay. Gravel is angular to subrounded fine to medium concrete and flint	0.0	1.9	Groundwater not encountered during drilling Monitoring levels 3.22m to 3.85m bgl
	Boyn Hill Gravel Member	Medium dense light brown slightly clayey very gravelly fine to coarse sand to 2.7m. Underlain by medium dense light orange-brown clayey gravelly fine to coarse sand to 4.3m Gravel is angular to rounded fine to coarse flint. From 4.3m, stiff light brown slightly gravelly sandy clay.	1.9	4.7	
	London Clay Formation	Stiff dark brownish grey silty clay with frequent fine sand sized selenite crystals From 8.4m, stiff to very stiff dark brownish grey silty clay. From 11.4m, Very stiff dark grey silty clay with frequent fine sand sized selenite crystals.	4.7	18	
BH03 473549, 171504 18m bgl April 2016 68.6mAOD	Made Ground	Tarmacadam over gravelly medium and coarse sand and concrete. Gravel of flint and concrete	0.0	1.1	Groundwater encountered at 3.1m Monitoring levels 3.25m
	Head Deposits	Firm to stiff dark orange-brown mottled light grey sandy clay.	1.1	2.75	

Borehole Ref NGR Depth Date Elevation	Stratum	Description	Depth to Top of Stratum (m bgl)	Thickness (m)	Groundwater
	Boyn Hill Gravel Member	Medium dense to dense orange-brown sandy fine and medium flint gravel becoming gravelly fine to coarse sand.	2.75	6.3	to 3.79m bgl
	London Clay Formation	Stiff light brown mottled dark orange-brown slightly sandy clay. Becoming very stiff at 8.8m.	6.3	18	
BH04 473501, 171510 18m bgl April 2016 69.45mAOD	Made Ground	Block paving over slightly clayey sandy concrete and flint gravel underlain by soft to firm light brown slightly sandy gravelly clay. Gravel is flint.	0.0	0.9	Groundwater not encountered during drilling
	Head Deposits	Stiff light orange brown slightly gravelly sandy clay. Gravel is flint. Underlain by firm sandy clay.	0.9	3.5	Monitoring levels 3.83m to 4.3m bgl
	Boyn Hill Gravel Member	Dense light brown slightly clayey very gravelly medium and coarse sand. Gravel is flint. Underlain by loose light brown very gravelly fine to coarse sand.	3.5	6.2	
	London Clay Formation	Stiff dark brown grey silty clay. From 9m includes frequent fine sand sized selenite. From 14.45m very stiff dark grey silty clay with frequent fine and medium sand sized pockets of light grey fine sand and rare shell fragments.	6.2	18	

The ground conditions revealed by the GEL ground investigation confirm the strata indicated by the geological records, proving Head deposits over the Boyn Hill Gravel Member. The superficial deposits were underlain by the London Clay Formation. A variable thickness of Made Ground was present above these materials.

4.2 Hydrogeology

4.2.1 Aquifer Classification

The EA's Groundwater Protection Policy adopts aquifer designations that are consistent with the Water Framework Directive. According to this system:

The underlying bedrock geology, the London Clay Formation, has been classified by the EA as Unproductive Strata. The EA defines Unproductive Strata as 'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'.

The superficial deposits have been classified by the EA as a Secondary (undifferentiated) aquifer.

The EA states that a Secondary (undifferentiated) aquifer “has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type”. However, the deposits potentially contain “permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases form an important source of base flow to rivers”.

4.2.2 Vulnerability of Groundwater Resources

The EA's Groundwater Vulnerability Map of the area shows that the soils overlying the Unproductive Strata beneath the site are not classified. However, the wider area surrounding the Reading University campus is identified as a Minor Aquifer High vulnerability zone (EA website).

In terms of identifying the risk of contamination from potential polluting activities in a given area to groundwater sources (wells, boreholes and springs) used for supplying public drinking water, the EA identifies Source Protection Zones. These show the extent of a groundwater source catchment and are divided into three zones, as follows:

SPZ 1 (Inner protection zone) is located immediately adjacent to the groundwater source. It is based on a 50-day travel time from any point below the water table and is designed to protect against the effects of human activity and biological/chemical contaminants that may have an intermediate effect on the source. The zone has a minimum radius 50m.

SPZ 2 (Outer protection zone) is larger than SPZ 1 and is defined by a 400-day travel time from a point below the water table to the source. The travel time designed to provide delay and attenuation of slowly degrading pollutants. This zone has a minimum radius of 250m or 500m, depending on the size of the abstraction.

SPZ 3 (Source catchment protection) covers the complete catchment area of a groundwater source.

Mapping produced by the EA and supplied with the Envirocheck report shows that the site is not situated within a Source Protection Zone.

Zone 1, Zone 2 and Zone 3 Source Protection Zones (ref Th200) are recorded 76m north-west of the site with the groundwater source reported as 200m north-west of the site and assigned as Reading University.

This SPZ is understood to relate to the Seaford and Newhaven Chalk Formation underlying the London Clay, however due to the extensive cover of the London Clay Formation above the Chalk it is considered that there is a very low risk of the abstraction being affected by any contamination (if present) at the site. The London Clay was encountered from between 4.7 to 6.3m bgl to the borehole completion depths of 18m bgl in the four GEL boreholes drilled in 2016.

4.2.3 Site Characteristics

The regional direction of groundwater flow is expected to follow the regional topography to the north / north-east in the direction of Whiteknights Lake located to the north of the site. The River Kennet is located approximately 2.1km west of the site and the River Thames is located approximately 2.5km north of the site.

The superficial deposits aquifer may contribute to the base flow of local surface water features (Whiteknights Lake). Groundwater levels recorded by GEL on four occasions indicate that the standing water level in wells on the site is within the superficial Boyn Hill Gravel Member deposits.

4.2.4 Licensed Groundwater Abstractions

With reference to the Envirocheck report there are three entries for the University relating to one licensed groundwater abstraction from a single point for drinking, cooking and sanitary use 482m west of the site.

One further abstraction from a single point for the same use is reported 1.6km north west of the site for the Royal Berkshire Hospital.

4.3 Hydrology

4.3.1 Surface Water Courses and Drainage

The Envirocheck reports that the nearest surface water feature is located 150m east of the site. This relates to a drainage ditch identified on the Ordnance Survey mapping, potentially feeding into Whiteknights Lake to the north east.

The Envirocheck report also identifies three 'Offline Drainage Features'; 186m south of the site, 307m south of the site and 355m east of the site.

Ponds are located 210m east and 225m south west of the site.

The closest part of Whiteknights Lake is located approximately 300m east of the site where a narrow tip widens to the north. This tip may also be the rising of a spring indicated on the Ordnance Survey mapping.

The River Kennet is located approximately 2.2km to the west of the site, joining with the River Thames located approximately 2.5km north of the site.

4.3.2 Surface Water Abstractions

With reference to the Envirocheck report there are no licensed surface water abstractions within 1km of the site.

4.3.3 Flooding

The indicative floodplain map for the area, presented in the Envirocheck report shows three entries for the site stating Limited potential for groundwater flooding to occur and the Potential for groundwater flooding of property situated below ground level (two entries).

There are five entries within 250m of the site as follows:

- Potential for groundwater flooding to occur at surface (72m north east)

- Potential for groundwater flooding of property situated below ground level (106m north west and 201m south east)

- Limited potential for groundwater flooding to occur (84m west and 190m west)

There are a further eleven entries between 267m north west and 498m south east for the Potential or Limited Potential of flooding.

4.4 Radon

The Envirocheck report indicates that the site is located within a lower probability radon area, as less than 1% of homes are above the action level. No radon protective measures are necessary in the construction of new dwellings.

4.5 Quarrying, Mining and Landfills

An attempt has been made to identify any quarrying operations, past and present that have taken place in the vicinity of the site. The sources of information referenced in this element of the desk study include:

- Envirocheck datasheet supplied by Landmark

- Old Ordnance Survey maps

- Geological maps

- EA online mapping

The Envirocheck report indicates that both Reading Unitary Council and Wokingham District Council have 'supplied landfill data' for the site, though no further details are provided relating to the site.

The potential for In-filled land (Non -Water) is reported in the 1995 mapping, 929m north of the site as 'Unknown Filled Ground (Pit, quarry etc)'.

The potential for In-filled land (Water) is reported in five entries at the following distances from the site (and mapping dates); 424m south (1962), 647m east (1931), 661m east (1931), 825m south east (1962) and 917m east (1931) as 'Unknown Filled Ground (Pond, marsh, river, stream, dock etc)'.

With reference to the above data there is no further evidence of any mining, quarrying operations or landfilling activities on the site or within 1km of the site.

4.5.1 Mining

With reference to the Envirocheck report, the site is not indicated to lie in an area considered to be affected by coal mining.

4.6 Previous Ground Investigations

4.6.1 Geotechnical Engineering Limited (GEL) Interpretative Report on Ground Investigation (ref 31710, May 2016) (Appendix B)

GEL undertook site investigation works in April 2016. These works were implemented to characterise ground conditions at the site at and around the Engineering building to inform the design of the HLS development.

The scope of investigation included:

- Four cable percussion boreholes.
- In-situ SPT testing and undisturbed sampling (UT100/U100).
- Installation of ground gas and ground water observation wells in each borehole.
- Post fieldwork monitoring on two occasions (subsequently expanded to four rounds as reported in GEL report 32362).
- Two machine excavated trial pits.
- A single soakaway test in accordance with BRE365 (2007).
- Three hand dug trial pits to establish existing foundation details.
- Two in-situ Dynamic Cone Penetrometer tests to establish California Bearing Ratio values.

Summary of Environmental findings

Perched water was encountered in TP02 at the interface of Made Ground and Head deposits at 1.1m bgl. A soakaway test was performed at TP02 and negligible infiltration was noted, suggesting limited water mobility within Made Ground in this area.

Groundwater was encountered during drilling at BH03 at 3.5m bgl rising to 3.1m bgl after 20 minutes.

Soil

Chemical laboratory testing of the scheduled soil samples, as detailed in the GEL Interpretative Report, recorded no exceedances against a screening for the proposed commercial end use with the site assessed with a low risk to human health with no remedial works required.

Groundwater

GEL concluded that proposed hardstanding will serve to limit any potential contamination from surface into the underlying Secondary (Undifferentiated) Aquifer of the superficial deposits.

Whilst chemical analysis of groundwater in BH01 to BH04 was generally recorded below the Tier 1 screening values (Environmental Quality Standards (EQS) for freshwater or Drinking Water Standards (DWS) exceedances of selenium, sulphide, polyaromatic hydrocarbons and total petroleum hydrocarbons, above the Tier 1 screening values. It is noted that the screening values were very conservative, with hydrocarbons exceedance against stringent drinking water standards.

Buried Concrete

Based on the water soluble soil and groundwater sulphate values GEL recommended a concrete specification DS- 1 AC-1, In accordance with the BRE Special Digest 1 (2005).

The geotechnical findings of the GEL report are not discussed in this Environmental assessment.

4.6.2 Geotechnical Engineering Limited, Supplementary Ground Gas Risk Assessment (ref 32362, October 2016) (Appendix C)

The initial GEL report recommended a further two rounds of gas monitoring (four in total) which were subsequently undertaken by GEL and reported in October 2016.

The following table, extracted from that report, presents a summary of the combined gas monitoring results.

Borehole	Response Zone/Strata (m bgl)	Evidence of Contamination	No. of Monitoring Visits	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Flow (l/hr)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Volatiles Organic Compounds (ppm)	Water Level (m bgl)	Atmospheric Pressure (Mb)
BH01	1.00 – 6.20/ HD & BHG	No	4	0.0-0.1	1.4-4.1	9.9-20.5	0.0	0-14	0	0.0-1.8	3.50-4.34	1003-1019
BH02	1.00-4.30/ MG, HD & BHG	No	4	0.0	0.6-5.1	11.2-20.0	0.0	0-20	0	0.0-1.7	3.22-3.85	1003-1018
BH03	1.00 – 6.30/ HD & BHG	No	4	0.0-0.1	0.0-9.2	0.0-20.5	-0.2 - 0.0	0-1	0-2	0.0-6.7	3.25-3.79	1004-1020
BH04	1.00 – 6.20/ HD & BHG	No	4	0.0	1.1-4.6	12.7-20.4	0.0	0-14	0	0.0-1.7	3.83-4.3	1003-1014

Notes: MG – Made Ground; HD – Head deposits; BHG – Boyn Hill Gravel Member

No visual evidence of contamination was noted.

No positive gas flow was detected during the four visits, with a maximum negative flow of -0.2l/hr.

The report states that “In accordance with the guidance in BS8485:2015, the GSV would indicate a Characteristic Gas Situation 1(CS1), with a very low hazard, however since that the maximum recorded concentration of carbon dioxide is nearly twice the maximum “five percent” threshold, it is recommended that ground gas precautionary measures be adopted in accordance with Characteristic Situation 2(CS2).

In addition it recommends that once the proposed scheme has been finalised, that details of the protection measures should be designed in accordance with BS8485:2015.

A maximum soil vapour concentration ({Volatile Organic Compounds} - VOCs) of 6.7ppm was recorded using the PID during the monitoring visits. Based on these results, vapour protection measures are not considered necessary for the site”.

4.7 Other Reports

4.7.1 Energy Centre Remediation

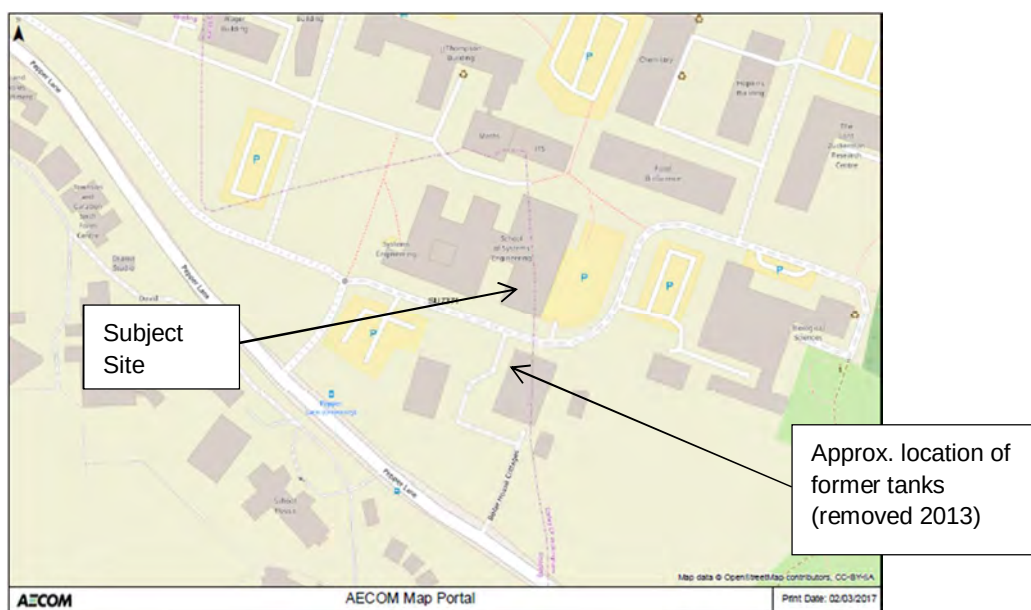
Four above ground storage tanks (USTs), located to the south of the site associated with the former boiler room were de-commissioned 2013 during the development of the Energy Centre. It is understood that a total of 20,000 litres of heating oil were removed from the tanks which were subsequently decommissioned and removed from the site.

Upon the commencement of the excavation works soils were found to be locally impacted by hydrocarbons, presumed to relate to historical leakage of the tanks.

Impacted soils were excavated and removed off site and AECOM was appointed with the objective of verifying the excavation works and assessing any residual impact with respect to hydrocarbons at the site, as reported in the AECOM letter report dated 3rd February 2013, reference 60289171/psm/L10447.

The validation area is located approximately 20m south of the current Engineering building on the south of the campus access road, as presented in Plate 1, below.

Plate 1 – Location of Former Heating Oil Storage Tanks (removed 2013)



The main conclusions of the validation works were as follows:

The tanks and associated concrete slab were removed between 25th and 26th September 2013.

Most of the contaminated soils in the west of the site were excavated and removed between 23rd October and 28th October 2013.

The removal of all the contamination was constrained by the presence of live electrical services in the east of the main pit and the presence of an active foul sewer (trending from north to east).

The results from the validation samples indicate that the residual risk to human health (commercial) and controlled water is considered to be low.

5. Review of Geo-environmental Risk

5.1 Introduction

This section is aimed at identifying possible risks, if any, to identified receptors arising from substances used or deposited on-site, or from other sources of land contamination. Both past and current potentially contaminative land uses have been considered.

5.2 Sources of Contamination

5.2.1 Historical Usage

The contamination on a site will largely depend on the history of the site and the range of processes carried out and materials used and produced there. The following sources of information have been reviewed:

The earliest mapping from 1887 indicated that the site was agricultural land until circa 1967. Mapping from 1967 shows the site and surrounding area was developed as part of the University of Reading. Mapping shows the buildings on the site to have been used as a university laboratory and an instrument workshop.

5.2.2 Current Usage

Since circa 2013 no significant changes have been made on the site and it is still in use by the University of Reading, however, the site is now due to be demolished and the building is currently vacant.

The desk study and walkover survey has not identified any significant potential sources of contamination present on the site. On the basis of the reconnaissance survey, we consider there is a very low probability of significant contamination / releases on the site with no evidence of staining / contamination with all building slabs intact, with no signs of cracks, etc.

Chemical laboratory testing of the scheduled soil samples, as detailed in the Geotechnical Engineering Interpretative Report on Ground Investigation report dated May 2016, reference 31710 (**Appendix B**), recorded no exceedances against a screening for the proposed commercial end use with the site assessed with a low risk to human health with no remedial works required.

5.2.3 Ground Gas Risk

Neither the desk based assessment nor the ground investigation identified any potential sources of ground gas, such as biodegradable or significant organic deposits on the site. No landfilling activities were identified within 1km and the nearest potential infilled feature was located 424m south.

Gas monitoring, undertaken at the site (GEL 2016) on four occasions, identifying elevated concentrations of carbon dioxide with a peak levels of 9.2%. Gas flow rates were negligible and methane was recorded as levels <0.1%. A supplementary gas monitoring visit was undertaken by AECOM in March 2017, in low (<1000mb) and falling barometric conditions (considered a worst case scenario) identified a peak carbon dioxide reading of 3.6%, with negligible flow and no methane detected.

Based on the very low risk of gas generation identified at the site, the absence of significant sources of offsite land gas generation and plausible pathways and, the consistency of ground gas data (including supplementary worst case conditions), it is considered that the monitoring undertaken is sufficient to characterise the site.

Using a precautionary approach based on the peak carbon dioxide levels measured and following guidance in BS8485:2015, the site was classified Characteristic Situation 2(CS2) – Low risk (GEL, 2016).

The gas monitoring, undertaken at the site (GEL 2016, AECOM, 2017) identified negligible levels of volatile organic compounds (<6.7 ppm) with no vapour protection measures considered necessary. This was confirmed in the supplementary AECOM monitoring round. Groundwater levels were typically measured at depths between 3.22m and 4.64m bgl beneath the site with no evidence of the presence of free phase product in groundwater. As vapour monitoring shows no evidence of elevated levels, with no free phase detected in groundwater, it can be concluded that vapours generated from groundwater contamination beneath the site do not present an unacceptable risk to human health.

The Envirocheck report indicates that the site was within an area where the risk from Radon is generally considered low (less than 1% of homes are above the UK 'Action Level') with no radon protection necessary.

5.2.4 Off Site Sources

Historical above ground heating oil storage tanks were identified to be located approximately 20m to the south of the site, associate with the former boiler room. During the re-development of the area with the Energy Centre in 2013 the tanks were decommissioned. Localised hydrocarbon impact of soils was identified, presumed to relate to historical leakage of the tanks. The Impacted soils were excavated with validation sampling undertaken with the residual risk to human health (commercial) and controlled waters assessed as low.

5.3 Potential Contaminants of Concern

With reference to the historical review and with reference to the other sources listed above the following potential sources of contamination can be anticipated at the site:

Table 5.1 Potential Contaminants of Concern

Sources	Activity / Location	Potential Contaminants of Concern
S1- Potential contaminated Made Ground	Built up areas including roads and buildings / On and off site	Unknown constituents of Made Ground (metal, phenols, sulphates, asbestos, poly aromatic hydrocarbons (PAHs) Land gas generation (carbon dioxide, methane)
S2 – Storage and use of fuel/oil/lubricants other chemicals	Former Engineering Building laboratory and instrument workshop/ Onsite	Solvents, petroleum (TPH) and poly aromatic hydrocarbons (PAHs), mineral oils
S3 – Offsite former Heating Oil Storage Tanks	Historical leakage, tanks associated with former boiler room., removed and impacted soils excavated 2013 / off site (approx.. 20m south)	Heating oils (TPH)

5.4 Pathways for Migration

The principal contamination pathways for migration may include the following:

- P1 – Dermal contact, inhalation or ingestion of the contaminants present in topsoil or underlying strata, during works and post-development
- P2 – Leaching of contaminants, impact and migration of groundwater;
- P3 – Surface water run-off and/or direct percolation from surface;
- P4 – Ingress and / or accumulation of ground gas/vapours.

5.5 Potential Receptors

Human Health Receptors

- R1 – Final end users
- R2 – Construction/ Maintenance Workers
- R3 – Adjacent site users

Controlled Waters Receptors

R4 – Groundwater (Superficial Secondary(Undifferentiated) Aquifer, Unproductive bedrock aquifer, SPZ 76m north-west)

R5 – Surface Water (Unnamed water course) – Drainage ditch 150m east

Property Receptors

R6 – Future proposed building structures and services

Other

No potential sensitive ecological system, archaeological site or ancient monument receptors were identified.

5.6 Assessment of Plausible Contaminant Linkages

A risk assessment of the identified plausible contamination linkages has been undertaken for the site in line with current legislation outlined in Appendix E of the report. The assessment takes into consideration the sources of possible contamination risk and the presence of any plausible pathways or receptors as outlined in the Environmental Protection Act 1990 (Part 2A).

A summary of the assessed risk is provided in Table 5.2. The risk matrix used in the assessment is based on guidance within R&D Publication 66 (NHBC and Environment Agency, 2008) and included in Appendix F.

For the purpose of this risk assessment, it is assumed that the proposed end use of the site following re-development is a commercial development.

A CSM illustrating plausible contaminant linkages has been formulated for the site. The qualitative risk assessment of the possible linkages of the above sources (S1 to S3), transport pathways (P1 to P4) and receptors (R1 to R6) is provided in Table 5.2 below:

Table 5.2: Plausible Pollutant Linkages (PPLs) and Qualitative Risk Assessment

Source (s)	Pathway	Receptor	Consequence	Probability	Risk	Justification
Hazards to Human Health						
S1 – Soil Contamination/ Made Ground S2 – Storage and use of fuel/oil other chemicals S3 – Offsite Former Heating Oil storage tanks	P1 - Dermal contact, inhalation or ingestion of the contaminants present in topsoil or underlying strata, during works and post-development;	R1 – Final end users	Medium	Unlikely	Low	Low Risk – Complete PPLs are unlikely to present a risk. No unacceptable levels of contamination have been identified at the site. Post development the site will be encapsulated beneath footprint of building / hardstanding.
		R2 - Construction / Maintenance Workers	Medium	Low	Low to moderate	Low to moderate Risk – Complete PPLs are unlikely to present an unacceptable risk No unacceptable levels of contamination have been identified at the site. Risks are likely to be short term i.e. for the duration of earthworks exposing contaminated ground and can be easily managed by the implementation of appropriate risk assessment, and mitigation measures during construction by the contractor.
		R3 - Adjacent site users	Medium	Unlikely	Low	Low Risk – Complete PPLs are unlikely to present a risk. Any future groundwork should be assessed with the appropriate risk assessment and mitigation measures if necessary
	P4 – Ingress and /or accumulation of ground gas /vapours	R1 – Final end users	Severe	Low	Moderate	Moderate Risk – Complete PPLs are likely to present an unacceptable risk without mitigation. The site has been characterised with a category CS2, low risk with respect to elevated levels of carbon dioxide. With implementation of appropriate mitigation measures the risk can be reduced to very low.
		R2 - Construction / Maintenance Workers	Severe	Low	Moderate	Moderate Risk – Complete PPLs may present an unacceptable risk but should be managed by the implementation of appropriate risk assessment, and mitigation measures during construction. Risks are likely to be short term.
Hazards to the Water Environment						
S1 – Soil Contamination/	P3 – Leaching of contaminants.	R4 - Groundwater	Medium	Unlikely	Low	Low Risk – Complete PPLs are unlikely to present a risk. No unacceptable levels of contamination have been identified at

Source (s)	Pathway	Receptor	Consequence	Probability	Risk	Justification
Made Ground S2 – Storage and use of fuel/oil other chemicals	impact and migration of groundwater (Secondary A aquifer)	(Superficial Secondary(Un differentiated) Aquifer, Unproductive bedrock aquifer, SPZ 76m north-west				the site. Post development the site will be encapsulated beneath virtually impermeable footprint with engineered surface drainage. Site is underlain by significant thickness of low permeability: London Clay, an unproductive aquifer, limiting downward migration.
	P4 – Surface water run-off and /or direct percolation from surface;	R5 – Surface Water (Drainage ditch 150m east)	Medium	Unlikely	Low	Low Risk – Complete PPLs are unlikely to present a risk. No unacceptable levels of contamination have been identified at the site. Post development the site will be encapsulated beneath virtually impermeable footprint with engineered surface drainage.
Hazards to Building Fabric, Structures and Services						
S1 – Soil Contamination/ Made Ground	P5 – Direct contact of ground with in-ground structures;	R6 – Future proposed building structures and services	Minor	Likely	Low	Low Risk - Complete PPLs are unlikely to present an unacceptable risk GEL (2016) recommends a concrete specification DS- 1 AC-1 In accordance with the BRE Special Digest 1 (2005)I
S1 – Soil Contamination/ Made Ground S2 – Storage and use of fuel/oil other chemicals S3 – Off-site Former Heating Oil storage tanks	P4 – Ingress and /or accumulation of ground gas /vapours	R7 – Future proposed building structures and services	Medium	Likely	Moderate	Moderate Risk – Complete PPLs are likely to present an unacceptable risk without mitigation. The site has been characterised with a category CS2, low risk with respect to elevated levels of carbon dioxide. With implementation of appropriate mitigation measures the risk can be reduced to very low.

5.7 Human Health

Based on the findings from the desk study information and review of site specific investigation and analytical results no unacceptable levels of contamination have been identified within soils at the site which are considered to pose an unacceptable risk to the future site users. In addition post-development the site will be encapsulated by the new building footprint preventing any potential pathways to future users. As such the risk was assessed to be low.

A moderate risk to site users was assessed with respect to elevated levels of carbon dioxide at the site identified through the gas monitoring works. This could be reduced to very low with the installation of appropriate gas protection measures within the proposed development.

It is considered that the risk to site/maintenance workers from contaminated soils is low to moderate. This is because direct contact of with soils by construction workers during any excavation works is considered possible, although can be reduced to low through an appropriate site specific health and safety risk assessment and appropriate PPE.

5.8 Controlled Waters

The site is underlain by a Secondary A superficial aquifer underlain by the Unproductive aquifer of the London Clay formation.

Source Protection Zones (are recorded 76m north-west of the site with the groundwater source reported as 200m north-west of the site and assigned as Reading University. This SPZ is understood to relate to the Seaford and Newhaven Chalk Formation underlying the London Clay, however due to the extensive cover of the London Clay Formation above the Chalk it is considered that there is a very low risk of the abstraction being affected by any contamination (if present) at the site. The London Clay was proved from between 4.7 to 6.3m bgl to a depth of 18m bgl in the four GEL boreholes drilled in 2016.

Monitoring of the groundwater (GEL, 2016) has identified some elevations of determinants, of particular interest elevated hydrocarbons. The banding of the hydrocarbons of groundwater in the wells of the HLS (Carbon banding EC13-35) indicate heavier end fuels, which would correspond to the historical fuel oil leakage at the Energy Centre, in close proximity the site. This source has been removed (2013) with any residual impact in a state of natural source zone depletion (NSZD). and as such the groundwater impact can be considered to be a shrinking plume.

A low risk was assessed with respect to controlled waters; this is because no unacceptable levels of contamination have been identified at the site and due to the fact that the site is underlain by significant thickness of low permeability: London Clay, an unproductive aquifer, limiting any migration pathways to sensitive receptors.

5.9 Property

Substances that can be involved in chemical attack on building materials and structures may be present beneath the site, these substances may include sulphates.

The risk is considered to be low, with GEL (2016) recommending a concrete specification DS- 1 AC-1 in accordance with the BRE Special Digest 1 (2005).

A moderate to low risk to buildings was assessed with respect to landfill gas generation from the potential presence of Made Ground although this can be reduced to low with a site specific gas risk assessment and the installation of appropriate gas protection measures within the proposed development.

6. Conclusions / Recommendations for Further Work

Based on the findings of the desk review and site investigation works carried out at the site no significant source of contamination was identified that can be considered to present an unacceptable risk to long term human health associated with the proposed commercial end use.

Monitoring of the groundwater (GEL, 2016) identified some elevations of determinants, of particular interest elevated hydrocarbons, beneath the site. However the banding of the hydrocarbons of groundwater in the wells (Carbon banding EC13-35) indicated heavier end fuels, and was linked to the historical fuel oil leakage at the Energy Centre, in close proximity the site, subject to remediation in 2013, and as such considered to not considered to present an unacceptable risk to human health or controlled waters.

Elevated levels of carbon dioxide were measured during gas monitoring, and based on a precautionary approach and following guidance in BS8485:2015, the site was classified Characteristic Situation 2(CS2) – Low risk. As such appropriate gas protection measures will be required.

Therefore, it is considered that no remedial works, other than the incorporation of engineering measures (gas protection) are required for the proposed commercial end use development.

Following guidance in BS8485:2015 the proposed commercial university development at the site would be considered to be classified as a Type C building (commercial / public building) with a minimum gas protection score of 2.5 required for the situation 2 identified.

The protective measures required can be achieved through a combination of the following measures:

Structural Barrier: i.e. a cast insitu slab can afford a gas protection score of between 0.5 to 1.5 dependent on the level of reinforcement and penetrations

Ventilation Measures: a passive sub floor dispersal layer can offer a gas protection score of between 1.5 to 2.5 dependent on performance

Gas Membrane: a suitable gas resistant membrane (meeting the requirements of Table 7) can offer a gas protection score of 2

It is also recommended, in accordance with BS8485:2015, that all works should be installed to a reasonable level of workmanship / in line with current good practise, under CQA with integrity testing and independent validation.

It should be noted that due to the presence of building structure, it has not been possible to investigate the sub-surface conditions across a large portion of the site. As such there may be ground conditions at the site that have not been revealed during intrusive ground investigations and therefore have not been previously taken into account.

An inspection and discovery strategy will be required to identify and deal with any unexpected contamination encountered during the demolition works. Groundworkers should remain vigilant for unforeseen or suspicious ground conditions. A contamination watching brief will be undertaken at all excavations and during the demolition and removal of existing slab. Identification of potential contamination should initially be based on visual and/or olfactory assessment.

General indicators of possible contamination could be arisings that are stained or appear inconsistent with the general soil mass. Examples could be oily (or free phase) pockets, fibrous materials, strong odours or vibrant colours associated with the soil itself, but also physical foreign objects such as cement board, ash, brick, concrete, glass and rubbish.

Physical contaminants such as potential Asbestos Containing Materials (pACM) or other Man Made Mineral Fibres (MMMF) should be treated as hazardous until proven otherwise.

Upon discovery of suspect ground conditions the works should be stopped and the Client's Contract Administrator and Geo-environmental Advisor informed. Work in the affected area should not continue until a strategy and programme have been formulated and, if required, approved by the appropriate regulatory authorities.

It is recommended that the Local Environmental Health Department are consulted on the scope of the proposed measures to be adopted at the earliest opportunity.

Statutory authorities should be consulted with respect to any specific requirements with respect to water supplies.

7. References

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- British Standards Institution (2013) BS 10175:2011+A1:2013 London, BSI.
- British Standards Institution (2015): BS 8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*. London, BSI.
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- Geotechnical Engineering Ltd (2016) *University of Reading - Health and Life Sciences Building, Interpretative Report on Ground Investigation*, 31710
- Geotechnical Engineering Ltd (2016) *University of Reading - Health and Life Sciences Building, Supplementary Ground Gas Risk Assessment*, 32362
- Landmark (2016) Envirocheck Report Reference 115805868_1_1 February 2017
- National House Building Council (2001) *NHBC Standards 2011. Part 4- Foundations*. Milton Keynes, NHBC.
- National House Building Council and Environment Agency (2008) *Guidance for the Safe Development of Housing on Land Affected by Contamination*. NHBC, Environment Agency and Chartered Institute of Environmental Health (R&D Publication 66).
-



Project name HLS
 Client Name UoR
 Date: Feb 2017
 Design: -- MR Checked: -- GJ
 Drawing Reference: 60441574/M001.003

Figure 1 – Site Location Plan

AECOM

Portwall Place
 Portwall Lane
 Bristol, BS1 6NB

Tel: +44 (0)117 927 7000
 Fax: +44 (0)845 863 0881
 www.aecom.com



Project name HLS
 Client Name UoR
 Date: Feb 2017
 Design: -- MR Checked: -- GJ
 Drawing Reference: 60441574/M001.003

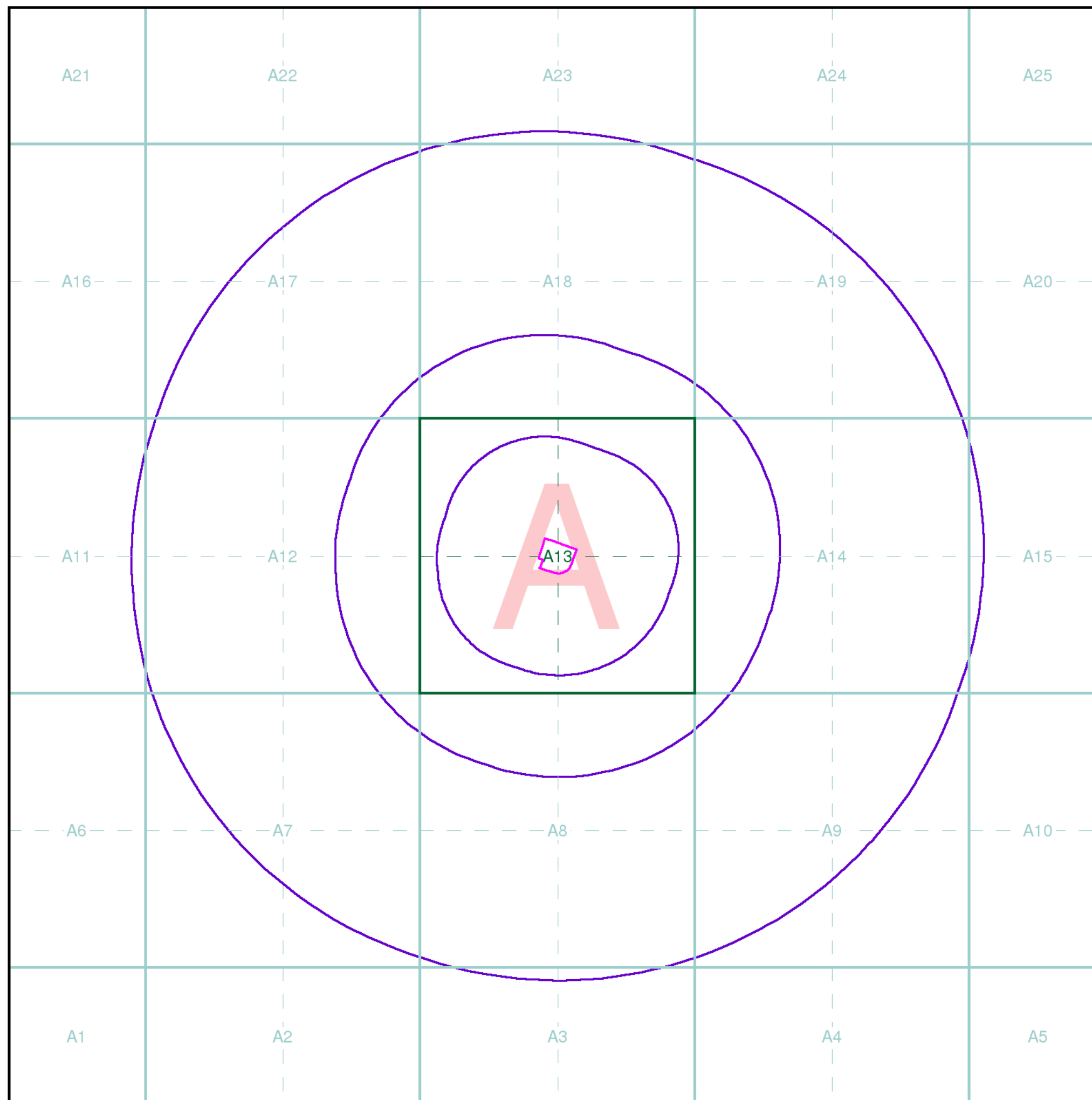
Figure 2 – Site Layout Plan

AECOM

Portwall Place
 Portwall Lane
 Bristol, BS1 6NB

Tel: +44 (0)117 927 7000
 Fax: +44 (0)845 863 0881
 www.aecom.com

Appendix A – Landmark Envirocheck Report



Index Map

For ease of identification, your site and buffer have been split into Slices, Segments and Quadrants. These are illustrated on the Index Map opposite and explained further below.

Slice

Each slice represents a 1:10,000 plot area (2.7km x 2.7km) for your site and buffer. A large site and buffer may be made up of several slices (represented by a red outline), that are referenced by letters of the alphabet, starting from the bottom left corner of the slice "grid". This grid does not relate to National Grid lines but is designed to give best fit over the site and buffer.

Segment

A segment represents a 1:2,500 plot area. Segments that have plot files associated with them are shown in dark green, others in light blue. These are numbered from the bottom left hand corner within each slice.

Quadrant

A quadrant is a quarter of a segment. These are labelled as NW, NE, SW, SE and are referenced in the datasheet to allow features to be quickly located on plots. Therefore a feature that has a quadrant reference of A7NW will be in Slice A, Segment 7 and the NW Quadrant.

A selection of organisations who provide data within this report:



Envirocheck reports are compiled from 136 different sources of data.

Client Details

MS J Foy, Aecom Infrastructure & Environment UK Ltd,
Longcross Court, 47 Newport Road, Cardiff, CF24 0AD

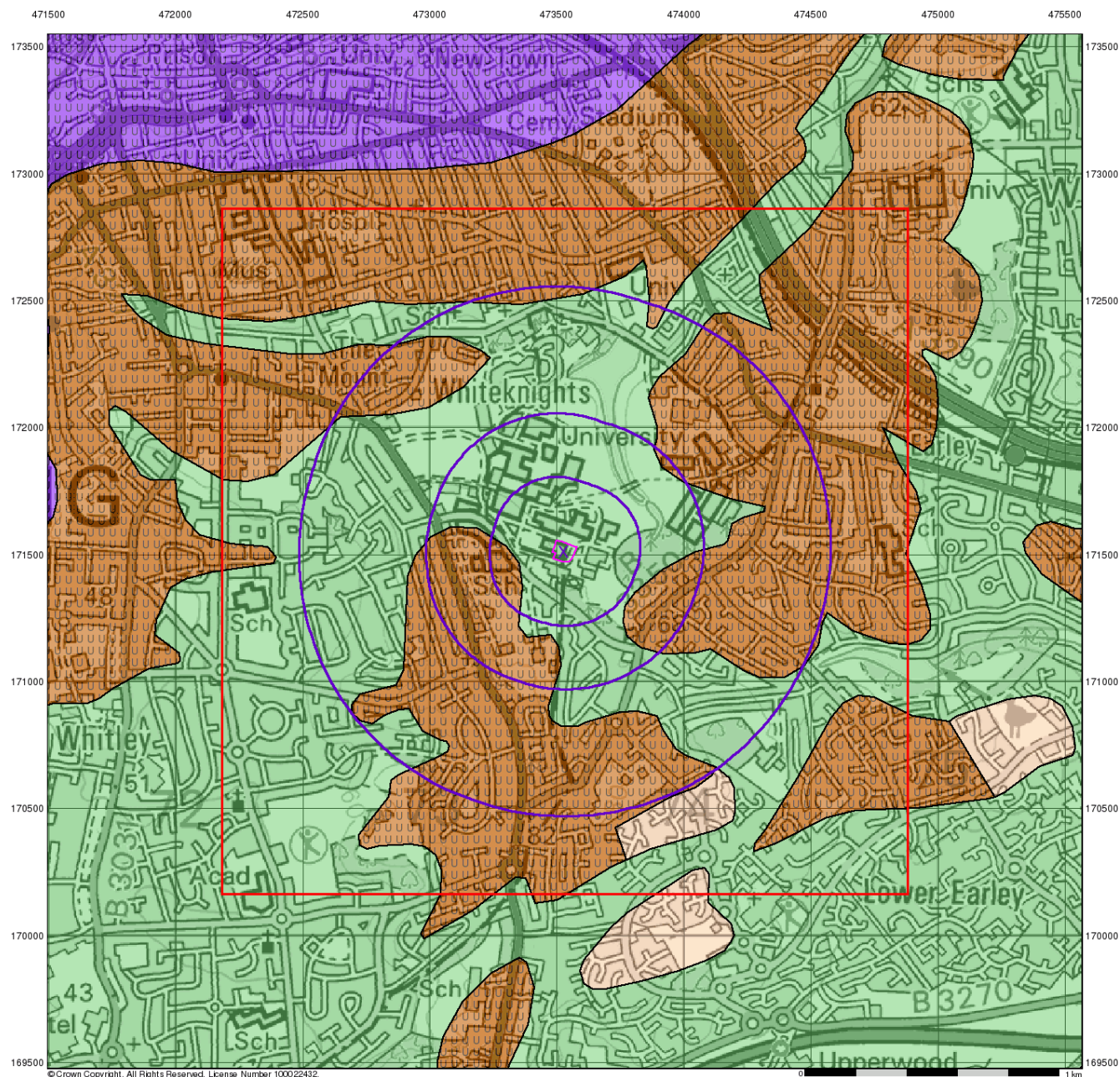
Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road,
READING, RG6 6UR

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<http://www.landmarkinfo.co.uk/Terms/Show/515>



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0 1 km

Groundwater Vulnerability

General

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

Agency and Hydrological

Geological 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

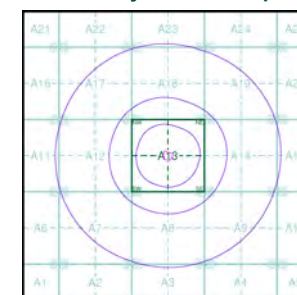
-

Drift Deposit

-

Soil Classes

Site Sensitivity Context Map - Slice A

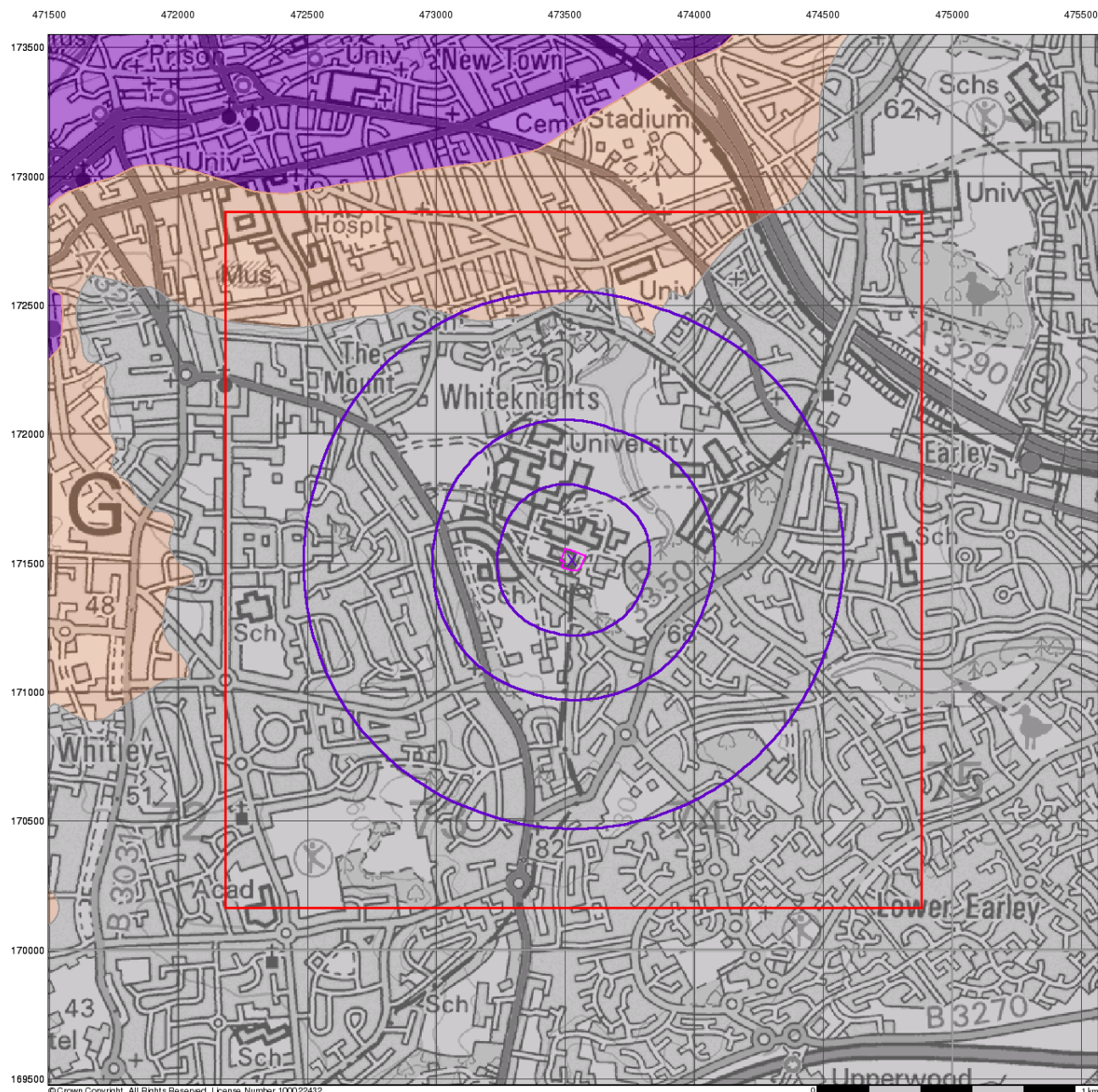


Order Details

Order Number: 115805868 1 1
 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 1000

Site Details

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0 1 km

Bedrock Aquifer Designation

General

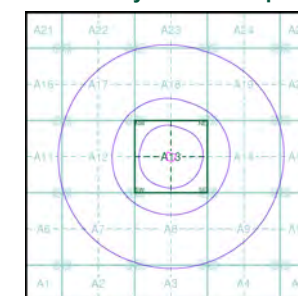
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A

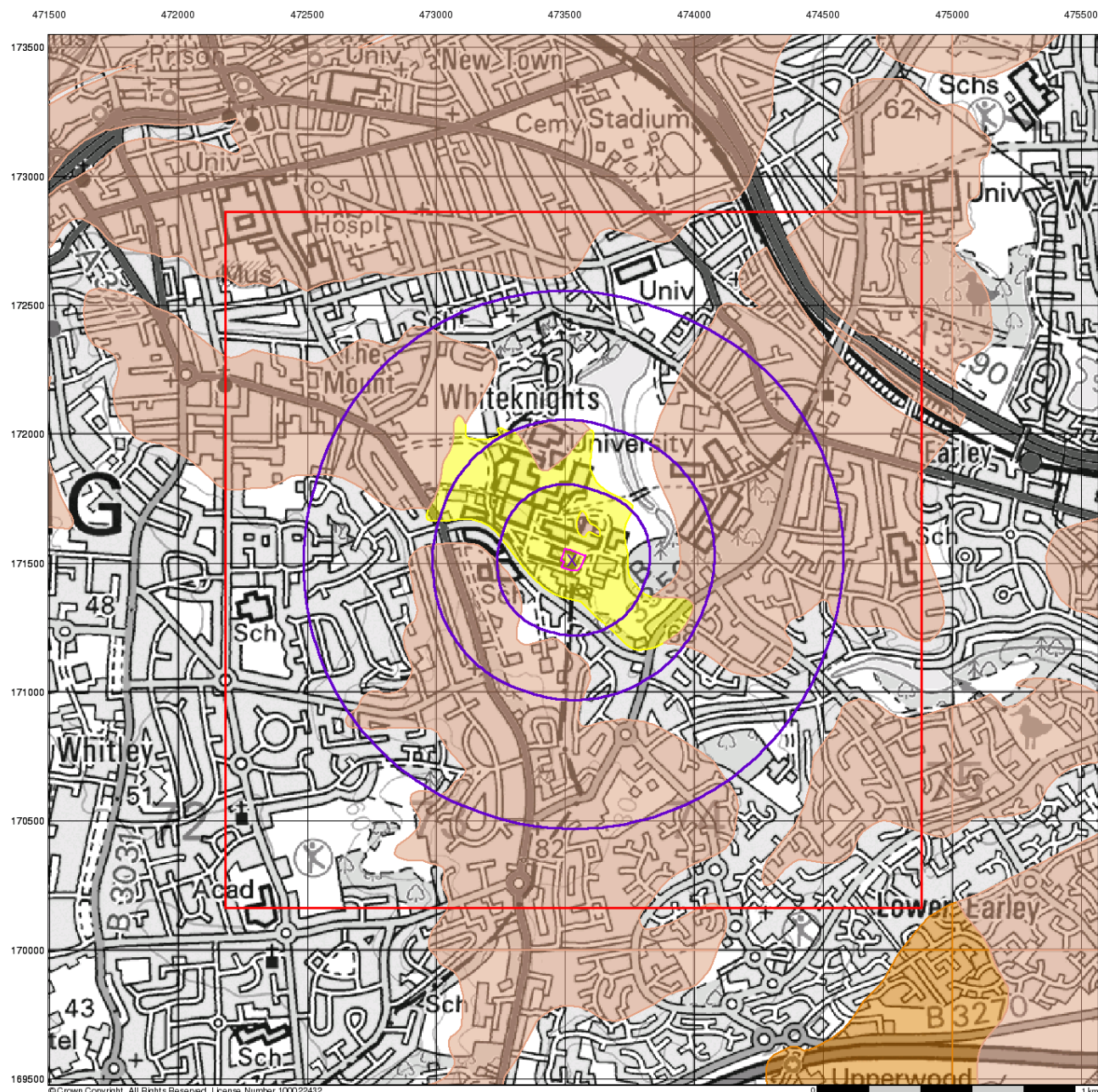


Order Details

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 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 1000

Site Details

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Superficial Aquifer Designation

General

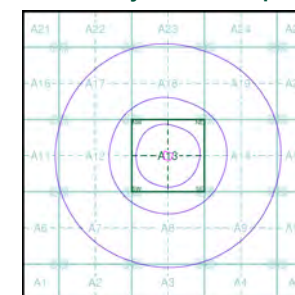
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A

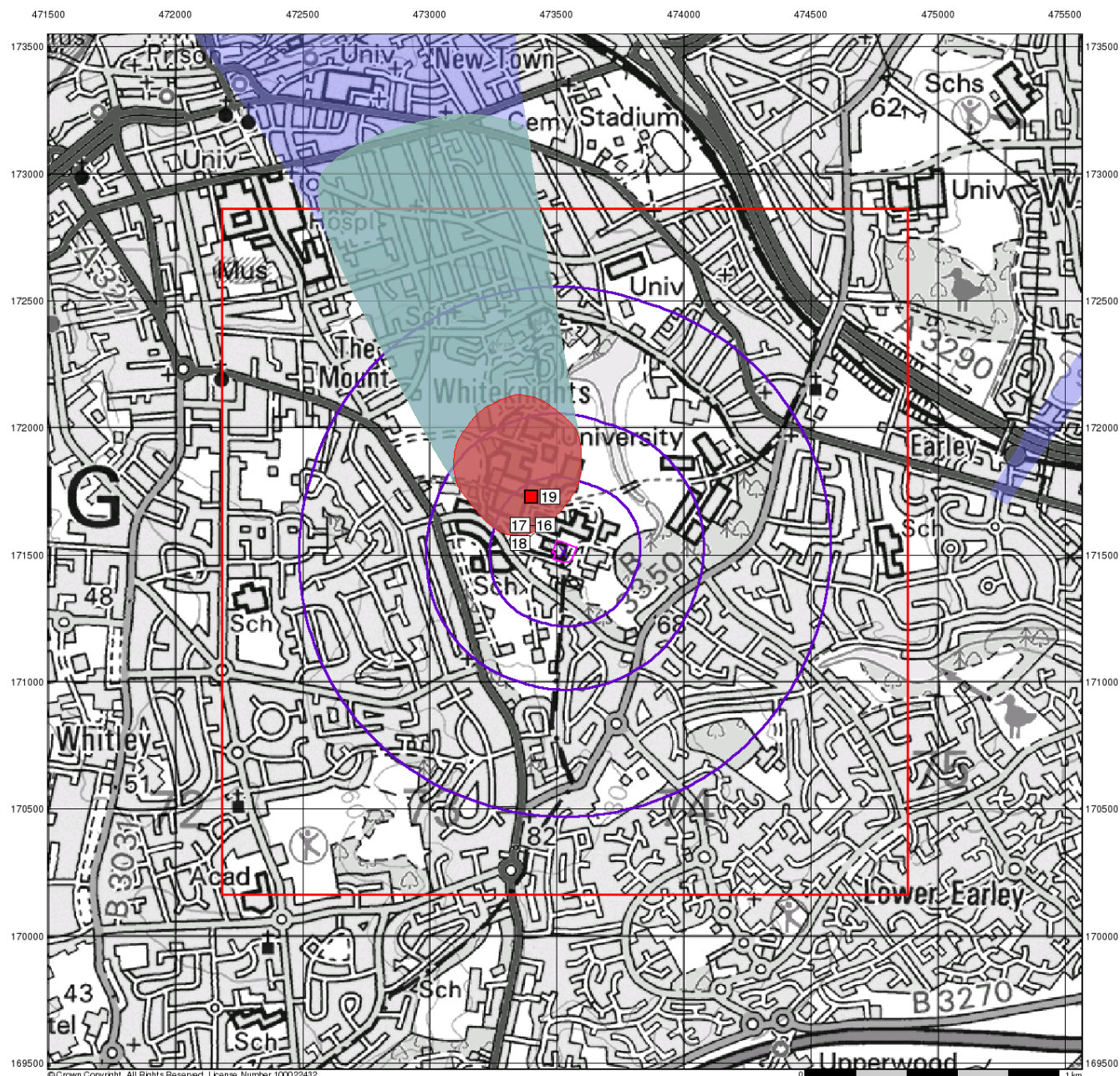


Order Details

Order Number: 115805868_1_1
 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 1000

Site Details

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Source Protection Zones

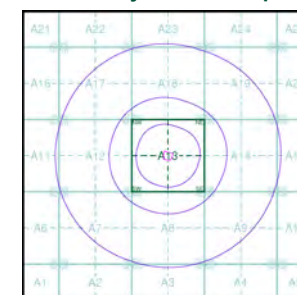
General

- 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

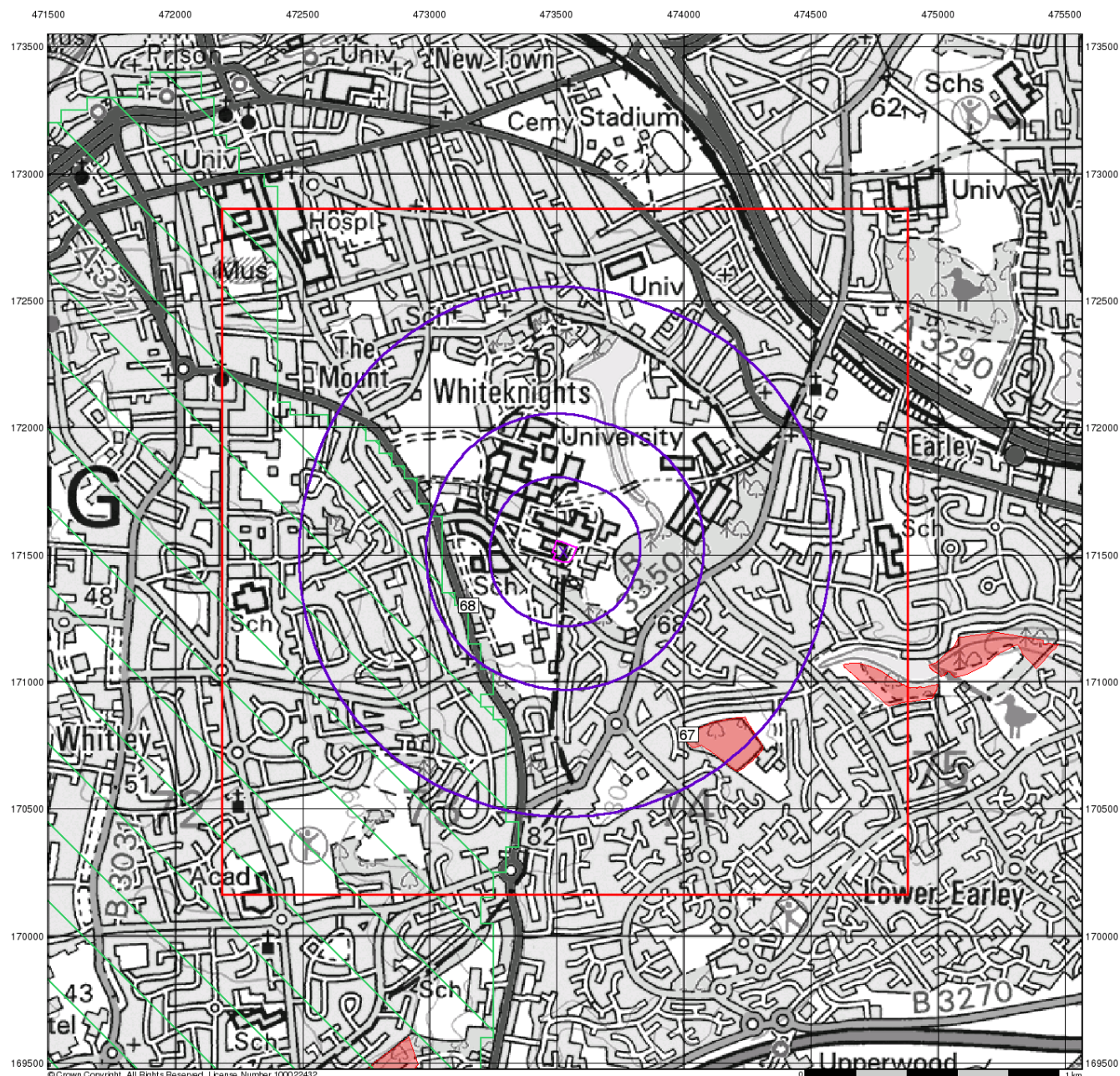


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 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
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 Search Buffer (m): 1000

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Sensitive Land Uses

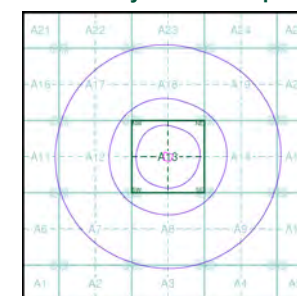
General

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

Sensitive Land Uses

- Ancient Woodland
- 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
- World Heritage Sites

Site Sensitivity Context Map - Slice A

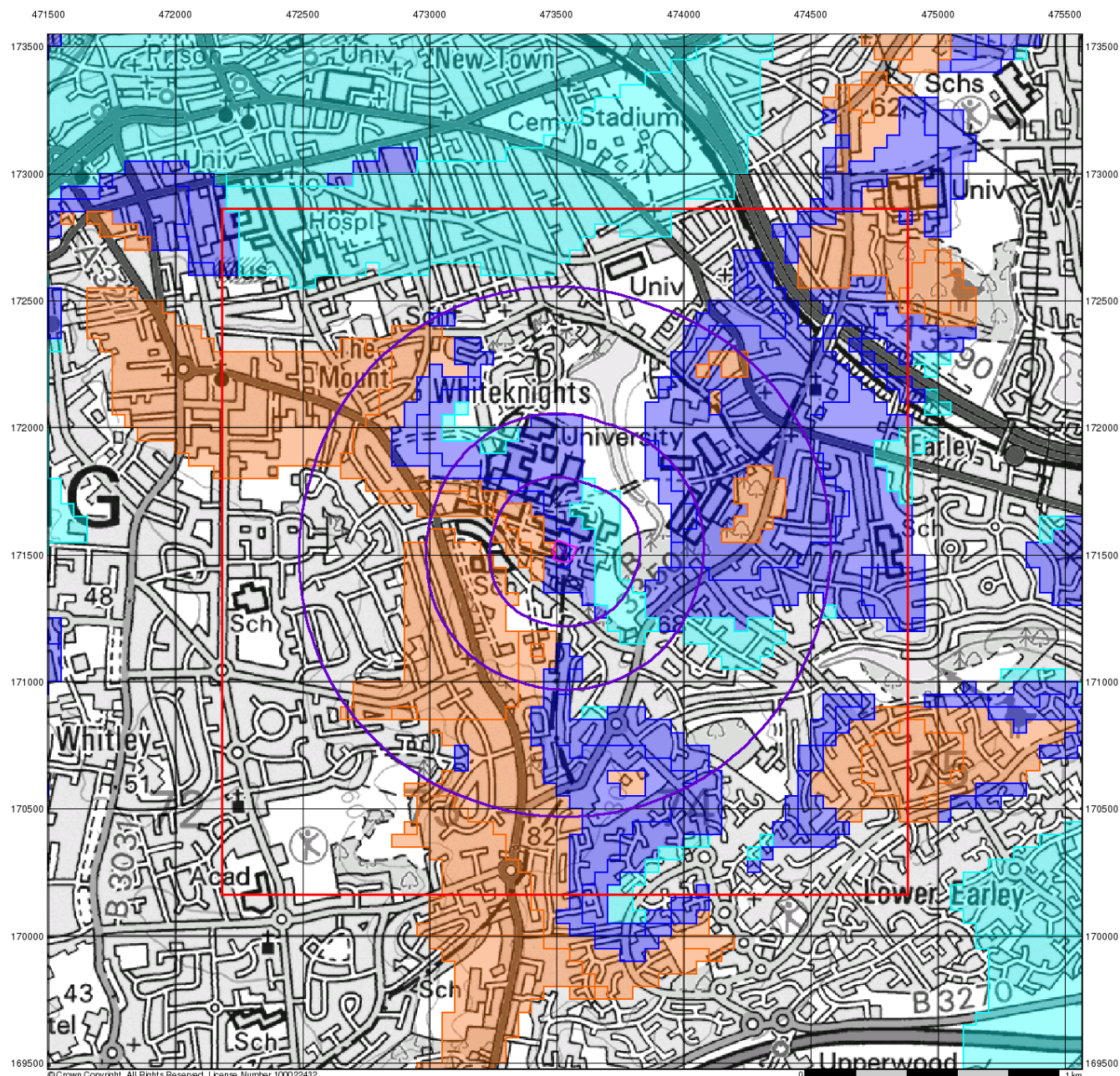


Order Details

Order Number: 115805868_1_1
 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 1000

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BGS Flood GFS Data

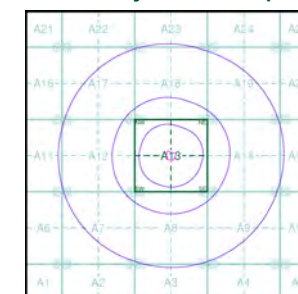
General

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

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 115805868_1_1
 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING RG6 6UR

Landmark
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 Web: www.envirocheck.co.uk

Envirocheck[®] Report:

Datasheet

Order Details:

Order Number:

115805868_1_1

Customer Reference:

60441574/M001.003

National Grid Reference:

473530, 171510

Slice:

A

Site Area (Ha):

0.56

Search Buffer (m):

1000

Site Details:

Life Sciences Building, University of Reading
Shinfield Road
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Cardiff
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Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	8
Hazardous Substances	-
Geological	9
Industrial Land Use	12
Sensitive Land Use	17
Data Currency	18
Data Suppliers	24
Useful Contacts	25

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)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 2			1	5
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 3				2
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 3		Yes		
Pollution Incidents to Controlled Waters	pg 3		2		5
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances	pg 5				2
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register					
Water Abstractions	pg 5			2	1 (*1)
Water Industry Act Referrals					
Groundwater Vulnerability	pg 6	Yes	n/a	n/a	n/a
Drift Deposits			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 6	Yes	n/a	n/a	n/a
Superficial Aquifer Designations	pg 6	Yes	n/a	n/a	n/a
Source Protection Zones	pg 6		4		
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
Detailed River Network Lines					n/a
Detailed River Network Offline Drainage	pg 6		Yes	Yes	n/a

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites					
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Landfill Coverage	pg 8	2	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 8				1
Potentially Infilled Land (Water)	pg 8			1	4
Registered Landfill Sites					
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 9	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 9	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 9				3
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain				n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 10	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards				n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 10	Yes		n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 10	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 10	Yes		n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 12		3	2	25
Fuel Station Entries	pg 14				1
Points of Interest - Commercial Services	pg 14				6
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 15	2	5		3
Points of Interest - Public Infrastructure	pg 16			3	7
Points of Interest - Recreational and Environmental	pg 16				2
Gas Pipelines					
Underground Electrical Cables					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland	pg 17				1
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 17			1	
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13SW (W)	0	2	473500 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SW (NE)	0	2	473527 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	0	2	473550 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13NE (NE)	72	2	473600 171600
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13SW (W)	84	2	473400 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (NW)	106	2	473450 171650
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13SW (W)	190	2	473300 171450
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (SE)	201	2	473650 171300
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (NW)	267	2	473250 171650
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13SW (S)	272	2	473500 171200
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	300	2	473850 171400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (S)	320	2	473527 171150
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A8NW (S)	330	2	473450 171150
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14NW (NE)	365	2	473900 171700
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14SW (E)	372	2	473950 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (NW)	386	2	473200 171800
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A18SW (NW)	398	2	473300 171900
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NE (S)	420	2	473550 171050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A14SW (SE)	498	2	474000 171250

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	Discharge Consents Operator: University Of Reading Property Type: EDUCATION/NURSERY/SCHOOL/COLLEGE/UNI/TRAINING VENUE Location: Plant Science, Food Studies & Chemistry Depts, University Of Reading, Berk Authority: Environment Agency, Thames Region Catchment Area: Not Given Reference: CNTM.0105 Permit Version: 1 Effective Date: 26th February 1992 Issued Date: 26th February 1992 Revocation Date: 23rd December 2015 Discharge Type: Trade Discharges - Cooling Water Discharge: Pond - No Outlet Environment: Receiving Water: Whiteknightslake Status: Surrendered under EPR 2010 Positional Accuracy: Located by supplier to within 100m	A13NE (NE)	286	3	473770 171740
2	Discharge Consents Operator: Thames Water Utilities Ltd Property Type: PUMPING STATION ON SEWERAGE NETWORK (WATER COMPANY) Location: Reading, Universityreadinguniversity Authority: Environment Agency, Thames Region Catchment Area: Not Supplied Reference: Temp.1777 Permit Version: 2 Effective Date: 3rd September 2010 Issued Date: 3rd September 2010 Revocation Date: 19th August 2014 Discharge Type: Sewage Discharges - Pumping Station - Water Company Discharge: Freshwater Stream/River Environment: Receiving Water: Whiteknights Stream Status: Surrendered under EPR 2010 Positional Accuracy: Located by supplier to within 100m	A18SE (N)	553	3	473600 172100
2	Discharge Consents Operator: Thames Water Utilities Ltd Property Type: PUMPING STATION ON SEWERAGE NETWORK (WATER COMPANY) Location: Reading, Universityreadinguniversity Authority: Environment Agency, Thames Region Catchment Area: Not Supplied Reference: Temp.1777 Permit Version: 1 Effective Date: 2nd November 1989 Issued Date: 2nd November 1989 Revocation Date: 2nd September 2010 Discharge Type: Sewage Discharges - Pumping Station - Water Company Discharge: Freshwater Stream/River Environment: Receiving Water: Whiteknights Stream Status: Temporary Consents (Water Act 1989, Section 113) Positional Accuracy: Located by supplier to within 100m	A18SE (N)	553	3	473600 172100
3	Discharge Consents Operator: University Of Reading Property Type: EDUCATION/NURSERY/SCHOOL/COLLEGE/UNI/TRAINING VENUE Location: J J Thompson Physical Lab, University Of Reading, Berks Authority: Environment Agency, Thames Region Catchment Area: Not Given Reference: CTCR.0714 Permit Version: 2 Effective Date: 7th May 1992 Issued Date: 21st July 1964 Revocation Date: 23rd December 2015 Discharge Type: Trade Discharges - Cooling Water Discharge: Pond - No Outlet Environment: Receiving Water: Whiteknightslake Status: Surrendered under EPR 2010 Positional Accuracy: Located by supplier to within 10m	A18SE (N)	615	3	473540 172170

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
3	Discharge Consents Operator: University Of Reading Property Type: EDUCATION/NURSERY/SCHOOL/COLLEGE/UNI/TRAINING VENUE Location: J J Thompson Physical Lab, University Of Reading, Berks Authority: Environment Agency, Thames Region Catchment Area: Not Supplied Reference: Ctr.0714 Permit Version: 1 Effective Date: 21st July 1964 Issued Date: 21st July 1964 Revocation Date: 6th May 1992 Discharge Type: Trade Discharges - Cooling Water Discharge: Pond/Lake Environment: Receiving Water: Whiteknightslake Status: Transferred from Rivers (Prevention of Pollution) Act 1951-1961 Positional Accuracy: Located by supplier to within 10m	A18SE (N)	615	3	473540 172170
4	Discharge Consents Operator: Thames Water Utilities Ltd Property Type: WTW/WATER COLLECTION/TREATMENT/SUPPLY Location: Earley Authority: Environment Agency, Thames Region Catchment Area: Not Supplied Reference: Temp.0099 Permit Version: 1 Effective Date: 15th September 1989 Issued Date: 15th September 1989 Revocation Date: 5th October 2000 Discharge Type: Trade Effluent Discharge: Freshwater Stream/River Environment: Receiving Water: River Thames Status: Authorisation revokedRevoked Positional Accuracy: Located by supplier to within 100m	A9SW (S)	942	3	473900 170600
5	Local Authority Pollution Prevention and Controls Name: Weldale Connect Location: 324 Wokingham Road, Reading, Berkshire, RG6 1JU Authority: Reading Borough Council, Environmental Health Department Permit Reference: EPA/PAR.B/28/98/P2 Dated: 24th August 1998 Process Type: Local Authority Pollution Prevention and Control Description: PG1/14 Petrol filling station Status: Permitted Positional Accuracy: Automatically positioned to the address	A19SE (NE)	907	4	474348 172009
6	Local Authority Pollution Prevention and Controls Name: Laundry 2 Go Location: 60 Christchurch Road, Reading, Rg2 7az Authority: Reading Borough Council, Environmental Health Department Permit Reference: EPA/PAR.B/DC2/P2 Dated: 1st November 2011 Process Type: Local Authority Air Pollution Control Description: PG6/46 Dry cleaning Status: Permitted Positional Accuracy: Manually positioned to the address or location	A17SW (NW)	978	4	472660 172058
	Nearest Surface Water Feature	A13SE (E)	150	-	473725 171500
7	Pollution Incidents to Controlled Waters Property Type: Not Given Location: READING Authority: Environment Agency, Thames Region Pollutant: Chemicals - Unknown Note: Confirmed incident Incident Date: 8th April 1999 Incident Reference: THWE1999042538 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Not Given Incident Severity: Category 2 - Significant Incident Positional Accuracy: Located by supplier to within 10m	A13SW (W)	185	3	473300 171500

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
8	Pollution Incidents to Controlled Waters Property Type: Not Given Location: Reading University Authority: Environment Agency, Thames Region Pollutant: Miscellaneous - Unknown Note: Confirmed As A Pollution Incident Incident Date: 12th October 1993 Incident Reference: WE930348 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Not Given Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A13NE (NE)	210	3	473700 171700
9	Pollution Incidents to Controlled Waters Property Type: Not Given Location: READING Authority: Environment Agency, Thames Region Pollutant: Chemicals - Unknown Note: Not Supplied Incident Date: 22nd June 1997 Incident Reference: THWE1997029339 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Not Given Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A12NE (W)	592	3	472900 171600
10	Pollution Incidents to Controlled Waters Property Type: Not Given Location: EARLEY Authority: Environment Agency, Thames Region Pollutant: Unknown Sewage Note: Confirmed As A Pollution Incident Incident Date: 29th July 1993 Incident Reference: WE930257 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Not Given Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A18SE (N)	610	3	473540 172165
11	Pollution Incidents to Controlled Waters Property Type: Not Given Location: EARLEY Authority: Environment Agency, Thames Region Pollutant: Unknown Sewage Note: No Incident Date: 15th July 1995 Incident Reference: S2950093 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Not Given Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A9NW (SE)	653	3	474000 171000
11	Pollution Incidents to Controlled Waters Property Type: Not Given Location: EARLEY Authority: Environment Agency, Thames Region Pollutant: General Note: Not Supplied Incident Date: 22nd November 1997 Incident Reference: THSE1997035964 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Not Given Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A9NW (SE)	656	3	474000 170995
12	Pollution Incidents to Controlled Waters Property Type: Not Given Location: READING Authority: Environment Agency, Thames Region Pollutant: Oils - Unknown Note: Confirmed As A Pollution Incident Incident Date: 13th October 1995 Incident Reference: WE950403 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Not Given Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A18NE (N)	785	3	473750 172300

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
13	Registered Radioactive Substances Name: University Of Reading Location: Whiteknights, PO Box 217, READING, Berkshire, RG6 6AH Authority: Environment Agency, Thames Region Permit Reference: AE4075 Dated: 31st March 1991 Process Type: Authorisation under S13 RSA for the disposal of Radioactive waste (was RSA60 S7) Description: Authorisation under RSA Status: Authorisation superseded by a substantial or non substantial variationSuperseded Positional Accuracy: Manually positioned to the address or location	A19SW (NE)	646	3	474110 171894
14	Registered Radioactive Substances Name: University Of Reading Location: PO Box 217, READING, Berkshire, RG6 6AH Authority: Environment Agency, Thames Region Permit Reference: Bw8224 Dated: 1st December 2003 Process Type: Authorisation under S13 RSA for the disposal of Radioactive waste (was RSA60 S7) Description: Minor variation to authorisation under RSA Status: Application has been authorised and any conditions apply to the operatorAuthorised Positional Accuracy: Located by supplier to within 10m	A17NE (NW)	805	3	473170 172290
15	Water Abstractions Operator: University Of Reading Licence Number: 28/39/22/0077 Permit Version: 103 Location: Whiteknights Park - Reading - Borehole Authority: Environment Agency, Thames Region Abstraction: Schools And Colleges: Drinking; Cooking; Sanitary; Washing; (Small Garden) Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Whiteknights Park - Reading Authorised Start: 01 April Authorised End: 31 March Permit Start Date: 1st April 2011 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A12NE (W)	482	3	473040 171700
15	Water Abstractions Operator: University Of Reading Licence Number: 28/39/22/0077 Permit Version: 102 Location: Whiteknights Park - Reading - Borehole Authority: Environment Agency, Thames Region Abstraction: Schools And Colleges: Drinking; Cooking; Sanitary; Washing; (Small Garden) Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Whiteknights Park - Reading Authorised Start: 01 January Authorised End: 31 December Permit Start Date: 4th August 2004 Permit End Date: 31st March 2011 Positional Accuracy: Located by supplier to within 10m	A12NE (W)	482	3	473040 171700
15	Water Abstractions Operator: University Of Reading Licence Number: 28/39/22/0077 Permit Version: 100 Location: Whiteknights Park, Reading Authority: Environment Agency, Thames Region Abstraction: Schools and Colleges: General Use (Medium Loss) Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): 1056 Yearly Rate (m3): 240000 Details: Whiteknight Park, Reading Authorised Start: 01 January Authorised End: 31 December Permit Start Date: 26th April 1993 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 100m	A12NE (W)	520	3	473000 171700

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Water Abstractions Operator: Royal Berkshire Hospital Licence Number: 28/39/22/0521 Permit Version: 100 Location: Royal Berkshire Hospital Authority: Environment Agency, Thames Region Abstraction: Hospitals: Drinking; Cooking; Sanitary; Washing; (Small Garden) Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): 350 Yearly Rate (m3): 127750 Details: Royal Berkshire Hospital, Reading Authorised Start: 01 January Authorised End: 31 December Permit Start Date: 17th January 1992 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 100m	A21SE (NW)	1660	3	472400 172800
	Groundwater Vulnerability Soil Classification: Not classified Map Sheet: Sheet 39 West London Scale: 1:100,000	A13SW (NE)	0	3	473527 171513
	Drift Deposits None				
	Bedrock Aquifer Designations Aquifer Designation: Unproductive Strata	A13SW (NE)	0	2	473527 171513
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - Undifferentiated	A13SW (NE)	0	2	473527 171513
16	Source Protection Zones Name: Reading University Source: Environment Agency, Head Office Reference: Th200 Type: Zone I (Inner Protection Zone): Travel time of 50 days or less to the groundwater source.	A13NW (NW)	76	3	473455 171618
17	Source Protection Zones Name: Reading University Source: Environment Agency, Head Office Reference: Th200 Type: Zone II (Outer Protection Zone): Either 25% of the source area or a 400 day travel time whichever is greater.	A13NW (NW)	76	3	473455 171618
18	Source Protection Zones Name: Reading University Source: Environment Agency, Head Office Reference: Th200 Type: Zone III (Total Catchment): The total area needed to support the discharge from the protected groundwater source.	A13NW (NW)	76	3	473455 171618
19	Source Protection Zones Name: Reading University Source: Environment Agency, Head Office Reference: Th200 Type: Groundwater Source	A13NW (NW)	200	3	473400 171730
	Extreme Flooding from Rivers or Sea without Defences None				
	Flooding from Rivers or Sea without Defences None				
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				
	Detailed River Network Lines None				
20	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A13SE (S)	186	3	473536 171284

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
21	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A8NW (S)	307	3	473531 171163
22	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A14NW (E)	355	3	473917 171634

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Local Authority Landfill Coverage Name: Reading Unitary Council - Has supplied landfill data		0	6	473520 171513
	Local Authority Landfill Coverage Name: Wokingham District Council - Has supplied landfill data		0	5	473527 171513
23	Potentially Infilled Land (Non-Water) Bearing Ref: N Use: Unknown Filled Ground (Pit, quarry etc) Date of Mapping: 1995	A18NE (N)	929	-	473824 172427
24	Potentially Infilled Land (Water) Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1962	A8NW (S)	424	-	473358 171080
25	Potentially Infilled Land (Water) Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1931	A14SE (E)	647	-	474216 171422
26	Potentially Infilled Land (Water) Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1931	A14NE (E)	661	-	474234 171608
27	Potentially Infilled Land (Water) Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1962	A9SW (SE)	825	-	473892 170724
28	Potentially Infilled Land (Water) Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1931	A14SE (E)	917	-	474481 171368

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Thames Group	A13SW (NE)	0	2	473527 171513
	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: <100 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SW (NE)	0	2	473527 171513
	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: <100 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NE (NE)	65	2	473569 171601
	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: <100 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SW (SW)	191	2	473309 171413
	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: <100 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SE (SE)	301	2	473840 171369
	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: 100 - 200 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	923	2	474500 171500
29	BGS Recorded Mineral Sites Site Name: Earley Rise Brick Field Location: Earley Rise, Reading, Berkshire Source: British Geological Survey, National Geoscience Information Service Reference: 234941 Type: Opencast Status: Ceased Operator: Not Supplied Operator Location: Not Supplied Periodic Type: Tertiary Geology: Lambeth Group Commodity: Common Clay and Shale Positional Accuracy: Located by supplier to within 10m	A18NE (N)	915	2	473816 172415

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
30	BGS Recorded Mineral Sites Site Name: Earley Rise Brick Field Location: , Earley Rise, Reading, Berkshire Source: British Geological Survey, National Geoscience Information Service Reference: 234942 Type: Opencast Status: Ceased Operator: Not Supplied Operator Location: Not Supplied Periodic Type: Tertiary Geology: Lambeth Group Commodity: Common Clay and Shale Positional Accuracy: Located by supplier to within 10m	A18NE (N)	971	2	473787 172483
31	BGS Recorded Mineral Sites Site Name: Earley Rise Brick Field Location: , Earley Rise, Reading, Berkshire Source: British Geological Survey, National Geoscience Information Service Reference: 234939 Type: Opencast Status: Ceased Operator: Not Supplied Operator Location: Not Supplied Periodic Type: Tertiary Geology: Lambeth Group Commodity: Common Clay and Shale Positional Accuracy: Located by supplier to within 10m	A18NE (N)	997	2	473847 172491
	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	A13SW (NE)	0	2	473527 171513
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (NE)	0	2	473527 171513
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (NE)	0	2	473527 171513
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (NE)	0	2	473527 171513
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (NE)	0	2	473527 171513
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	104	2	473476 171372
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	191	2	473309 171413
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (NE)	0	2	473527 171513
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13SE (S)	0	2	473537 171477
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	65	2	473568 171602

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Radon Potential - Radon Affected Areas Affected Area: The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A13SW (NE)	0	2	473527 171513
	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	A13SW (NE)	0	2	473527 171513

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
32	Contemporary Trade Directory Entries Name: Kinsella James Location: 1, University Cottages, Pepper Lane, Reading, RG6 5SE Classification: Boilers - Servicing, Replacements & Repairs Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SW (S)	67	-	473524 171404
33	Contemporary Trade Directory Entries Name: Reading Scientific Services Ltd Location: Reading Science Centre, The University, Whiteknights, Reading, RG6 6LA Classification: Laboratories Status: Active Positional Accuracy: Automatically positioned to the address	A13NE (NE)	116	-	473679 171586
33	Contemporary Trade Directory Entries Name: R S S L Pharma Location: Lord Zukerman Research Centre, The University, Whiteknights, Reading, Berkshire, RG6 6LA Classification: Pharmaceutical Manufacturers & Distributors Status: Inactive Positional Accuracy: Automatically positioned to the address	A13NE (NE)	116	-	473679 171586
34	Contemporary Trade Directory Entries Name: Communication Systems & Installations Location: Ardenwood, Pepper Lane, Earley, Reading, RG6 5SH Classification: Fibre Optics Status: Inactive Positional Accuracy: Automatically positioned to the address	A8NE (SE)	401	-	473737 171119
35	Contemporary Trade Directory Entries Name: Tate & Lyle Sucralose Location: Earley Gate, Whiteknights Road, Reading, Berkshire, RG6 6BZ Classification: Food Products - Manufacturers Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (E)	463	-	474039 171565
36	Contemporary Trade Directory Entries Name: Zinetic.Co.Uk Location: University Of Reading Science & Technology Centre, Earley Gate Whiteknights Road, Reading, Berkshire, RG6 6BZ Classification: Computer Manufacturers Status: Active Positional Accuracy: Automatically positioned to the address	A19SW (NE)	519	-	473983 171853
36	Contemporary Trade Directory Entries Name: Bio Interactions Location: Science & Technology Centre, Earley Gate, Whiteknights Road, Reading, RG6 6BZ Classification: Laboratories Status: Active Positional Accuracy: Automatically positioned to the address	A14NW (NE)	542	-	474015 171850
37	Contemporary Trade Directory Entries Name: Adphos (Uk) Ltd Location: 8, Fowler Close, Earley, Reading, RG6 7SS Classification: Printing Engineering Services Status: Inactive Positional Accuracy: Automatically positioned to the address	A9NW (SE)	635	-	474069 171103
38	Contemporary Trade Directory Entries Name: Fresh & Clean Services Location: 92, Northcourt Avenue, Reading, RG2 7HQ Classification: Cleaning Services - Commercial Status: Inactive Positional Accuracy: Automatically positioned to the address	A7NE (SW)	637	-	473047 171023
38	Contemporary Trade Directory Entries Name: Northcourt Garage Bearing Engineering Ltd Location: 88-90, Northcourt Avenue, Reading, RG2 7HQ Classification: Garage Services Status: Active Positional Accuracy: Automatically positioned to the address	A7NE (SW)	637	-	473038 171031
39	Contemporary Trade Directory Entries Name: Train Rite Location: 67, Elm Road, Earley, Reading, RG6 5TR Classification: Fork Lift Trucks Status: Inactive Positional Accuracy: Automatically positioned to the address	A8NE (S)	657	-	473727 170841

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
40	Contemporary Trade Directory Entries Name: Associated Pallets Ltd Location: 101, Barnsdale Road, Reading, RG2 7JQ Classification: Pallets, Crates & Packing Cases Status: Inactive Positional Accuracy: Automatically positioned to the address	A7NE (SW)	667	-	472969 171063
40	Contemporary Trade Directory Entries Name: The B S S Group Location: 101, Barnsdale Road, Reading, RG2 7JQ Classification: Industrial Engineers Status: Inactive Positional Accuracy: Automatically positioned to the address	A7NE (SW)	667	-	472969 171063
41	Contemporary Trade Directory Entries Name: My Home Services Ltd Location: Unit F7 ,University Of Reading, Reading, Berkshire, RG6 6AT Classification: Carpet, Curtain & Upholstery Cleaners Status: Inactive Positional Accuracy: Manually positioned within the geographical locality	A18NW (NW)	704	-	473236 172209
42	Contemporary Trade Directory Entries Name: Printmagic Location: 1a, Upper Redlands Road, Reading, RG1 5JJ Classification: Printers Status: Inactive Positional Accuracy: Automatically positioned to the address	A18NW (N)	809	-	473393 172358
42	Contemporary Trade Directory Entries Name: Purco Print Location: Unit 4-5,Barnat Works,1A Upper Redlands Rd, Reading, Berkshire, RG1 5JJ Classification: Printers Status: Inactive Positional Accuracy: Manually positioned within the geographical locality	A18NW (N)	827	-	473406 172378
43	Contemporary Trade Directory Entries Name: Trusteco Location: 69, Whiteknights Road, Reading, RG6 7BB Classification: Carpet, Curtain & Upholstery Cleaners Status: Active Positional Accuracy: Automatically positioned to the address	A19NW (NE)	810	-	474026 172203
44	Contemporary Trade Directory Entries Name: Richardsons Botanical Identifications Location: 49-51 Whiteknights Rd, Reading, Berkshire, RG6 7BB Classification: Laboratories Status: Inactive Positional Accuracy: Manually positioned to the address or location	A19NW (NE)	829	-	473962 172263
45	Contemporary Trade Directory Entries Name: Crusader Cleaning Location: 39, Stanhope Road, Reading, RG2 7HW Classification: Commercial Cleaning Services Status: Active Positional Accuracy: Automatically positioned to the address	A12SW (W)	837	-	472654 171405
46	Contemporary Trade Directory Entries Name: Ryan Location: 13, Holmes Road, Reading, RG6 7BH Classification: Electrical Engineers Status: Inactive Positional Accuracy: Automatically positioned to the address	A19SE (NE)	841	-	474265 172013
46	Contemporary Trade Directory Entries Name: Aladdin Location: 10, Holmes Road, Reading, RG6 7BH Classification: Carpet, Curtain & Upholstery Cleaners Status: Inactive Positional Accuracy: Automatically positioned to the address	A19SE (NE)	861	-	474263 172050
47	Contemporary Trade Directory Entries Name: Get Fresh Location: 11, Linden Road, Reading, RG2 7EG Classification: Cleaning Services - Domestic Status: Active Positional Accuracy: Automatically positioned to the address	A8SW (S)	864	-	473265 170647
48	Contemporary Trade Directory Entries Name: Purco Print Location: 7, Upper Redlands Road, Reading, RG1 5JJ Classification: Printers Status: Inactive Positional Accuracy: Automatically positioned to the address	A18NW (N)	866	-	473380 172413

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
49	Contemporary Trade Directory Entries Name: Meridian Cleaning Services Location: 31, Cressingham Road, Reading, RG2 7RU Classification: Cleaning Services - Commercial Status: Inactive Positional Accuracy: Automatically positioned to the address	A7NW (SW)	871	-	472845 170895
50	Contemporary Trade Directory Entries Name: Weldale Service Station Location: 324, Wokingham Road, Reading, RG6 1JU Classification: Petrol Filling Stations - 24 Hour Status: Inactive Positional Accuracy: Automatically positioned to the address	A19SE (NE)	907	-	474348 172009
51	Contemporary Trade Directory Entries Name: Clean Uk Ltd Location: 36a, Elm Road, Reading, RG6 5TS Classification: Commercial Cleaning Services Status: Active Positional Accuracy: Automatically positioned to the address	A8SE (S)	912	-	473531 170558
51	Contemporary Trade Directory Entries Name: David Evans Valeting Location: 12, Devitt Close, Reading, RG2 8EF Classification: Garage Services Status: Inactive Positional Accuracy: Automatically positioned to the address	A8SE (S)	952	-	473547 170518
52	Contemporary Trade Directory Entries Name: Top Gear Tyres Ltd Location: Whitley Park Lane, READING, RG2 7BE Classification: Tyre Dealers Status: Active Positional Accuracy: Automatically positioned to the address	A17SW (NW)	972	-	472648 172025
52	Contemporary Trade Directory Entries Name: Laundry 2 Go Location: 60, Christchurch Road, Reading, RG2 7AZ Classification: Dry Cleaners Status: Inactive Positional Accuracy: Automatically positioned to the address	A17SW (NW)	979	-	472659 172059
53	Contemporary Trade Directory Entries Name: Spick N Span Location: Flat 12, Thames House, Regis Park Road, Reading, RG6 7AF Classification: Cleaning Services - Domestic Status: Inactive Positional Accuracy: Automatically positioned to the address	A19NW (NE)	1000	-	473960 172453
54	Fuel Station Entries Name: Weldale Sf Connect Location: 324, Wokingham Road, Reading, RG6 1JU Brand: BP Premises Type: Petrol Station Status: Open Positional Accuracy: Manually positioned to the address or location	A19SE (NE)	908	-	474348 172009
55	Points of Interest - Commercial Services Name: Northcourt Garage Ltd Location: 88-90 Northcourt Avenue, Reading, RG2 7HQ Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A7NE (SW)	637	7	473038 171031
55	Points of Interest - Commercial Services Name: Northcourt Garage Bearing Engineering Ltd Location: 88-90 Northcourt Avenue, Reading, RG2 7HQ Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A7NE (SW)	638	7	473038 171030
56	Points of Interest - Commercial Services Name: Car Wash Location: 324 Wokingham Road, Reading, RG6 1JU Category: Personal, Consumer and other Services Class Code: Vehicle Cleaning Services Positional Accuracy: Positioned to address or location	A19SE (NE)	908	7	474348 172009
56	Points of Interest - Commercial Services Name: Weldale Sf Connect Location: 324 Wokingham Road, Reading, RG6 1JU Category: Personal, Consumer and other Services Class Code: Vehicle Cleaning Services Positional Accuracy: Positioned to address or location	A19SE (NE)	935	7	474388 171996

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
57	Points of Interest - Commercial Services Name: A M Ltd Location: 149 Linden Road, Reading, RG2 7EJ Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A7SE (SW)	928	7	473127 170628
57	Points of Interest - Commercial Services Name: A M Windscreens Services Location: 149 Linden Road, Reading, RG2 7EJ Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A7SE (SW)	928	7	473127 170628
58	Points of Interest - Manufacturing and Production Name: Instrument Workshop Location: Not Supplied Category: Industrial Features Class Code: Unspecified Works Or Factories Positional Accuracy: Positioned to an adjacent address or location	A13SE (SE)	0	7	473545 171493
58	Points of Interest - Manufacturing and Production Name: Workshop Location: RG6 Category: Industrial Features Class Code: Unspecified Works Or Factories Positional Accuracy: Positioned to an adjacent address or location	A13SE (SE)	0	7	473545 171492
58	Points of Interest - Manufacturing and Production Name: Tanks Location: RG6 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to an adjacent address or location	A13SE (S)	14	7	473547 171458
58	Points of Interest - Manufacturing and Production Name: Tank Location: RG6 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to address or location	A13SW (S)	17	7	473525 171454
58	Points of Interest - Manufacturing and Production Name: Tank Location: RG6 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to address or location	A13SW (S)	17	7	473529 171454
58	Points of Interest - Manufacturing and Production Name: Tank Location: RG6 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to address or location	A13SE (S)	17	7	473533 171453
58	Points of Interest - Manufacturing and Production Name: Tank Location: RG6 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to address or location	A13SE (S)	19	7	473537 171451
59	Points of Interest - Manufacturing and Production Name: Tank Location: RG6 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to an adjacent address or location	A14NW (E)	588	7	474150 171663
60	Points of Interest - Manufacturing and Production Name: Reading Enterprise Centre Location: University of Reading, Whiteknights Road, Reading, RG6 6BU Category: Industrial Features Class Code: Business Parks and Industrial Estates Positional Accuracy: Positioned to address or location	A14NW (NE)	632	7	474123 171848
61	Points of Interest - Manufacturing and Production Name: Barnat Works Location: RG1 Category: Industrial Features Class Code: Unspecified Works Or Factories Positional Accuracy: Positioned to an adjacent address or location	A18NW (N)	826	7	473393 172375

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
62	Points of Interest - Public Infrastructure Name: Outfall Location: RG6 Category: Infrastructure and Facilities Class Code: Waste Storage, Processing and Disposal Positional Accuracy: Positioned to an adjacent address or location	A13NE (NE)	300	7	473779 171751
62	Points of Interest - Public Infrastructure Name: Weir Location: RG6 Category: Water Class Code: Weirs, Sluices and Dams Positional Accuracy: Positioned to an adjacent address or location	A13NE (NE)	313	7	473831 171713
63	Points of Interest - Public Infrastructure Name: Sluice Location: RG6 Category: Water Class Code: Weirs, Sluices and Dams Positional Accuracy: Positioned to an adjacent address or location	A18SE (NE)	384	7	473738 171878
64	Points of Interest - Public Infrastructure Name: Sluice Location: RG6 Category: Water Class Code: Weirs, Sluices and Dams Positional Accuracy: Positioned to an adjacent address or location	A18NE (N)	810	7	473816 172304
65	Points of Interest - Public Infrastructure Name: Wokingham Road Fire Station Location: Fire Station, Wokingham Road, Reading, RG6 1JU Category: Central and Local Government Class Code: Fire Brigade Stations Positional Accuracy: Positioned to address or location	A19SE (NE)	903	7	474306 172063
65	Points of Interest - Public Infrastructure Name: BP Service Station Location: 324 Wokingham Road, Reading, RG6 1JU Category: Road And Rail Class Code: Petrol and Fuel Stations Positional Accuracy: Positioned to address or location	A19SE (NE)	907	7	474348 172009
65	Points of Interest - Public Infrastructure Name: BP Service Station Location: 324 Wokingham Road, Reading, RG6 1JU Category: Road And Rail Class Code: Petrol and Fuel Stations Positional Accuracy: Positioned to address or location	A19SE (NE)	907	7	474348 172009
65	Points of Interest - Public Infrastructure Name: BP Connect Location: 324 Wokingham Road, Reading, RG6 1JU Category: Road And Rail Class Code: Petrol and Fuel Stations Positional Accuracy: Positioned to address or location	A19SE (NE)	907	7	474348 172009
65	Points of Interest - Public Infrastructure Name: Weldale Connect Location: 324 Wokingham Road, Reading, RG6 1JU Category: Road And Rail Class Code: Petrol and Fuel Stations Positional Accuracy: Positioned to address or location	A19SE (NE)	907	7	474348 172009
65	Points of Interest - Public Infrastructure Name: Weldale Sf Connect Location: 324 Wokingham Road, Reading, RG6 1JU Category: Road And Rail Class Code: Petrol and Fuel Stations Positional Accuracy: Positioned to address or location	A19SE (NE)	908	7	474348 172009
66	Points of Interest - Recreational and Environmental Name: Playground Location: Linden Road, RG2 Category: Recreational Class Code: Playgrounds Positional Accuracy: Positioned to address or location	A7SE (S)	955	7	473190 170576
66	Points of Interest - Recreational and Environmental Name: Playground Location: Not Supplied Category: Recreational Class Code: Playgrounds Positional Accuracy: Positioned to an adjacent address or location	A7SE (S)	959	7	473187 170573

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
67	Ancient Woodland Name: Redhatch Copse Reference: 1494921 Area(m ²): 37200.49 Type: Ancient and Semi-Natural Woodland	A9SW (SE)	825	8	474016 170793
68	Nitrate Vulnerable Zones Name: Not Supplied Description: Surface Water Source: Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	A12SE (SW)	384	9	473150 171300

Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices Reading Borough Council - Environmental Health Department Wokingham District Council - Environmental Health Department South Oxfordshire District Council - Environmental Health Department West Berkshire Council - Environmental Health Department	April 2014 February 2013 January 2015 November 2014	Annual Rolling Update Annual Rolling Update Annual Rolling Update Annual Rolling Update
Discharge Consents Environment Agency - Thames Region	January 2017	Quarterly
Enforcement and Prohibition Notices Environment Agency - Thames Region	March 2013	As notified
Integrated Pollution Controls Environment Agency - Thames Region	October 2008	Not Applicable
Integrated Pollution Prevention And Control Environment Agency - South East Region - West Thames Area Environment Agency - Thames Region	January 2017 January 2017	Quarterly Quarterly
Local Authority Integrated Pollution Prevention And Control South Oxfordshire District Council - Environmental Health Department Wokingham District Council - Environmental Health Department West Berkshire Council - Environmental Health Department Reading Borough Council - Environmental Health Department	June 2014 June 2014 June 2015 October 2014	Annual Rolling Update Annual Rolling Update Annual Rolling Update Annual Rolling Update
Local Authority Pollution Prevention and Controls South Oxfordshire District Council - Environmental Health Department Wokingham District Council - Environmental Health Department West Berkshire Council - Environmental Health Department Reading Borough Council - Environmental Health Department	June 2014 June 2014 June 2015 October 2014	Annual Rolling Update Annual Rolling Update Bi-Annually Annual Rolling Update
Local Authority Pollution Prevention and Control Enforcements South Oxfordshire District Council - Environmental Health Department Wokingham District Council - Environmental Health Department West Berkshire Council - Environmental Health Department Reading Borough Council - Environmental Health Department	June 2014 June 2014 June 2015 October 2014	Annual Rolling Update Annual Rolling Update Annual Rolling Update Annual Rolling Update
Nearest Surface Water Feature Ordnance Survey	July 2012	Quarterly
Pollution Incidents to Controlled Waters Environment Agency - Thames Region	September 1999	Not Applicable
Prosecutions Relating to Authorised Processes Environment Agency - Thames Region	March 2013	As notified
Prosecutions Relating to Controlled Waters Environment Agency - Thames Region	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 East Region - West Thames Area Environment Agency - Thames Region - South East Area Environment Agency - Thames Region - West Area	January 2017 January 2017 January 2017	Quarterly Quarterly Quarterly
Water Abstractions Environment Agency - Thames Region	October 2016	Quarterly
Water Industry Act Referrals Environment Agency - Thames Region	January 2017	Quarterly

Agency & Hydrological	Version	Update Cycle
Groundwater Vulnerability Environment Agency - Head Office	April 2015	Not Applicable
Drift Deposits Environment Agency - Head Office	January 1999	Not Applicable
Bedrock Aquifer Designations British Geological Survey - National Geoscience Information Service	August 2015	As notified
Superficial Aquifer Designations British Geological Survey - National Geoscience Information Service	August 2015	As notified
Source Protection Zones Environment Agency - Head Office	February 2017	Quarterly
Extreme Flooding from Rivers or Sea without Defences Environment Agency - Head Office	November 2016	Quarterly
Flooding from Rivers or Sea without Defences Environment Agency - Head Office	November 2016	Quarterly
Areas Benefiting from Flood Defences Environment Agency - Head Office	November 2016	Quarterly
Flood Water Storage Areas Environment Agency - Head Office	November 2016	Quarterly
Flood Defences Environment Agency - Head Office	November 2016	Quarterly
Detailed River Network Lines Environment Agency - Head Office	September 2014	Annually
Detailed River Network Offline Drainage Environment Agency - Head Office	March 2012	Annually
Surface Water 1 in 30 year Flood Extent Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 100 year Flood Extent Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 1000 year Flood Extent Environment Agency - Head Office	October 2013	As notified
Surface Water Suitability Environment Agency - Head Office	October 2013	As notified
BGS Groundwater Flooding Susceptibility British Geological Survey - National Geoscience Information Service	May 2013	Annually

Waste	Version	Update Cycle
BGS Recorded Landfill Sites British Geological Survey - National Geoscience Information Service	June 1996	Not Applicable
Historical Landfill Sites Environment Agency - Head Office	January 2017	Quarterly
Integrated Pollution Control Registered Waste Sites Environment Agency - Thames Region	October 2008	Not Applicable
Licensed Waste Management Facilities (Landfill Boundaries) Environment Agency - South East Region - West Thames Area Environment Agency - Thames Region - South East Area Environment Agency - Thames Region - West Area	August 2016 August 2016 August 2016	Quarterly Quarterly Quarterly
Licensed Waste Management Facilities (Locations) Environment Agency - South East Region - West Thames Area Environment Agency - Thames Region - South East Area Environment Agency - Thames Region - West Area	January 2017 January 2017 January 2017	Quarterly Quarterly Quarterly
Local Authority Landfill Coverage Oxfordshire County Council Reading Borough Council - Planning South Oxfordshire District Council - Environmental Health Department West Berkshire Council - Environmental Health Department Wokingham District Council - Environmental Health Department	May 2000 May 2000 May 2000 May 2000 May 2000	Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable
Local Authority Recorded Landfill Sites Oxfordshire County Council Reading Borough Council - Planning South Oxfordshire District Council - Environmental Health Department West Berkshire Council - Environmental Health Department Wokingham District Council - Environmental Health Department	May 2000 May 2000 May 2000 May 2000 October 2005	Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable
Potentially Infilled Land (Non-Water) Landmark Information Group Limited	December 1999	Not Applicable
Potentially Infilled Land (Water) Landmark Information Group Limited	December 1999	Not Applicable
Registered Landfill Sites Environment Agency - Thames Region - South East Area Environment Agency - Thames Region - West Area	March 2003 March 2003	Not Applicable Not Applicable
Registered Waste Transfer Sites Environment Agency - Thames Region - South East Area Environment Agency - Thames Region - West Area	March 2003 March 2003	Not Applicable Not Applicable
Registered Waste Treatment or Disposal Sites Environment Agency - Thames Region - South East Area Environment Agency - Thames Region - West Area	March 2003 March 2003	Not Applicable Not Applicable

Hazardous Substances	Version	Update Cycle
Control of Major Accident Hazards Sites (COMAH) Health and Safety Executive	July 2016	Bi-Annually
Explosive Sites Health and Safety Executive	September 2016	Bi-Annually
Notification of Installations Handling Hazardous Substances (NIHHS) Health and Safety Executive	November 2000	Not Applicable
Planning Hazardous Substance Enforcements Oxfordshire County Council South Oxfordshire District Council - Planning Department (West) West Berkshire Council Wokingham District Council Reading Borough Council - Planning	February 2016 February 2016 February 2016 February 2016 May 2016	Annual Rolling Update Annual Rolling Update Annual Rolling Update Annual Rolling Update Annual Rolling Update
Planning Hazardous Substance Consents Oxfordshire County Council South Oxfordshire District Council - Planning Department (West) West Berkshire Council Wokingham District Council Reading Borough Council - Planning	February 2016 February 2016 February 2016 February 2016 May 2016	Annual Rolling Update Annual Rolling Update Annual Rolling Update Annual Rolling Update 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	October 2015	As notified
BGS Recorded Mineral Sites British Geological Survey - National Geoscience Information Service	October 2016	Bi-Annually
CBSCB Compensation District Cheshire Brine Subsidence Compensation Board (CBSCB)	August 2011	Not Applicable
Coal Mining Affected Areas The Coal Authority - Property Searches	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	May 2015	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	January 2017	Quarterly
Fuel Station Entries Catalist Ltd - Experian	November 2016	Quarterly
Gas Pipelines National Grid	July 2014	Quarterly
Points of Interest - Commercial Services PointX	December 2016	Quarterly
Points of Interest - Education and Health PointX	December 2016	Quarterly
Points of Interest - Manufacturing and Production PointX	December 2016	Quarterly
Points of Interest - Public Infrastructure PointX	December 2016	Quarterly
Points of Interest - Recreational and Environmental PointX	December 2016	Quarterly
Underground Electrical Cables National Grid	December 2015	Bi-Annually

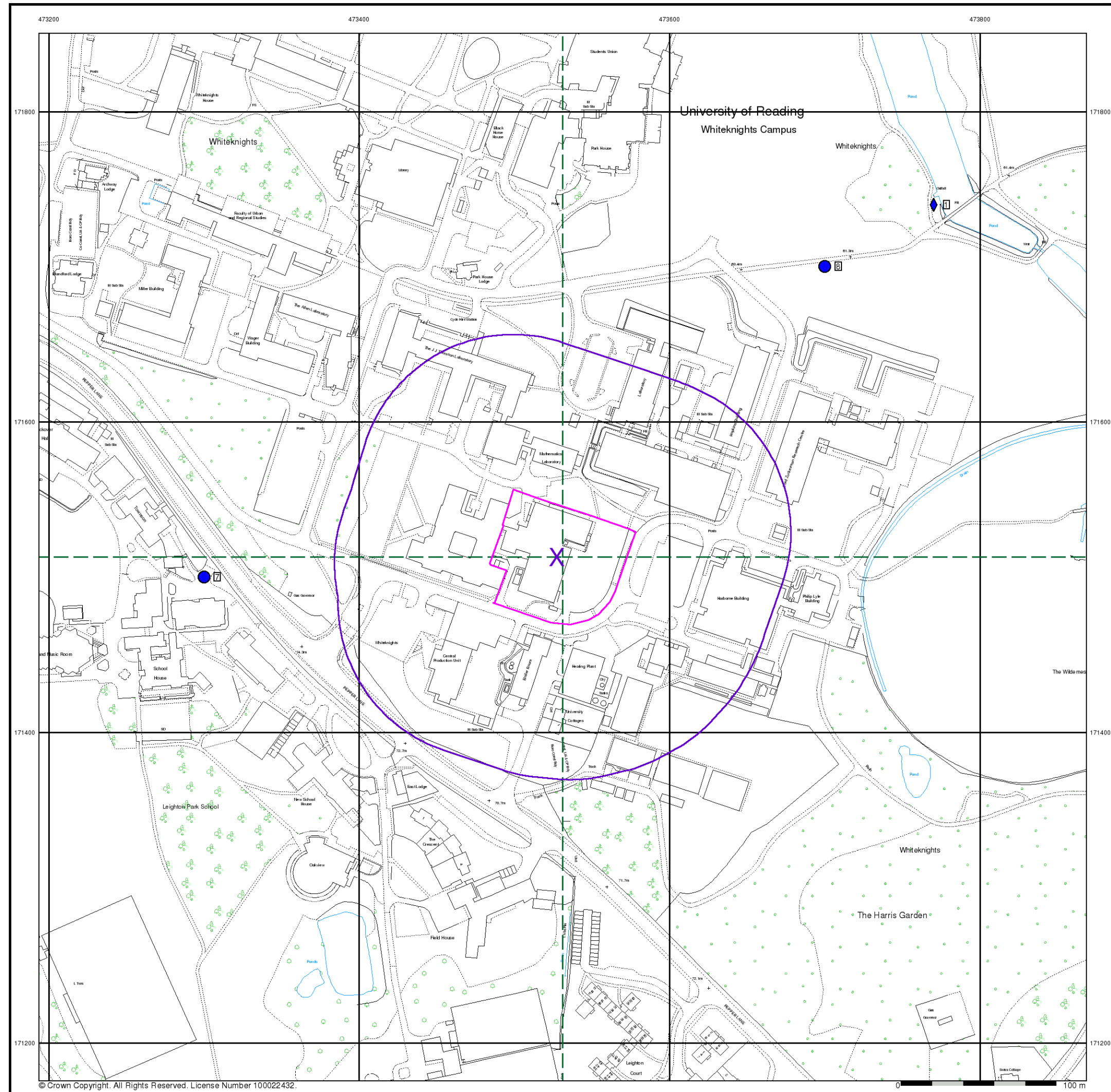
Sensitive Land Use	Version	Update Cycle
Ancient Woodland Natural England	August 2016	Bi-Annually
Areas of Adopted Green Belt South Oxfordshire District Council Wokingham District Council	February 2017 February 2017	As notified As notified
Areas of Unadopted Green Belt South Oxfordshire District Council Wokingham District Council	February 2017 February 2017	As notified As notified
Areas of Outstanding Natural Beauty Natural England	January 2017	Bi-Annually
Environmentally Sensitive Areas Natural England	January 2017	Annually
Forest Parks Forestry Commission	April 1997	Not Applicable
Local Nature Reserves Natural England	January 2017	Bi-Annually
Marine Nature Reserves Natural England	January 2017	Bi-Annually
National Nature Reserves Natural England	January 2017	Bi-Annually
National Parks Natural England	February 2017	Bi-Annually
Nitrate Sensitive Areas Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	April 2016	Not Applicable
Nitrate Vulnerable Zones Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	October 2015	Annually
Ramsar Sites Natural England	January 2017	Bi-Annually
Sites of Special Scientific Interest Natural England	January 2017	Bi-Annually
Special Areas of Conservation Natural England	January 2017	Bi-Annually
Special Protection Areas Natural England	January 2017	Bi-Annually
World Heritage Sites English Heritage - National Monument Record Centre	September 2015	Bi-Annually

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	 British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL
Centre for Ecology and Hydrology	 Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL
Natural Resources Wales	
Scottish Natural Heritage	
Natural England	
Public Health England	
Ove Arup	
Peter Brett Associates	

Contact	Name and Address	Contact Details
2	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
3	Environment Agency - National Customer Contact Centre (NCCC) PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 03708 506 506 Email: enquiries@environment-agency.gov.uk
4	Reading Borough Council - Environmental Health Department Civic Centre, Reading, Hampshire, RG1 7DT	Telephone: 0118 939 9099 Fax: 0118 958 9770 Website: www.reading.gov.uk
5	Wokingham District Council - Environmental Health Department Council Offices, Shute End, Wokingham, Surrey, RG40 1BN	Telephone: 0118 974 6000 Fax: 0118 974 5053 Website: www.wokingham.gov.uk
6	Reading Borough Council - Planning Civic Centre, READING, Hampshire, RG1 7TD	Telephone: 0118 939 0900 Fax: 0118 958 9770 Website: www.reading.gov.uk
7	PointX 7 Abbey Court, Eagle Way, Sowton, Exeter, Devon, EX2 7HY	Website: www.pointx.co.uk
8	Natural England County Hall, Spetchley Road, Worcester, WR5 2NP	Telephone: 0300 060 3900 Email: enquiries@naturalengland.org.uk Website: www.naturalengland.org.uk
9	Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA) Government Buildings, Otley Road, Lawnswood, Leeds, West Yorkshire, LS16 5QT	Telephone: 0113 2613333 Fax: 0113 230 0879
10	Environment Agency - Head Office Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol, Avon, BS32 4UD	Telephone: 01454 624400 Fax: 01454 624409
-	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.



- General

Specified Site

Specified Buffer(s)

Bearing Reference Point

Map ID

Several of Type at Location

Pylon

Overhead Transmission Line
- 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 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

Hazardous Substances

COMAH Site

Explosive Site

NIHHS Site

Planning Hazardous Substance Consent

Planning Hazardous Substance Enforcement

BGS Recorded Mineral Site

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

Potentially Infilled Land (Non-water)

Potentially Infilled Land (Non-water)

Potentially Infilled Land (Non-water)

Potentially Infilled Land (Water)

Potentially Infilled Land (Water)

Potentially Infilled Land (Water)

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
- Site Sensitivity Map - Segment A13

A21A22A23A24A25

A16A17A18A19A20

A11A12A13A14A15

A6A7A8A9A10

A1A2A3A4A5

N
- Order Details

Order Number:

115805868_1_1

Customer Ref:

60441574/M001.003

National Grid Reference:

473530, 171510

Slice:

A

Site Area (Ha):

0.56

Plot Buffer (m):

100
- Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING, RG6 6UR
- Landmark[®]

INFORMATION GROUP

Tel:

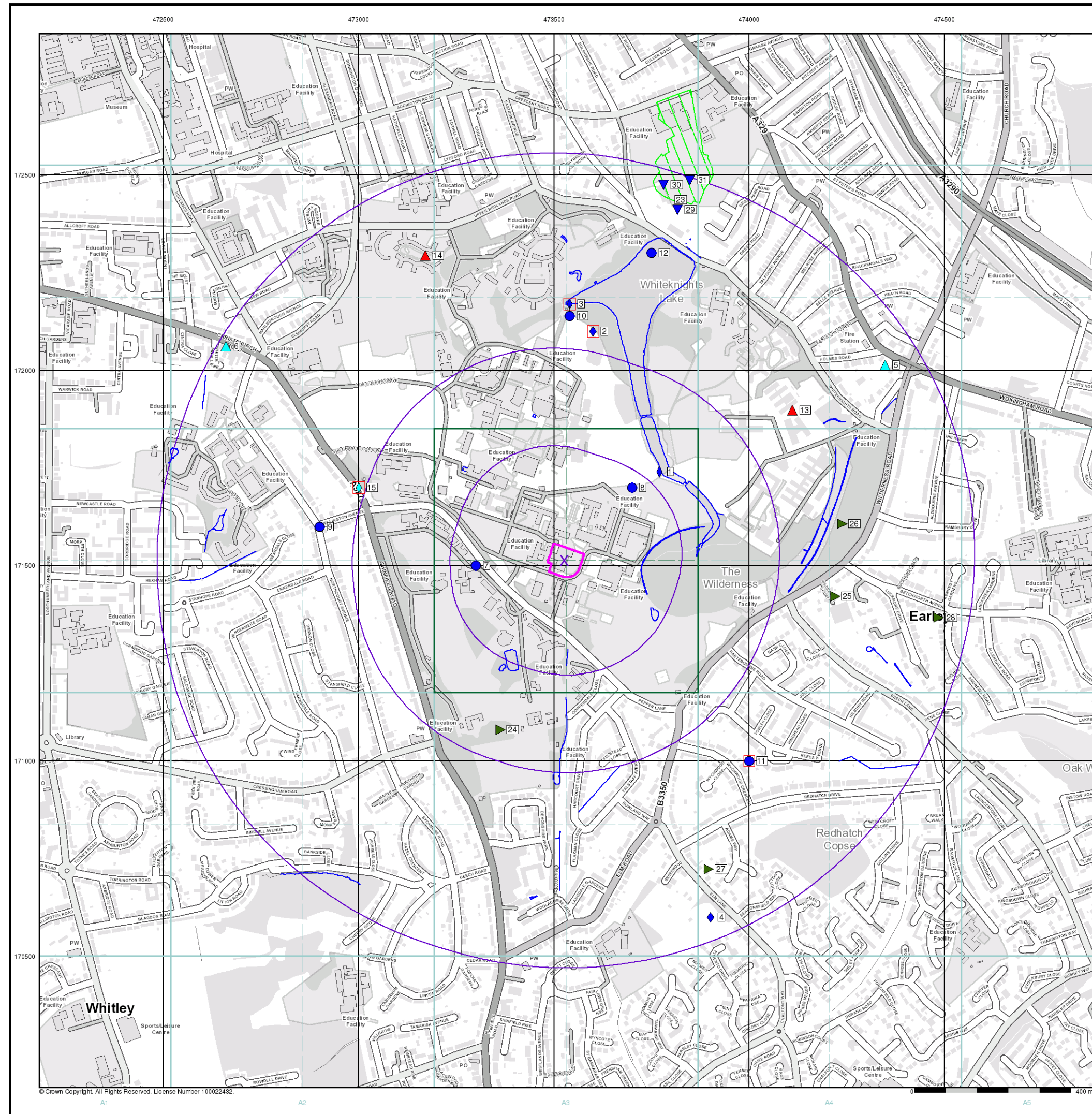
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Fax:

0844 844 9951

Web:

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- A Landmark Information Group Service v50.0 27-Feb-2017 Page 1 of 1



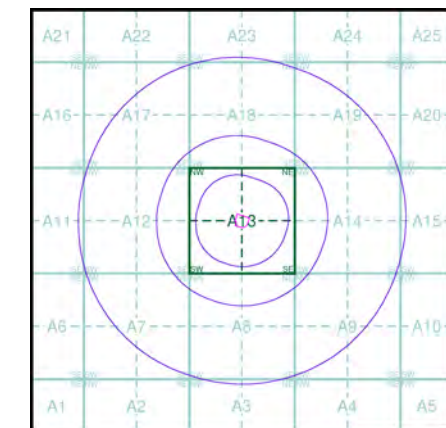
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LANDMARK INFORMATION GROUP[®]

- 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
- Hazardous Substances**
- COMAH Site
 - Explosive Site
 - NIHHS Site
 - Planning Hazardous Substance Consent
 - Planning Hazardous Substance Enforcement
 - BGS Recorded Mineral Site
- 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
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - 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

Site Sensitivity Map - Slice A



Order Details

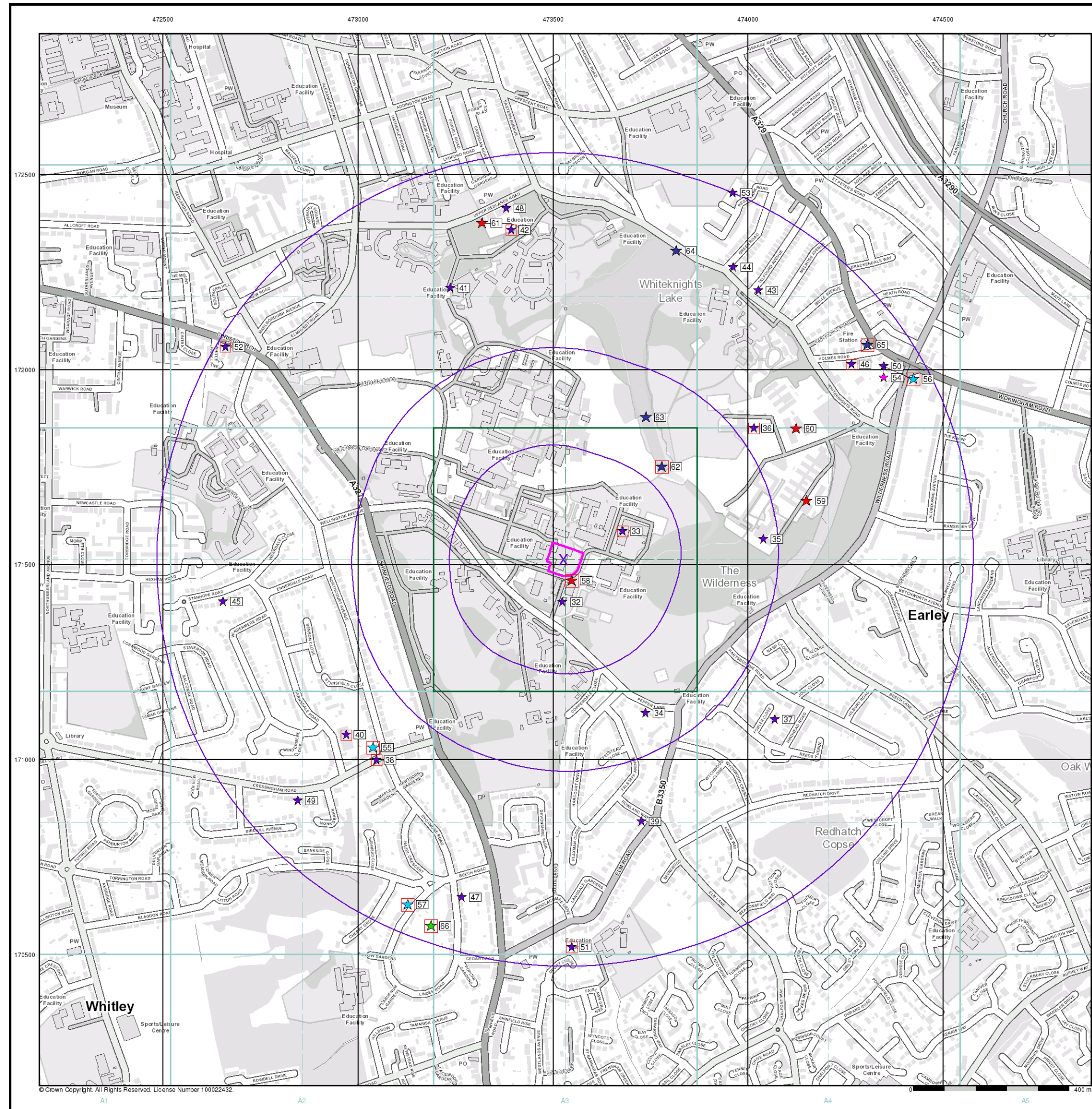
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Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road,
READING, RG6 6UR

Landmark
INFORMATION GROUP

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



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Industrial Land Use Map

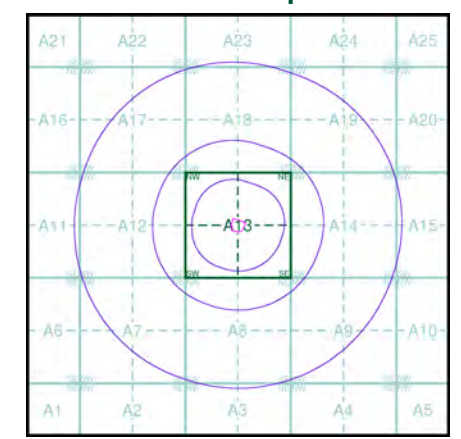
General

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

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry
- Gas Pipeline
- Points of Interest - Commercial Services
- Points of Interest - Education and Health
- Points of Interest - Manufacturing and Production
- Points of Interest - Public Infrastructure
- Points of Interest - Recreational and Environmental
- Underground Electrical Cables

Industrial Land Use Map - Slice A



Order Details

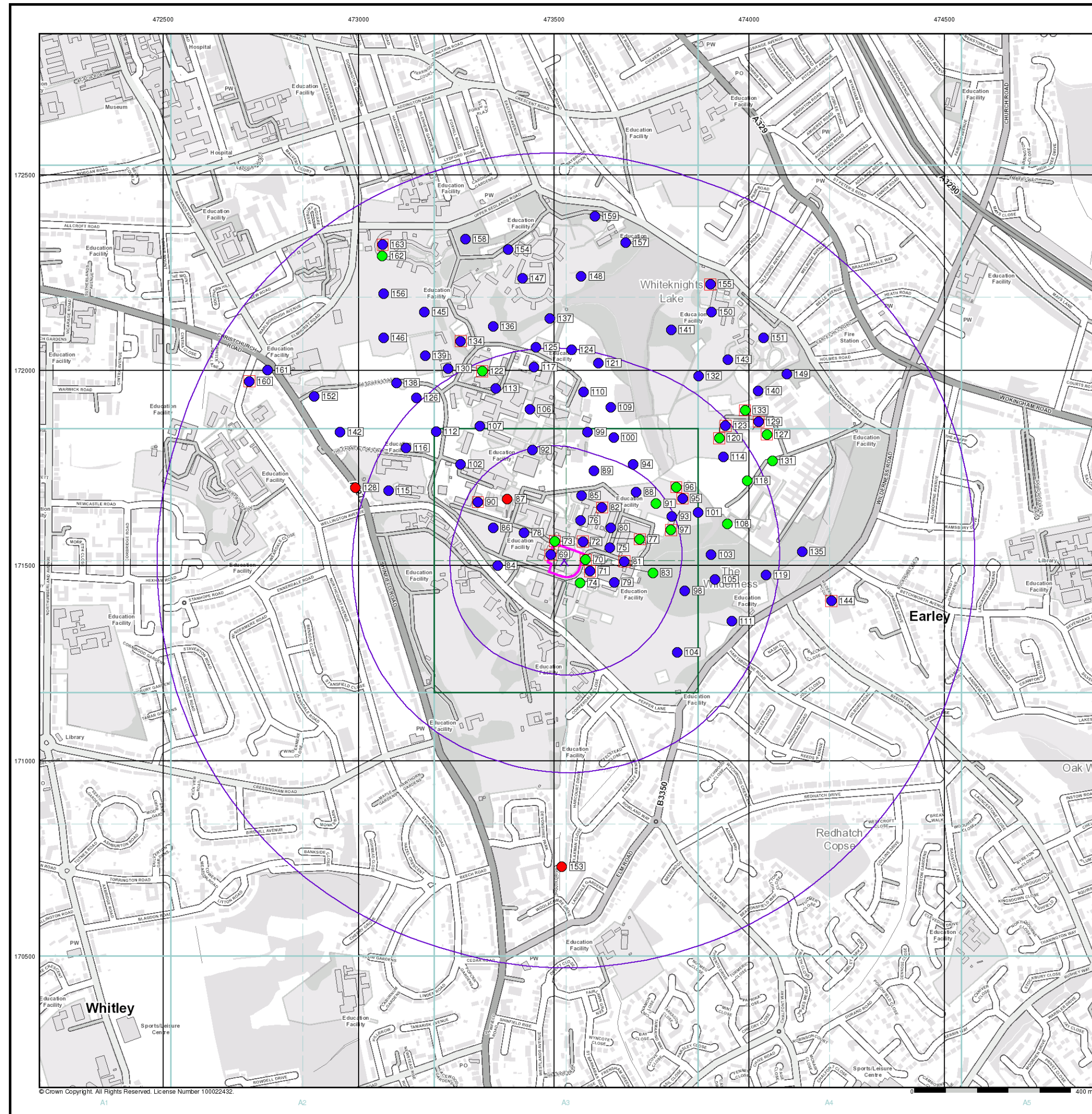
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING, RG6 6UR

Landmark
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Tel: 0844 844 9952
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General

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

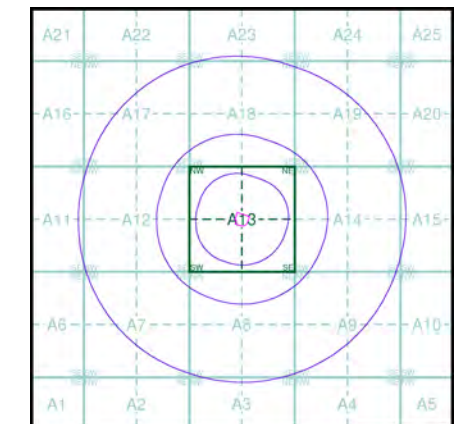
Agency and Hydrological (Boreholes)

- 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

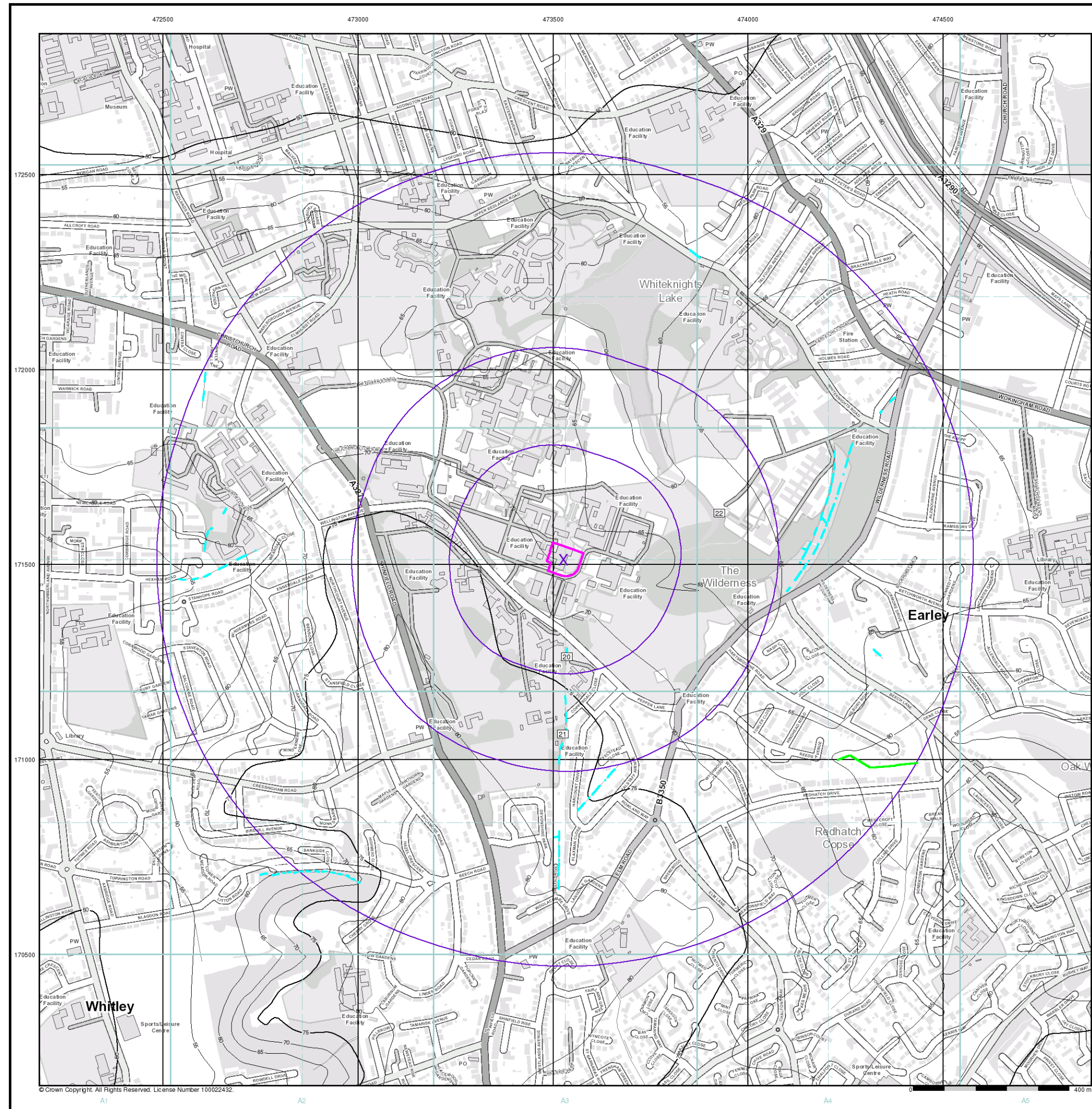


Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

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General

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

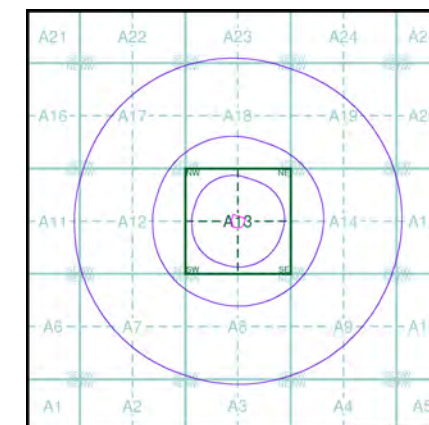
Detailed River Network Data

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

Contours (height in metres)

- Standard Contour 105 100 95
- Master Contour
- Spot Height 167.3
- MLW Mean Low Water
- MHW Mean High Water

EAN/RW Detailed River Network Map - Slice A

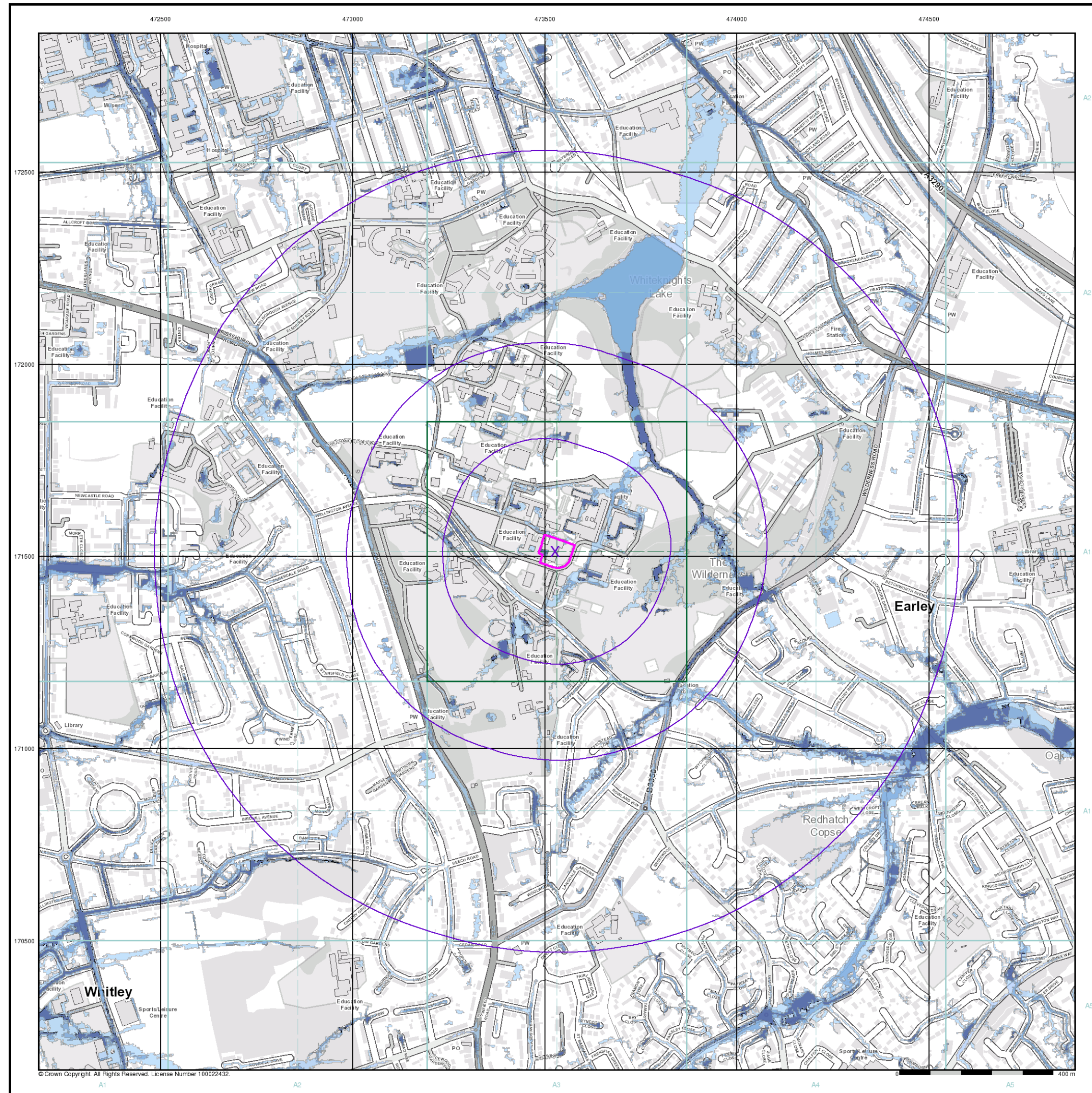


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General

- Specified Site
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- Bearing Reference Point

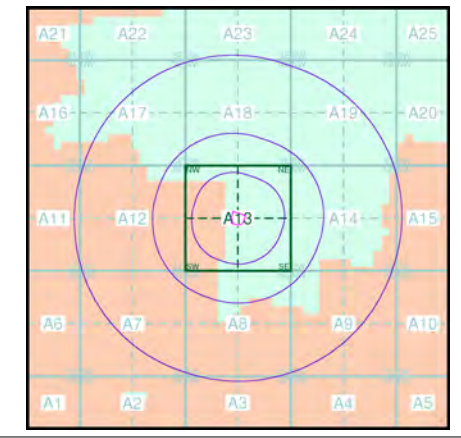
Risk of Flooding from Surface Water

- 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

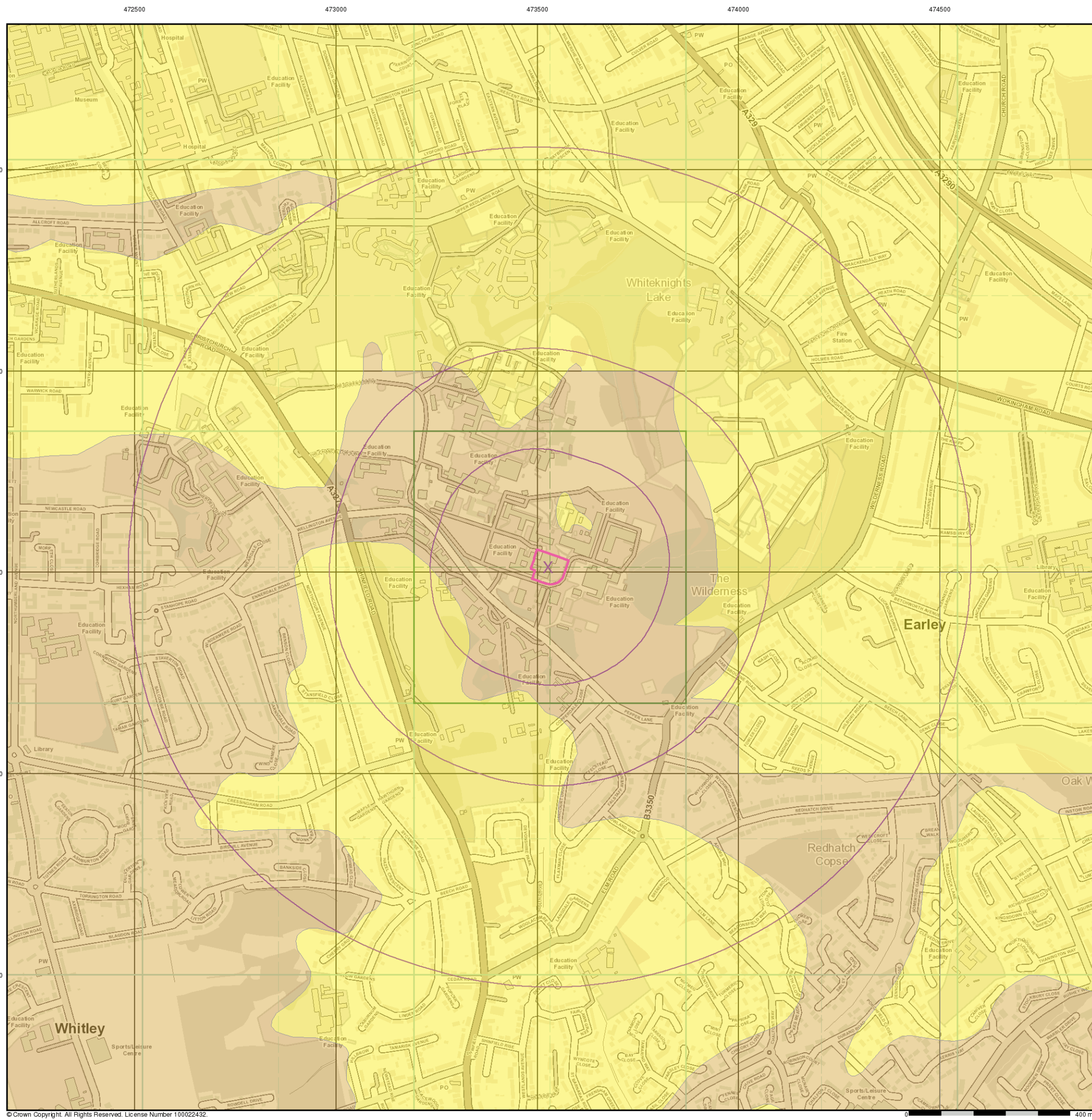


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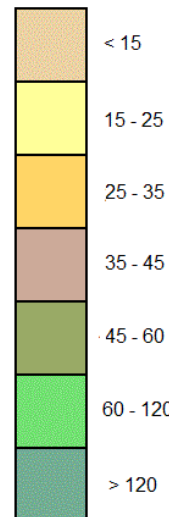


General

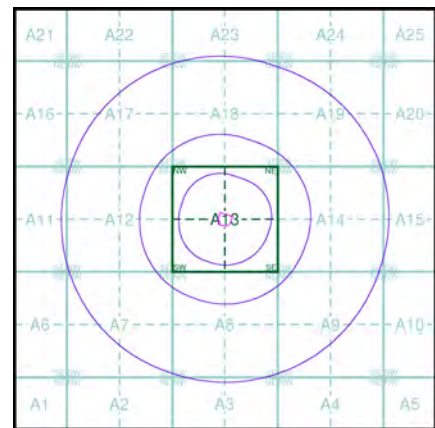
Specified Site Specified Buffer(s) Bearing Reference Point

Estimated Soil Chemistry Arsenic

Arsenic Concentrations mg/kg



Estimated Soil Chemistry Arsenic - Slice A

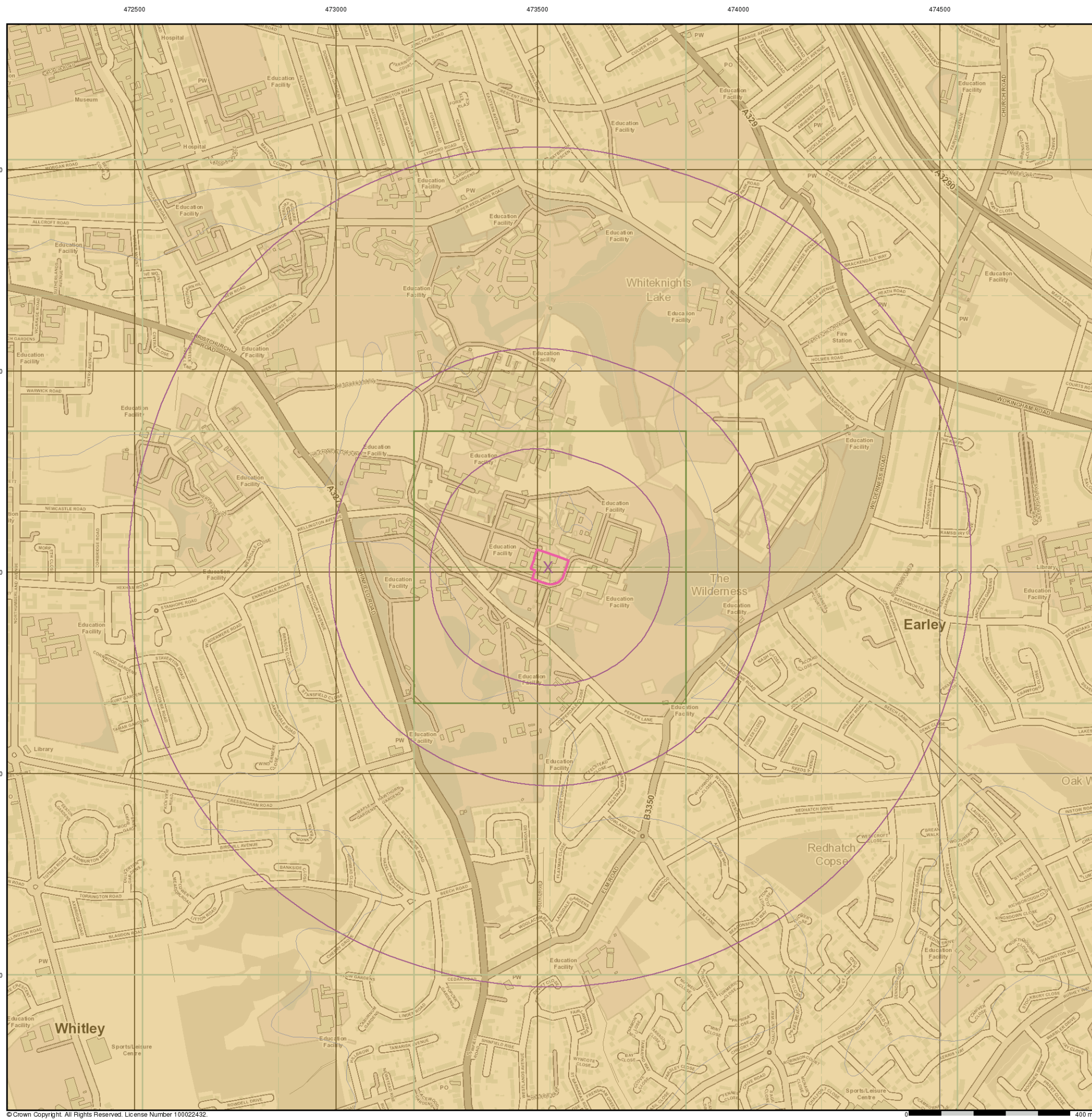


Order Details

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Slice: A
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Site Details

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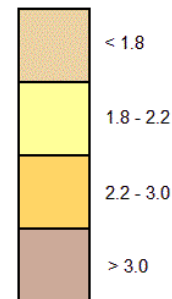


General

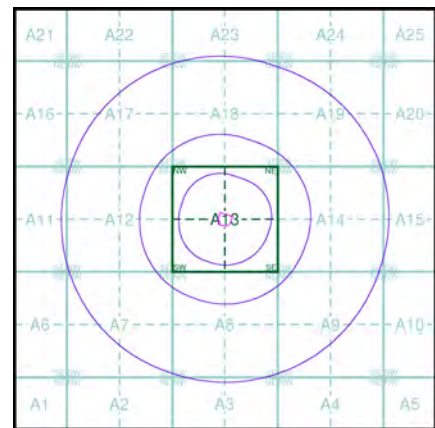
Specified Site Specified Buffer(s) Bearing Reference Point

Estimated Soil Chemistry Cadmium

Cadmium Concentrations mg/kg



Estimated Soil Chemistry Cadmium - Slice A

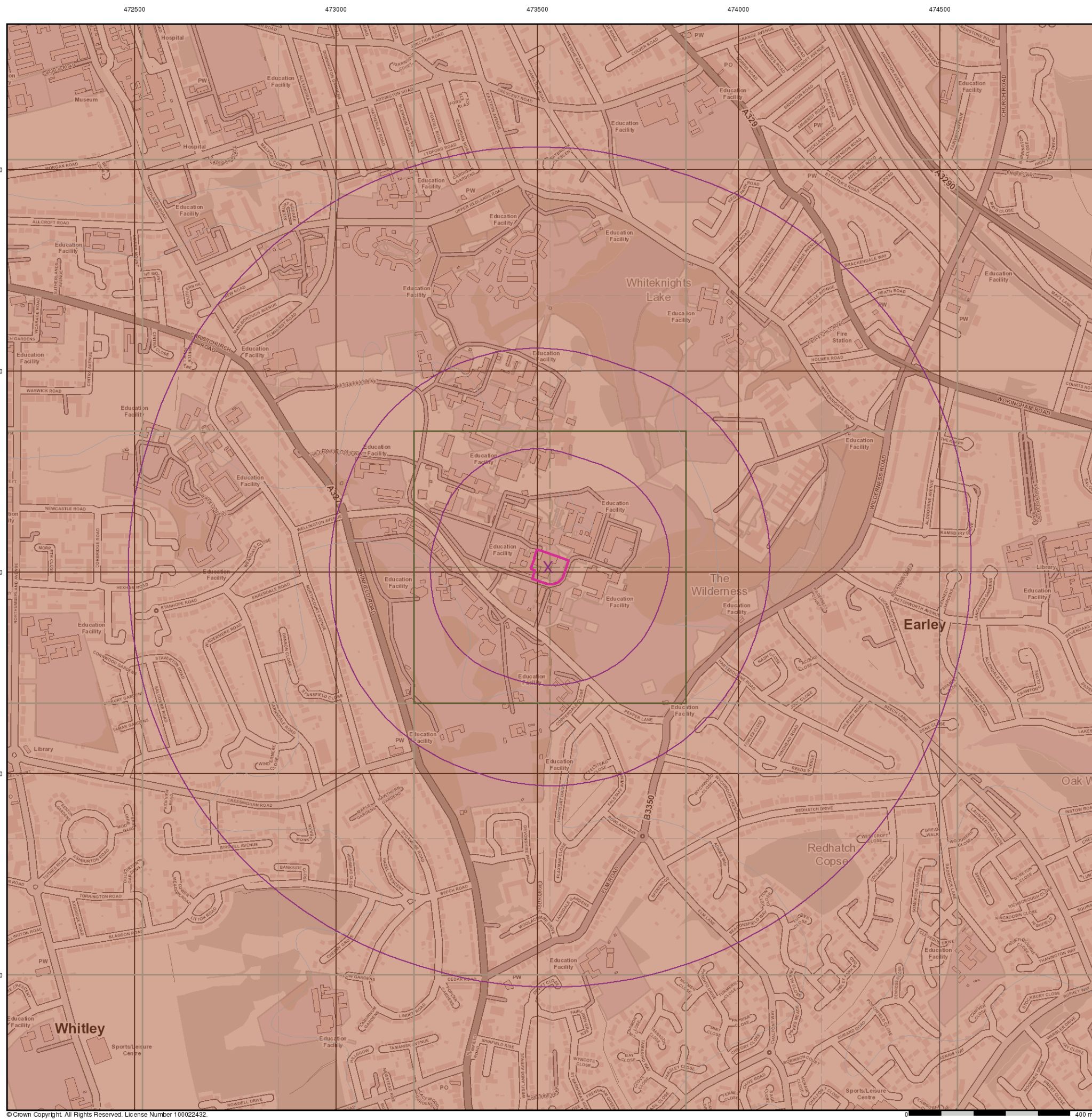


Order Details

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Site Details

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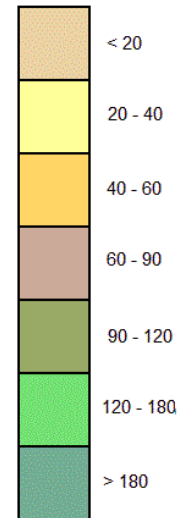
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General

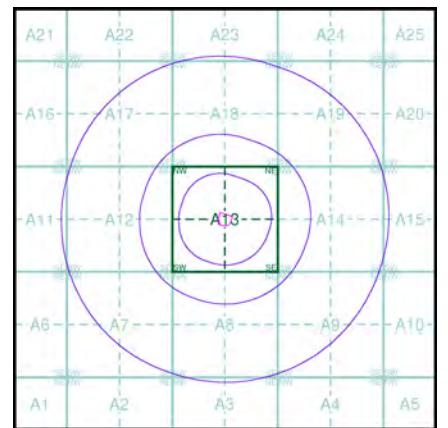
Specified Site Specified Buffer(s) Bearing Reference Point

Estimated Soil Chemistry Chromium

Chromium Concentrations mg/kg



Estimated Soil Chemistry Chromium - Slice A

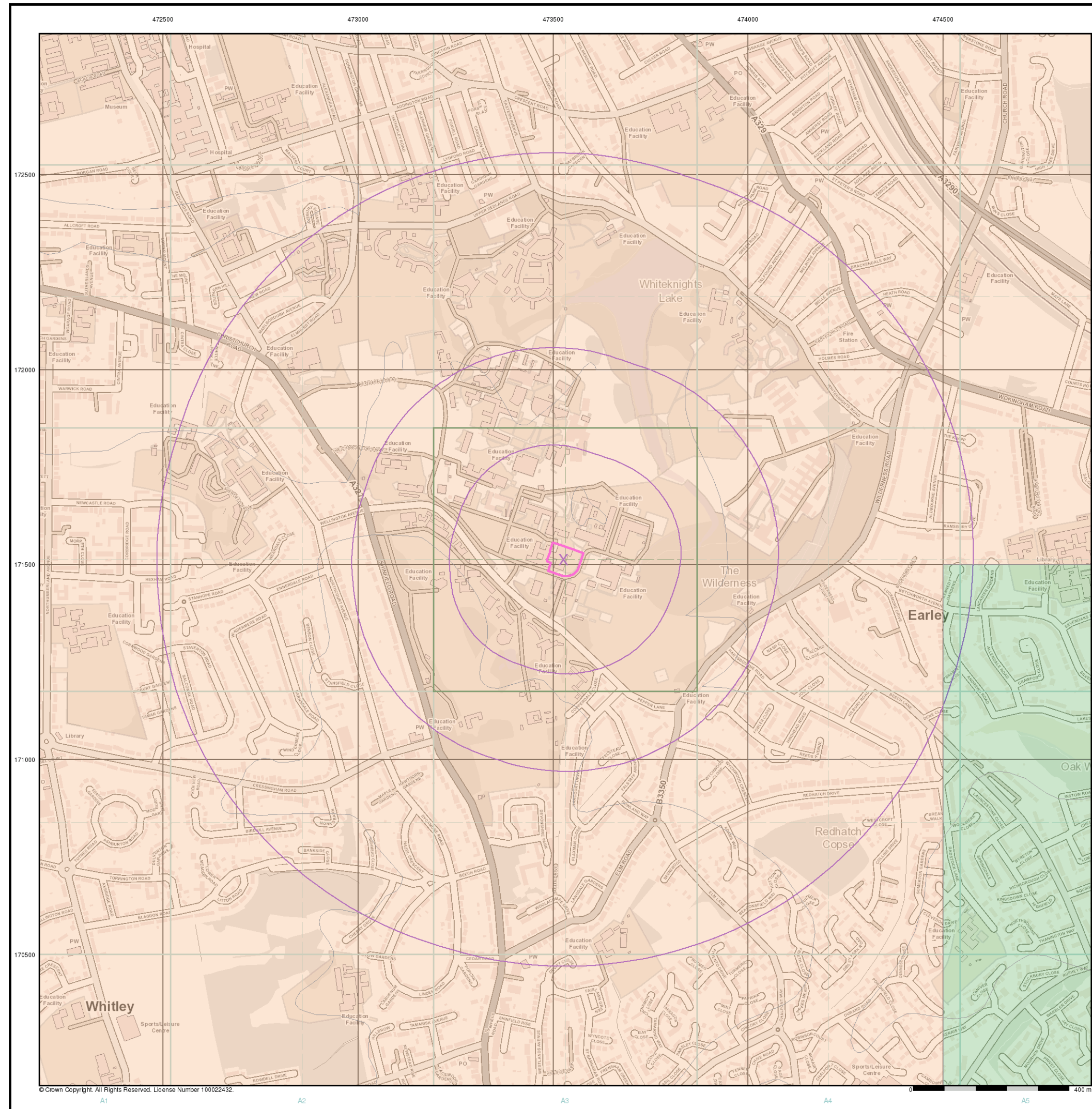


Order Details

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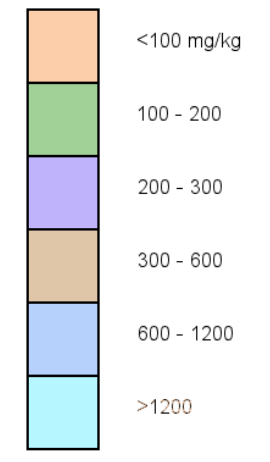


General

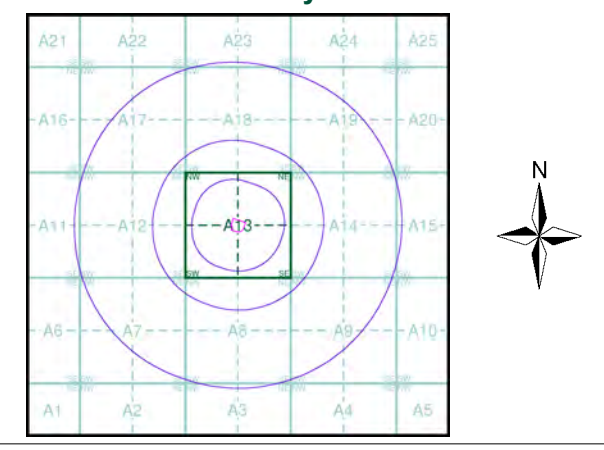
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Estimated Soil Chemistry Lead

Lead Concentrations mg/kg



Estimated Soil Chemistry Lead - Slice A

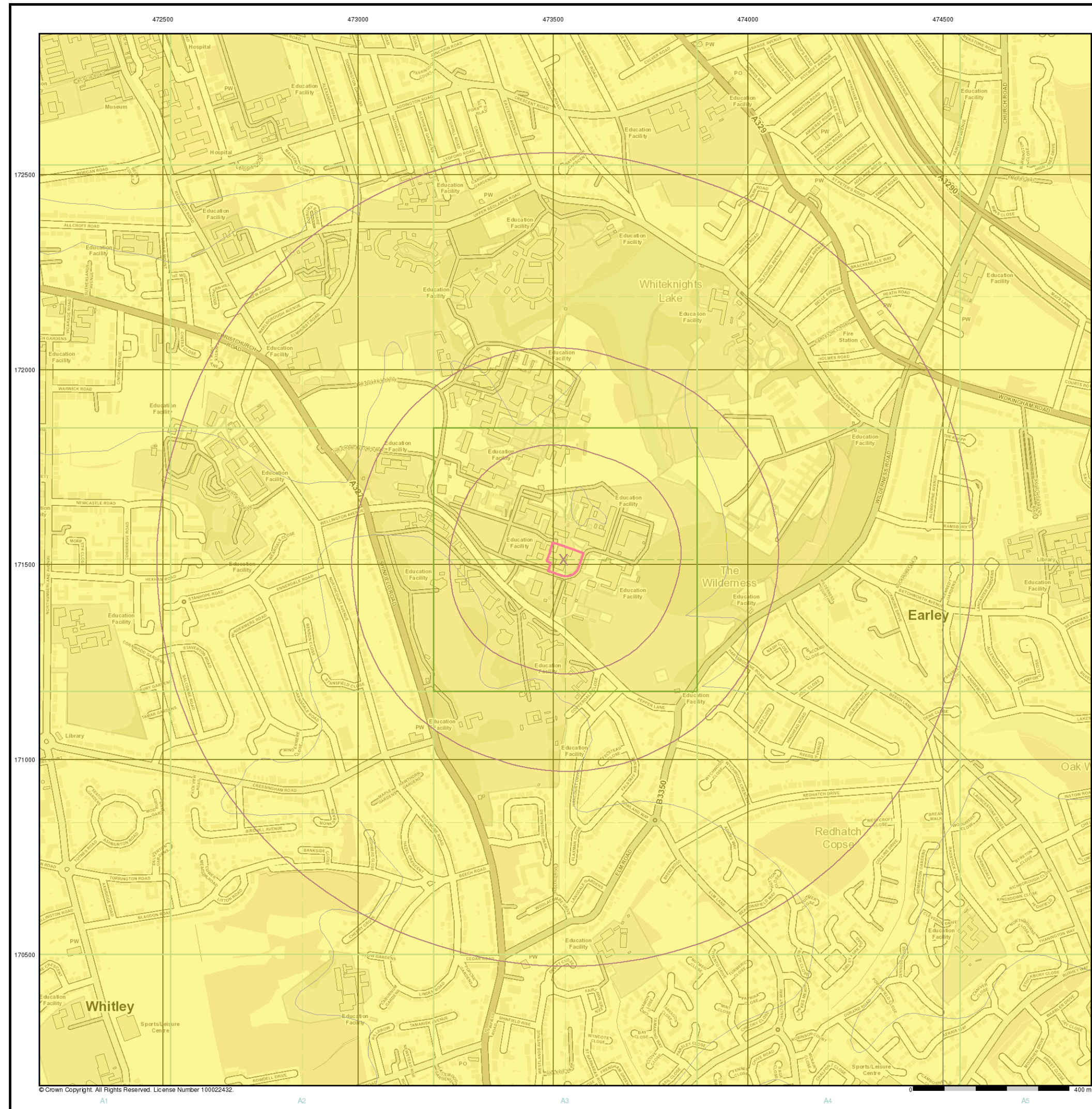


Order Details

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Customer Ref: 60441574/M001.003
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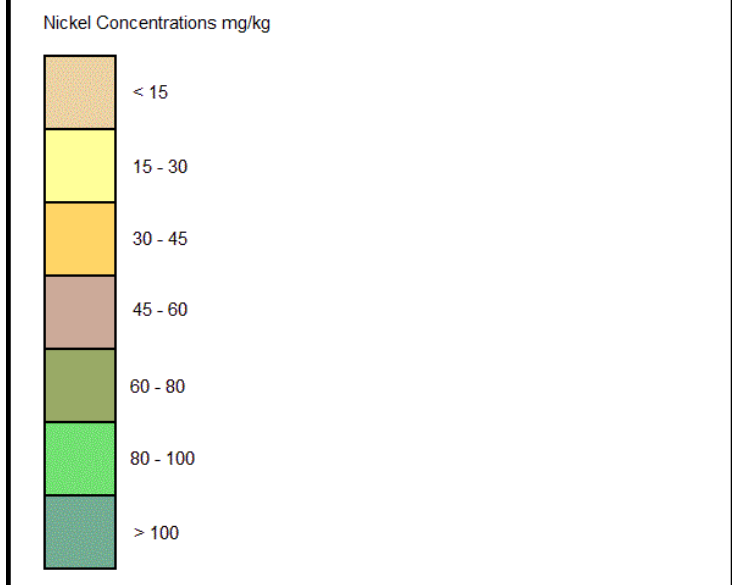


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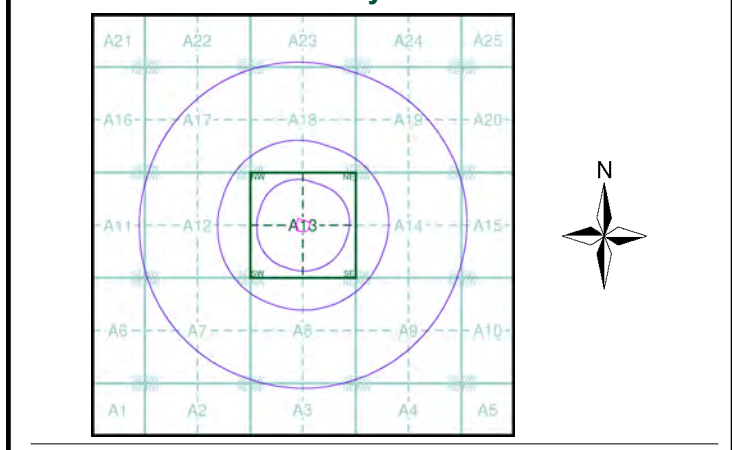
General

Specified Site Specified Buffer(s) Bearing Reference Point

Estimated Soil Chemistry Nickel



Estimated Soil Chemistry Nickel - Slice A



Order Details

Order Details: 115805868_1_1
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Site Details

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Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	WMGR	Infilled Ground	Artificial Deposit	Cenozoic - Cenozoic
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	WGR	Worked Ground (Undivided)	Void	Holocene - Holocene

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Flandrian
	KPGR	Kempton Park Gravel Formation	Sand and Gravel	Devensian - Devensian
	TPGR	Taplow Gravel Formation	Sand and Gravel	Wolstonian - Wolstonian
	BHT	Boyn Hill Gravel Member	Sand and Gravel	Wolstonian - Hoxnian
	HEAD	Head	Clay, Silt, Sand and Gravel	Quaternary - Quaternary
	RTD6	River Terrace Deposits, 6	Sand and Gravel	Quaternary - Quaternary
	RTD4	River Terrace Deposits, 4	Sand and Gravel	Quaternary - Quaternary
	BRK	Brickearth	Clay, Silt and Sand	Quaternary - Quaternary
	RTD2	River Terrace Deposits, 2	Sand and Gravel	Quaternary - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LC	London Clay Formation	Clay, Silt and Sand	Eocene - Eocene
	LMBE	Lambeth Group	Clay, Silt and Sand	Paleocene - Paleocene
	SNCK	Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated)	Chalk	Campanian - Coniacian

Geology 1:50,000 Maps

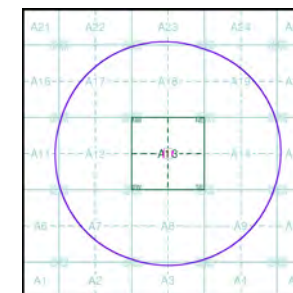
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	1
Map Sheet No:	268
Map Name:	Reading
Map Date:	2000
Bedrock Geology:	Available
Superficial Geology:	Available
Artificial Geology:	Available
Faults:	Not Supplied
Landslip:	Not Available
Rock Segments:	Not Supplied

Geology 1:50,000 Maps - Slice A

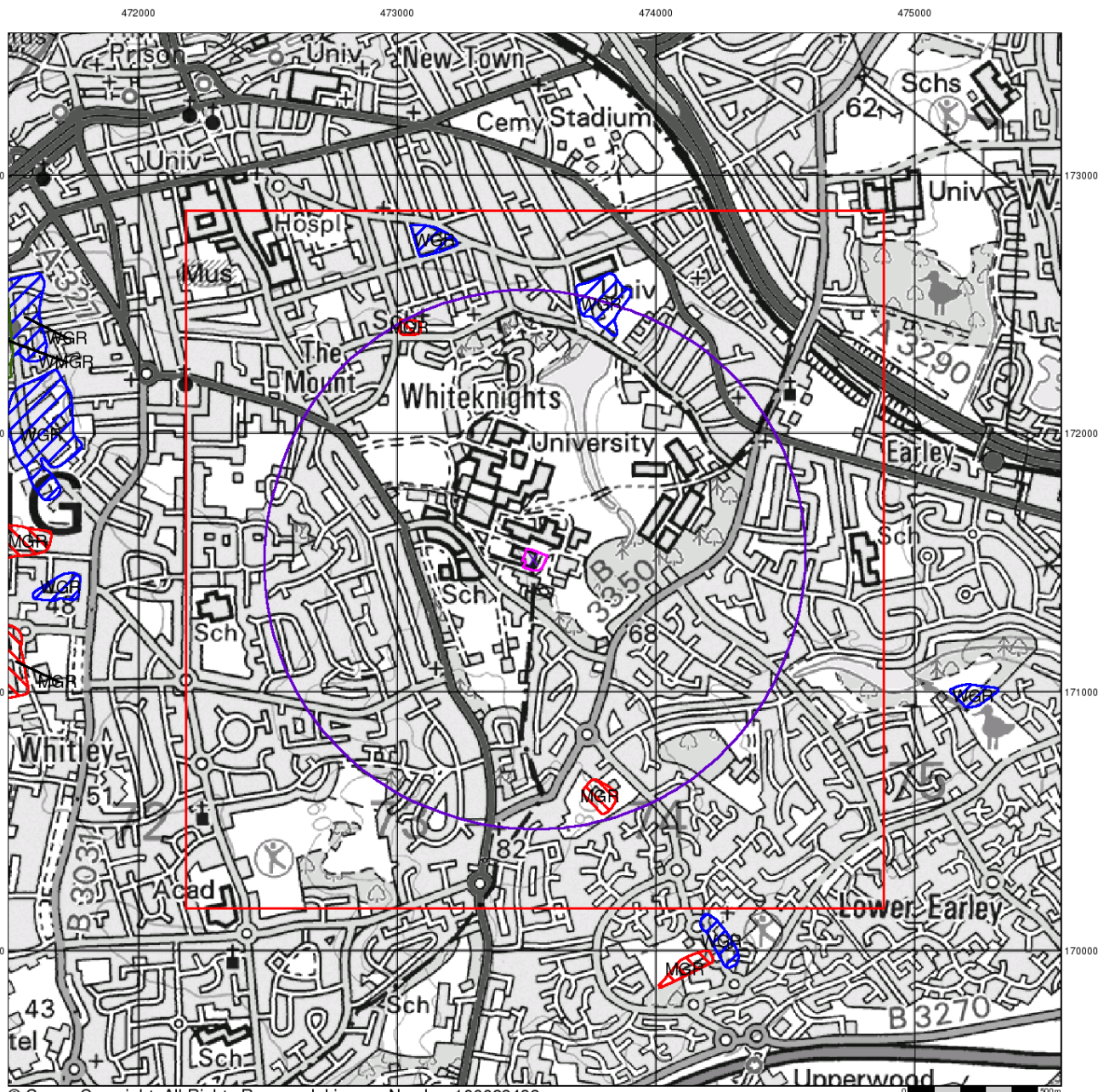


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Artificial Ground and Landslip

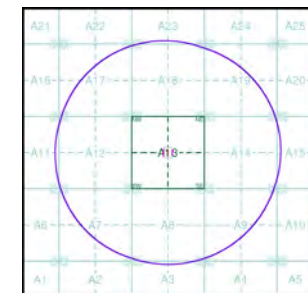
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



Order Details:

Order Number: 115805868 1 1
Customer Reference: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details:

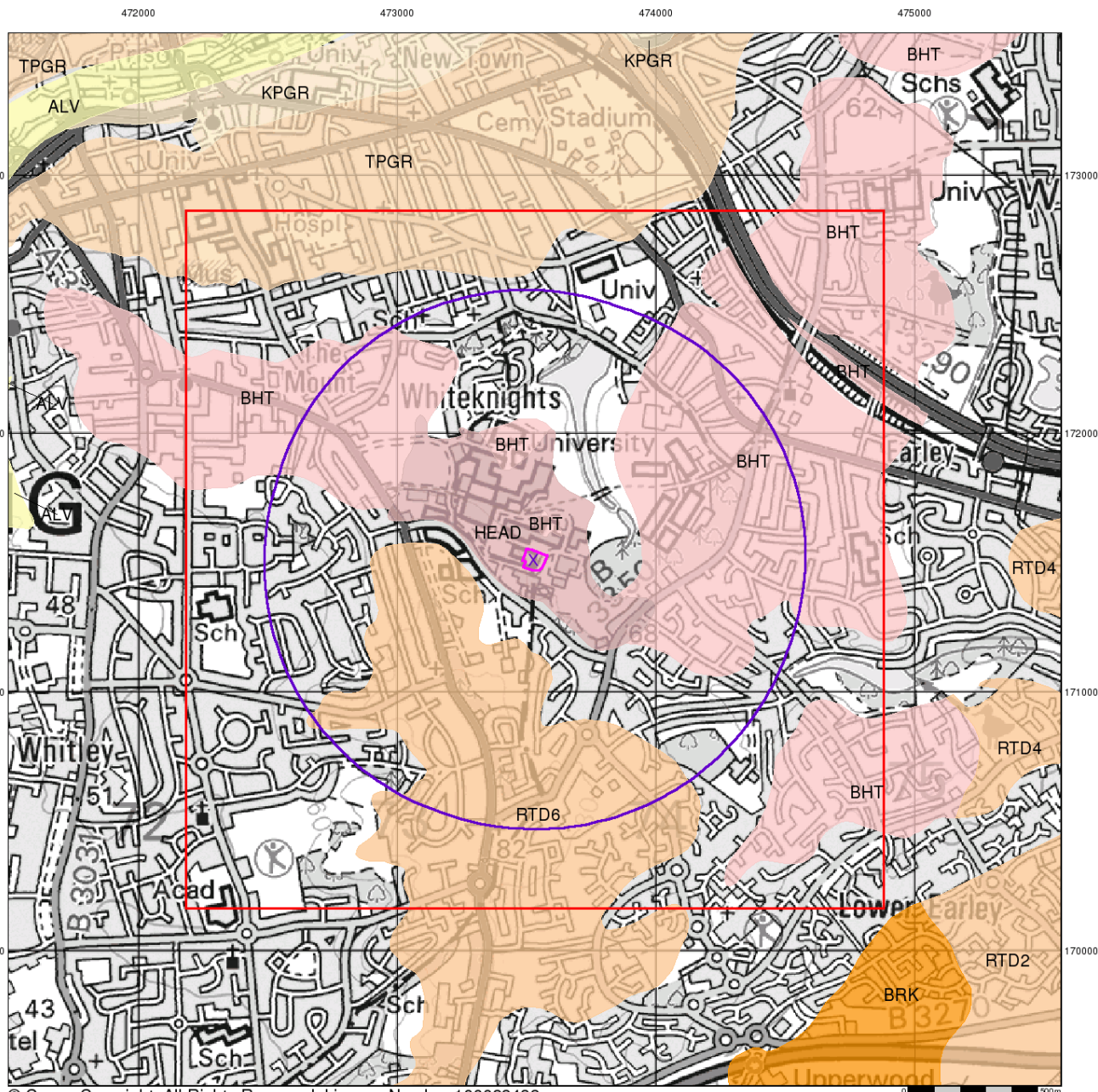
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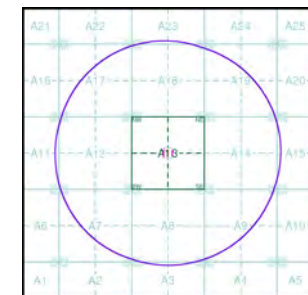
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details:

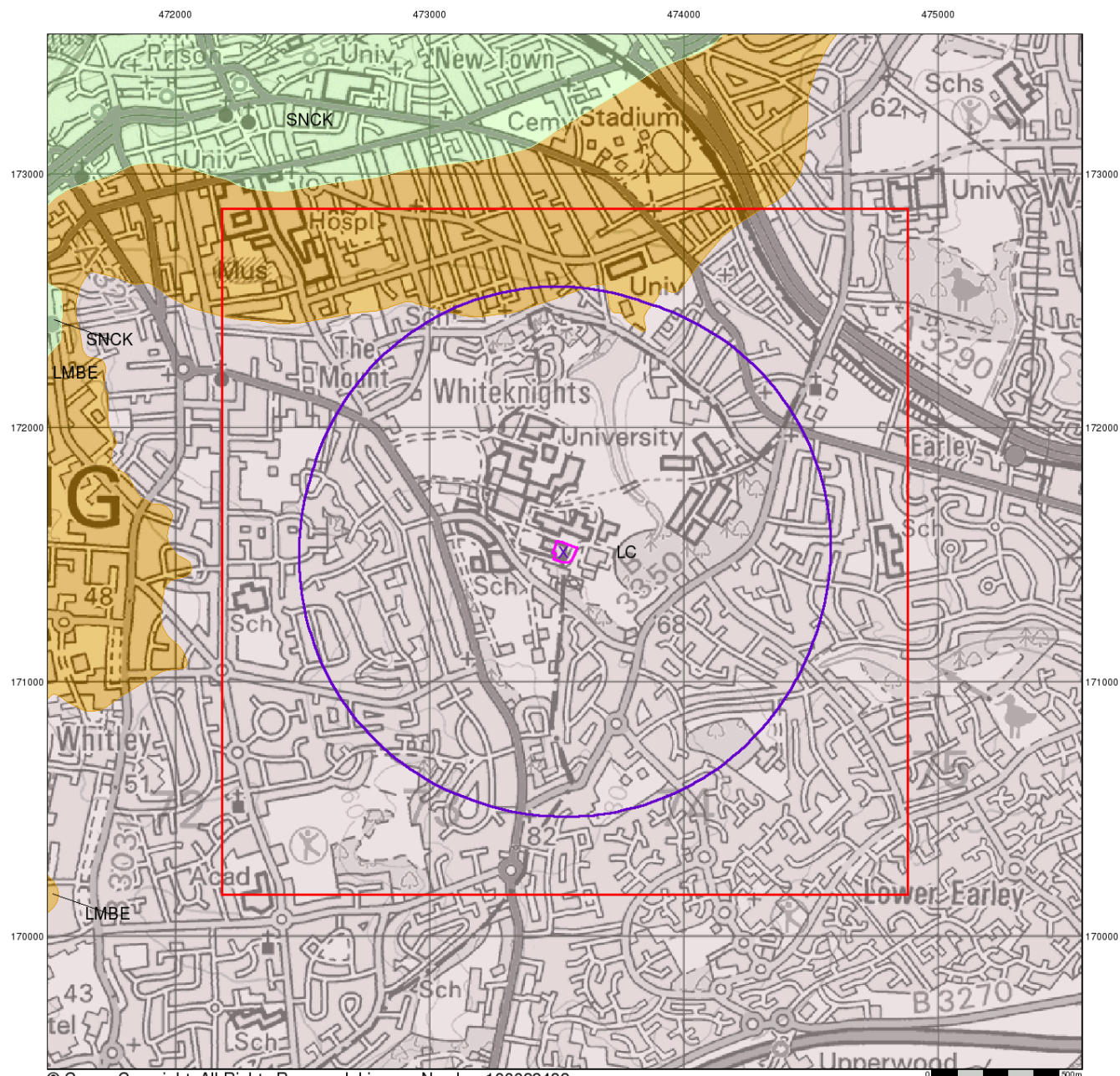
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Bedrock and Faults

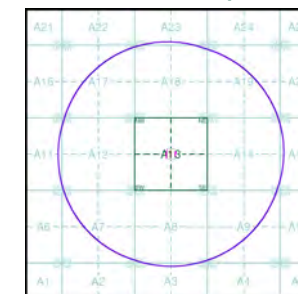
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



Order Details:

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Site Details:

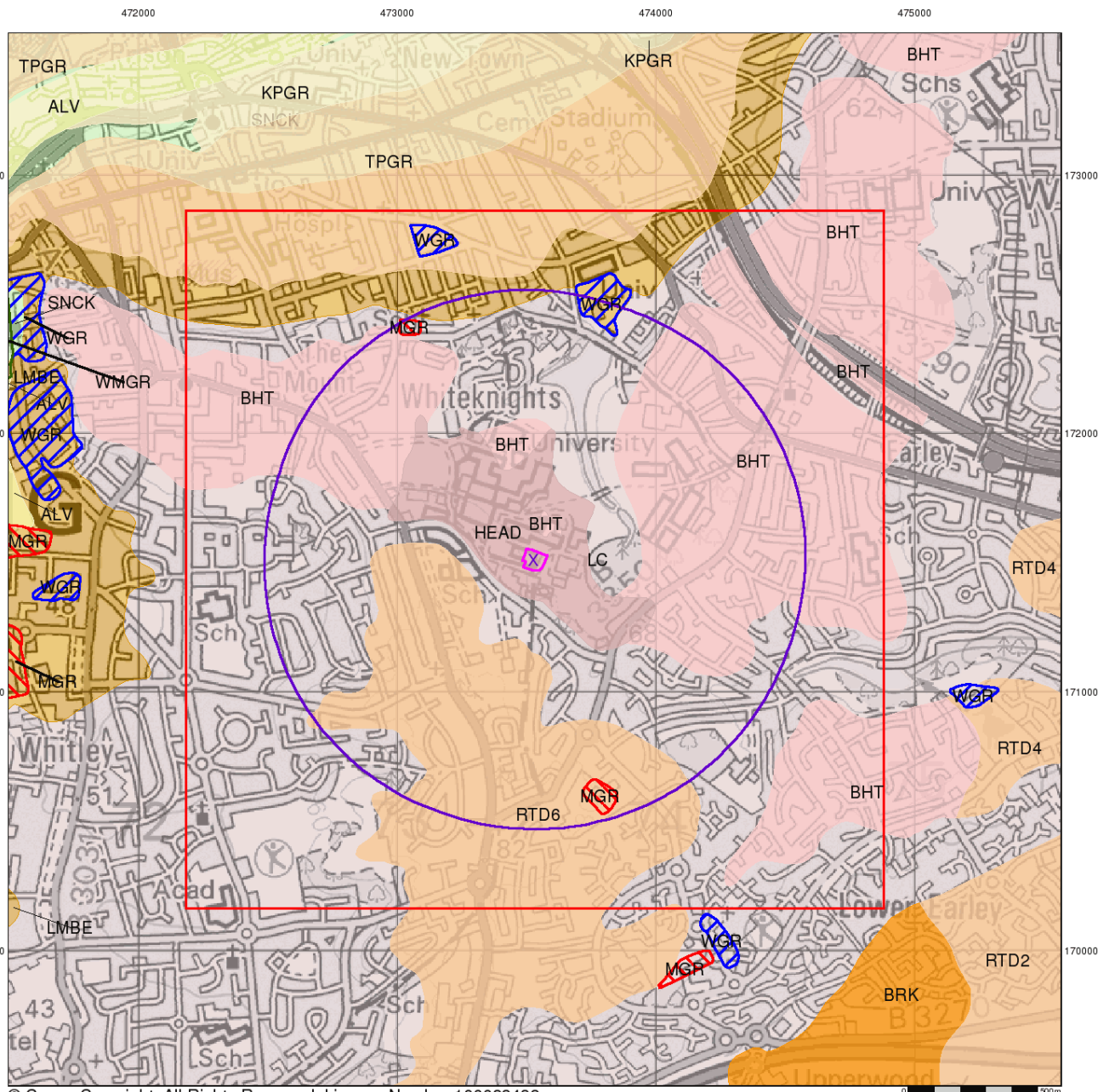
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Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

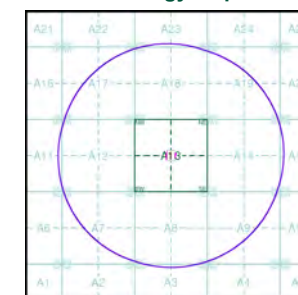
Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Telephone: 0115 936 3143
Fax: 0115 936 3276
email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



Order Details:

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Historical Mapping Legends

Ordnance Survey County Series 1:10,560

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

Ordnance Survey Plan 1:10,000

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

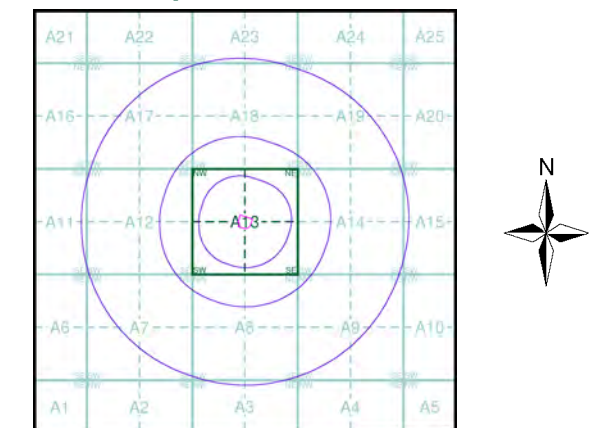
1:10,000 Raster Mapping

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

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Berkshire	1:10,560	1883	3
Berkshire	1:10,560	1900	4
Berkshire	1:10,560	1901	5
Berkshire	1:10,560	1913	6
Berkshire	1:10,560	1933	7
Berkshire	1:10,560	1938	8
Berkshire	1:10,560	1938	9
Historical Aerial Photography	1:10,560	1948	10
Ordnance Survey Plan	1:10,000	1962	11
Ordnance Survey Plan	1:10,000	1973	12
Ordnance Survey Plan	1:10,000	1979	13
Ordnance Survey Plan	1:10,000	1990	14
Reading	1:10,000	1990	15
Ordnance Survey Plan	1:10,000	1995	16
10K Raster Mapping	1:10,000	1999	17
10K Raster Mapping	1:10,000	2006	18
VectorMap Local	1:10,000	2017	19

Historical Map - Slice A



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Russian Military Mapping Legends

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

a. Not drawn to scale b. Drawn to scale

Government and Administrative Buildings Military and Industrial Buildings

Military and Communication Areas Subway Entrance

Fireproof Building Prominent Fireproof Building

Non-fireproof Building Non-fireproof Building (non-dwelling)

Factory, mill, and flour mill, with chimneys Factory, mill, and flour mill, without chimneys

Power Station, drawn to scale Hydroelectric Power Station

Radio Station, drawn to scale Telephone Station, drawn to scale

Abandoned Open-pit Mine or Quarry Open-pit Salt Mine

Pit Oil Deposit or Well Oil Seepage

Tailings Pile Fuel Storage Tanks Natural Gas Tank

Bench Mark Drill Hole Burial Mound Triangulation Point on Burial Mound

Single-track Railroad Double-track Railroad and Station Building

Coniferous Forest Deciduous Forest Mixed Forest

Lawns Citrus Orchard Wet Ground Scattered Vegetation

243.8 Values for prominent elevations

186.0 Numbers for spot elevations, depth soundings, contour lines, etc.

0.2 Velocity of the current, width of river bed, depth of river

180/12 Fractional terms: length and capacity of bridges; depth of fords and condition of the river bottom; height of forest and the diameter of trees

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

А а (A) З з (Z) П п (P) Ч ч (CH)

Б б (B) И и (I) Р р (R) Ш ш (SH)

В в (V) Й й (Y) С с (S) Щ щ (SHCH)

Г г (G) К к (K) Т т (T) Ъ (-)

Д д (D) Л л (L) У у (U) Ы (Y)

Е е (E) М м (M) Ф ф (F) Ь (')

Ё ё (YO) Н н (N) Х х (KH) Э э (E)

Ж ж (ZH) О о (O) Ц ц (TS) Ю ю (YU or IU)

Я я (YA or IA)

1:25,000 mapping

a. Not drawn to scale b. Drawn to scale

Government and Administrative Buildings Military and Industrial Buildings

Military and Communication Areas Subway Entrance

Partly Demolished Buildings Demolished Buildings

Built-Up Area with Fireproof Buildings Predominant Built-Up Area with Non-Fireproof Buildings Predominant

Individual Fireproof Building Prominent Industrial Building

Individual Dwelling, Fireproof Ruins of an Individual Dwelling

Factory or Mill Chimney Factory or Mill with Chimney Factory or Mill without Chimney Mine or Open Pit Mine

Operating Shaft or Mine Non-Operating Shaft or Mine Salt Mine Tailings Pile

Pit Stone Quarry Gas Pump or Service Station Fuel Storage or Natural Gas Tank

Oil or Natural Gas Derrick Small Hydroelectric Power Station Power Station Transformer Station

Cemetery Burial Mound (height in metres) Triangulation Point on Burial Mound Triangulation Point

Bench Mark Bench Mark (monumented) Telegraph Office Telephone Station

Radio Station Radio Tower Airfield or Seaplane Base Landing Strip

Telegraph/Telephone Lines Main Highway Highway under Construction Improved Dirt Road (former truck road)

Double-track Railroad with First Class Station Dismantled Railroad Railroad Under Construction

Shore Embankment River or Ditch with Embankment Direction and velocity of current Water Gauge Water Level Mark

Well Water Reservoir or Rain Water Pit Spring Isobath with value

Heavy (Index) Contour Line Contour Line and Value Half Contour Line Spot Elevation Value

Coniferous Deciduous Mixed Scrub

Key to Numbers on Mapping

SU77SW_Reading

No.	Description
58	Education Establishment (University)

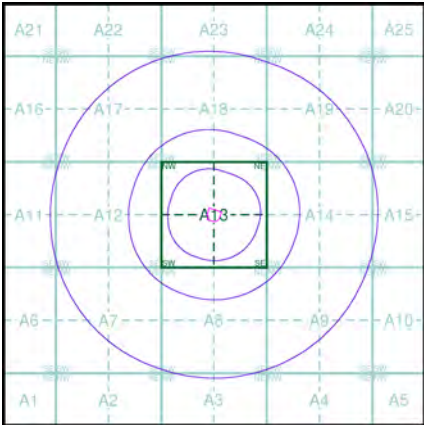
Envirocheck

LANDMARK INFORMATION GROUP

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Berkshire	1:10,560	1883	3
Berkshire	1:10,560	1900	4
Berkshire	1:10,560	1901	5
Berkshire	1:10,560	1913	6
Berkshire	1:10,560	1933	7
Berkshire	1:10,560	1938	8
Berkshire	1:10,560	1938	9
Historical Aerial Photography	1:10,560	1948	10
Ordnance Survey Plan	1:10,000	1962	11
Ordnance Survey Plan	1:10,000	1973	12
Ordnance Survey Plan	1:10,000	1979	13
Ordnance Survey Plan	1:10,000	1990	14
Reading	1:10,000	1990	15
Ordnance Survey Plan	1:10,000	1995	16
10K Raster Mapping	1:10,000	1999	17
10K Raster Mapping	1:10,000	2006	18
VectorMap Local	1:10,000	2017	19

Russian Map - Slice A



Order Details

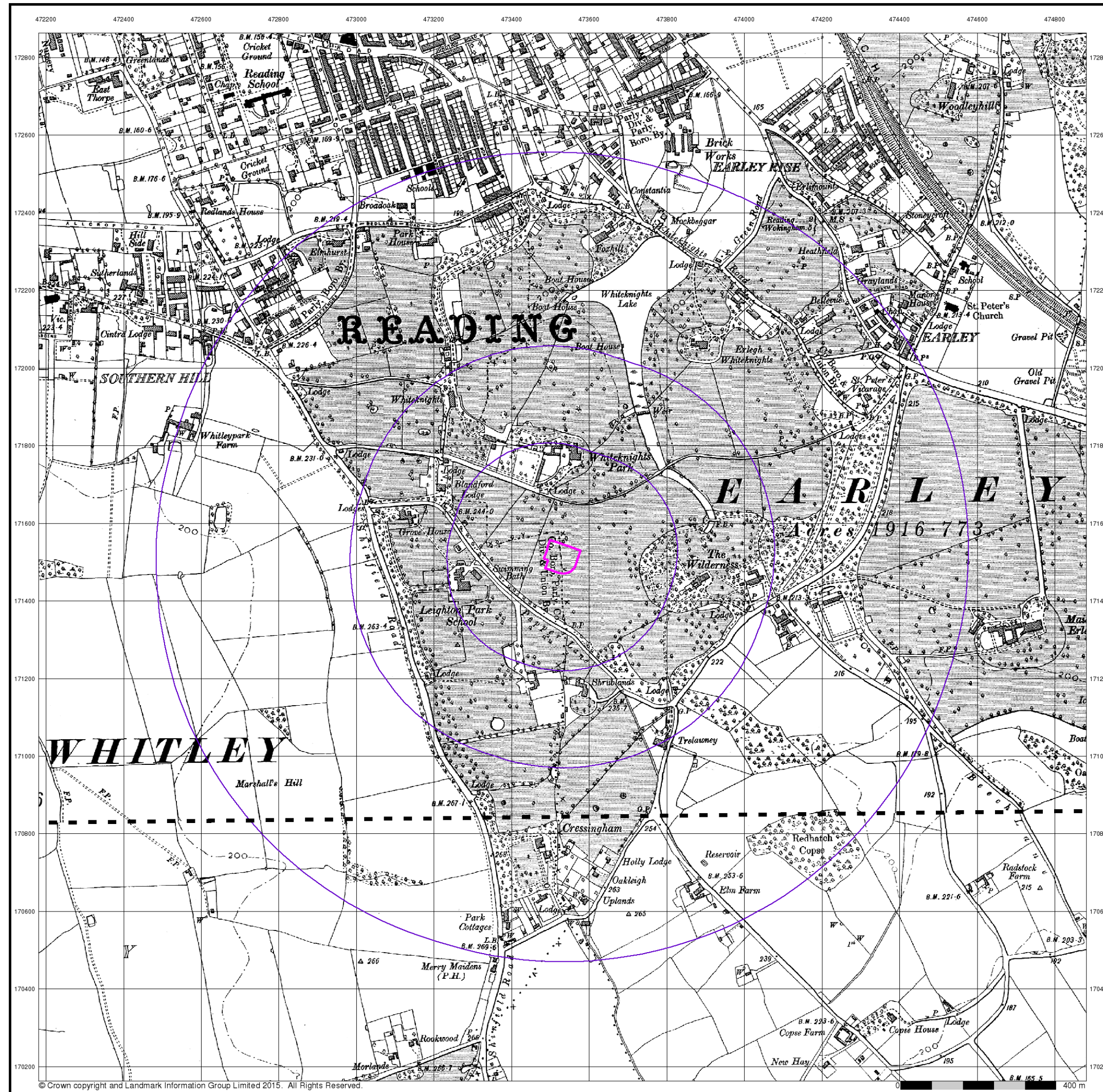
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING, RG6 6UR

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INFORMATION GROUP

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



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Berkshire

Published 1900

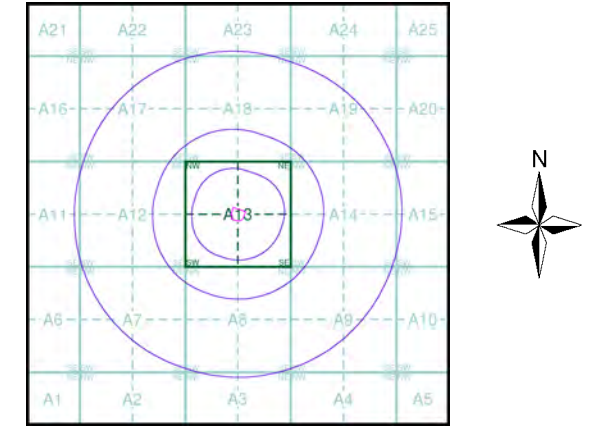
Source map scale - 1:10,560

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)

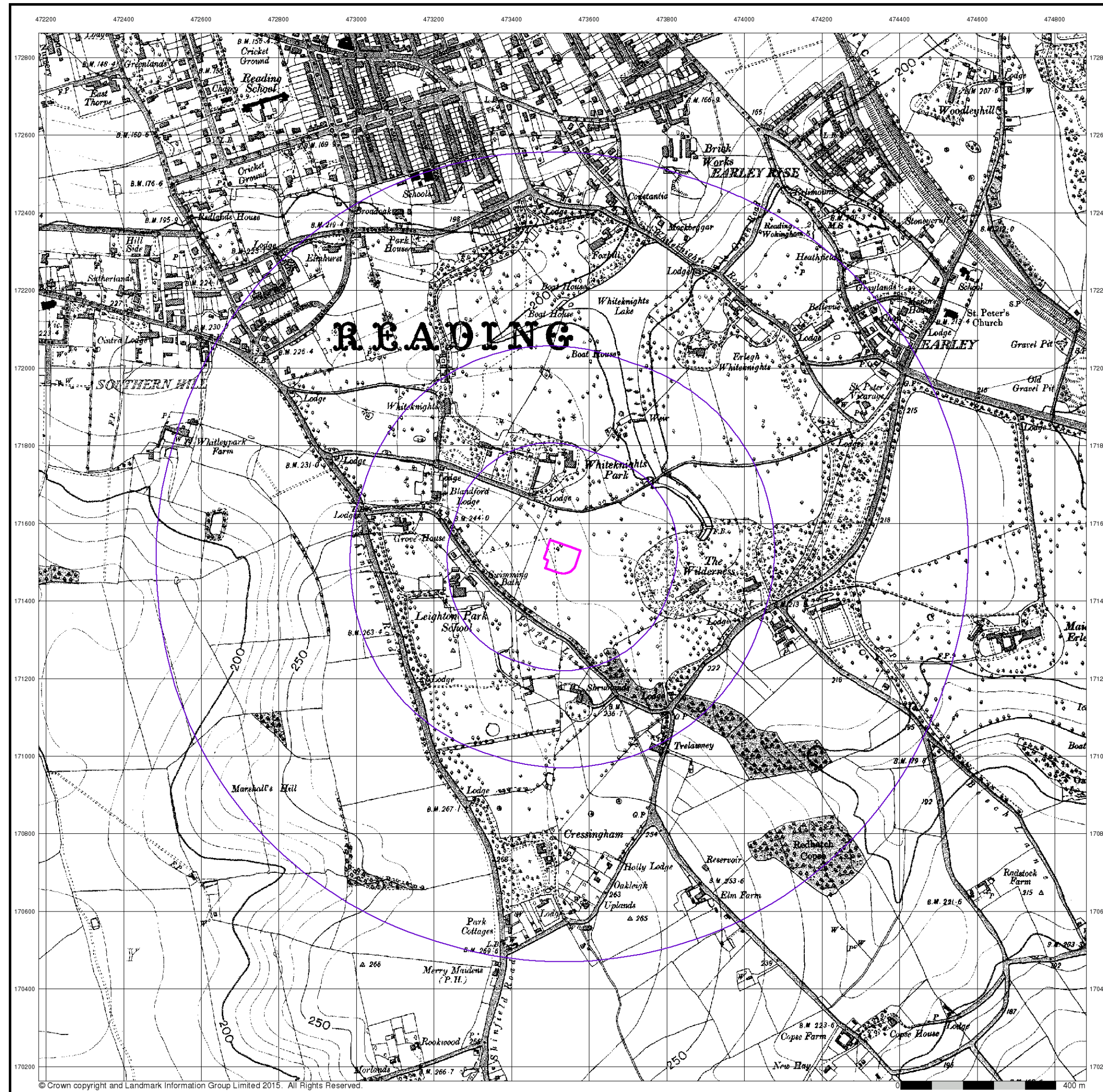
037NE
1900
1:10,560
037SE
1900
1:10,560

Historical Map - Slice A



Order Details	
Order Number:	115805868_1_1
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Site Area (Ha):	0.56
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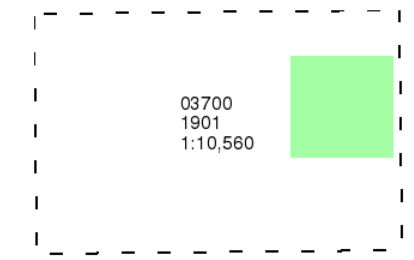
Berkshire

Published 1901

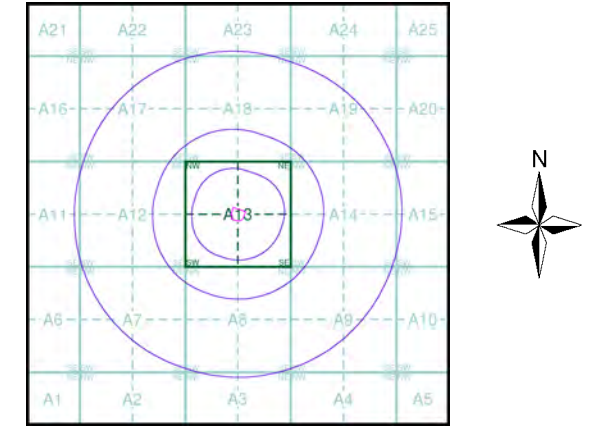
Source map scale - 1:10,560

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.

Map Name(s) and Date(s)

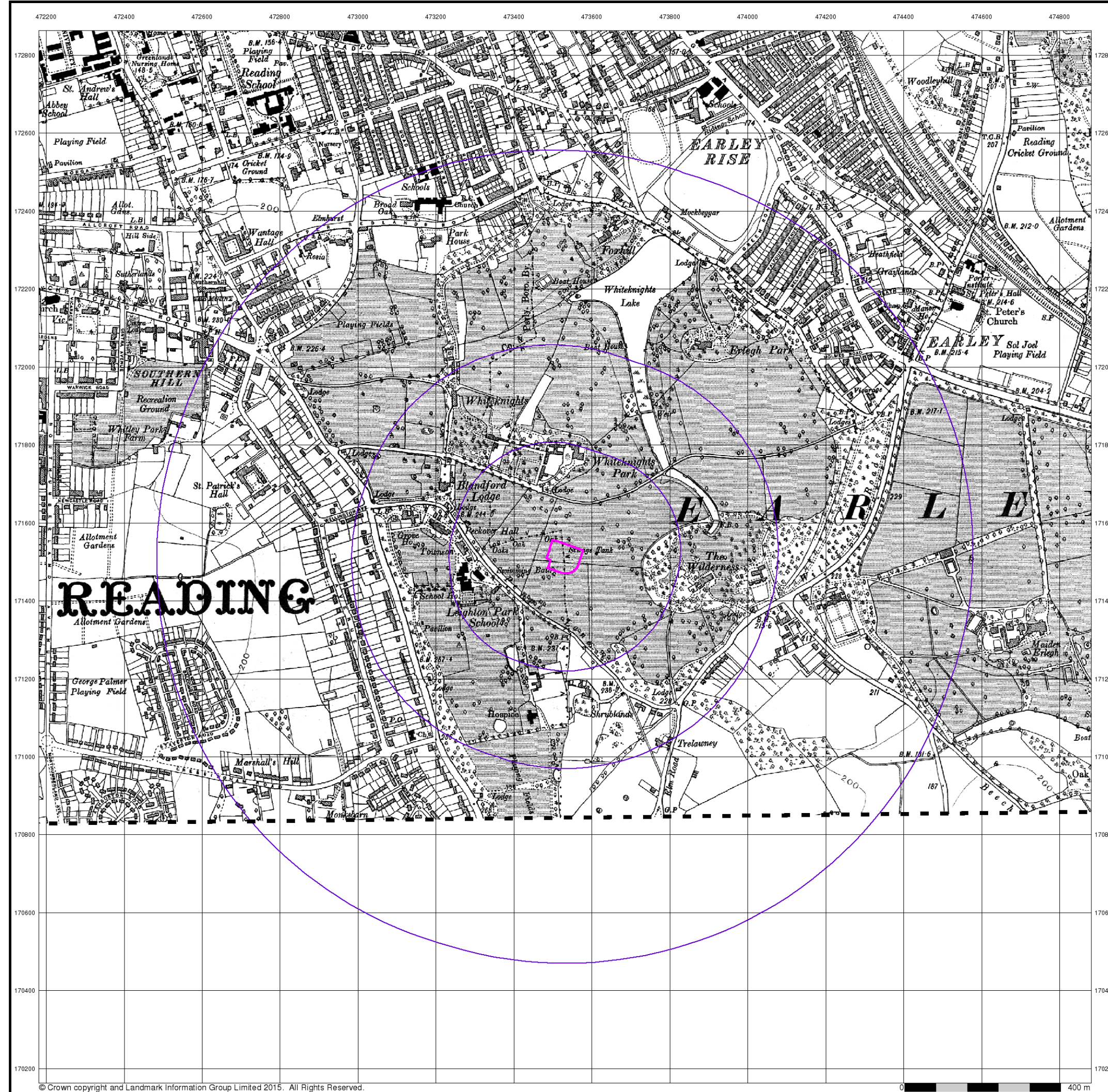


Historical Map - Slice A



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0 400 m

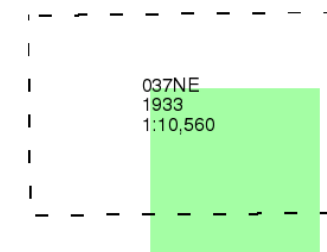
Berkshire

Published 1933

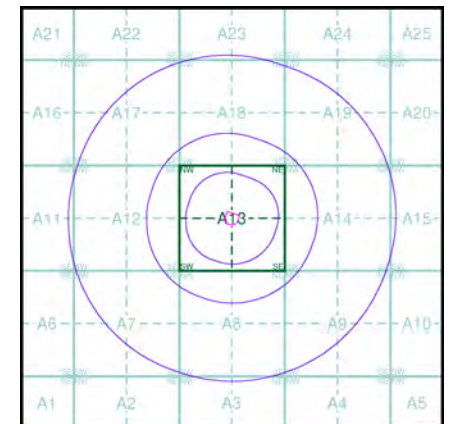
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

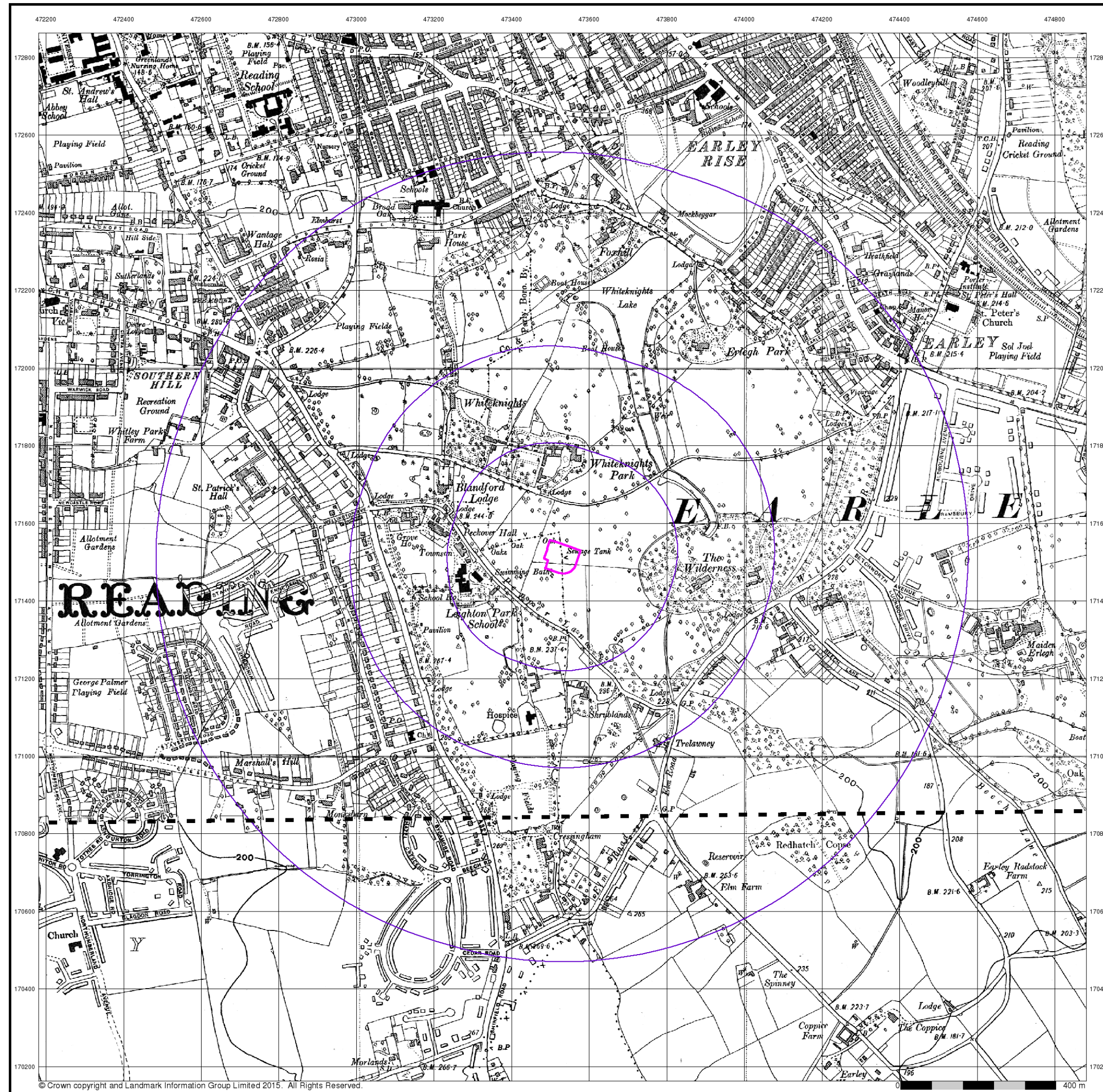


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Customer Ref: 60441574/M001.003
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Site Details

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Berkshire

Published 1938

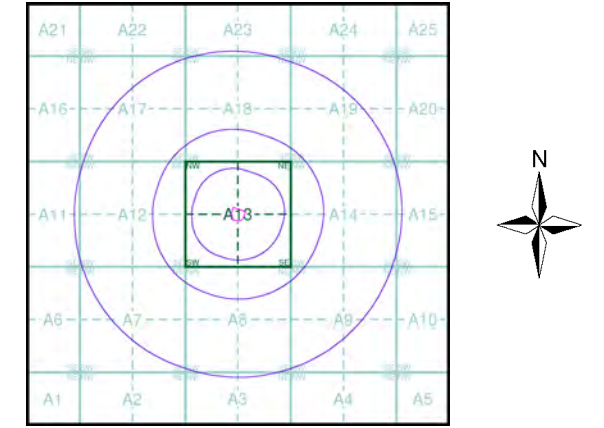
Source map scale - 1:10,560

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)

037NE	1938	1:10,560
037SE	1938	1:10,560

Historical Map - Slice A

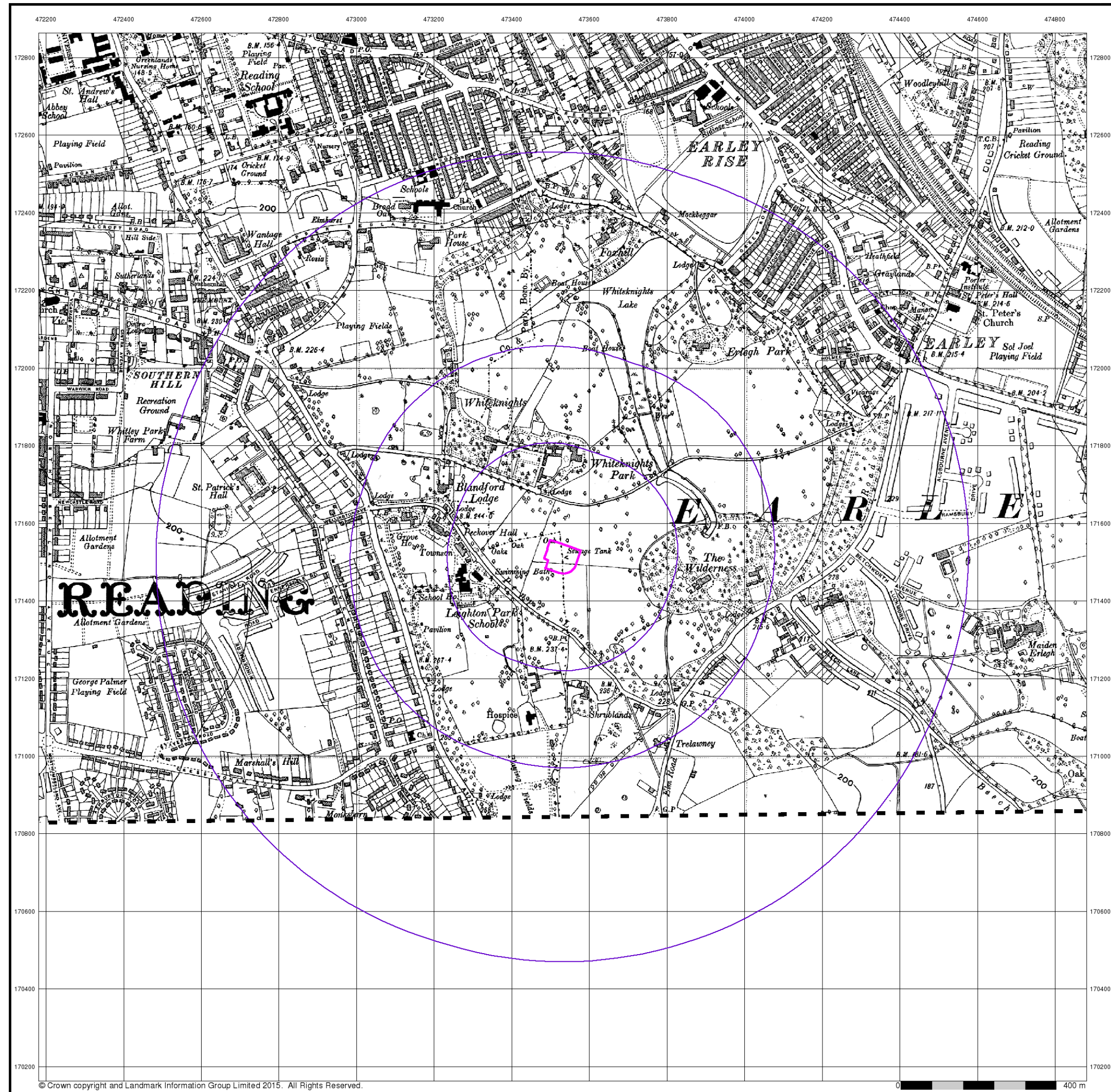


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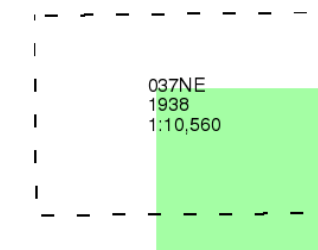
Berkshire

Published 1938

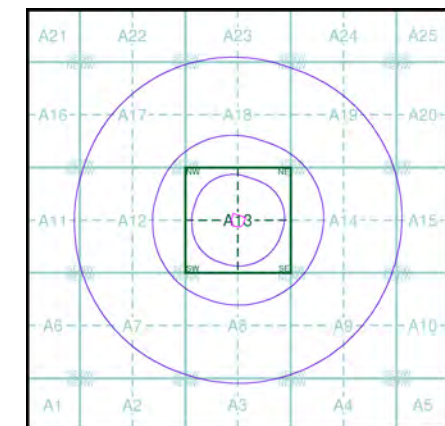
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

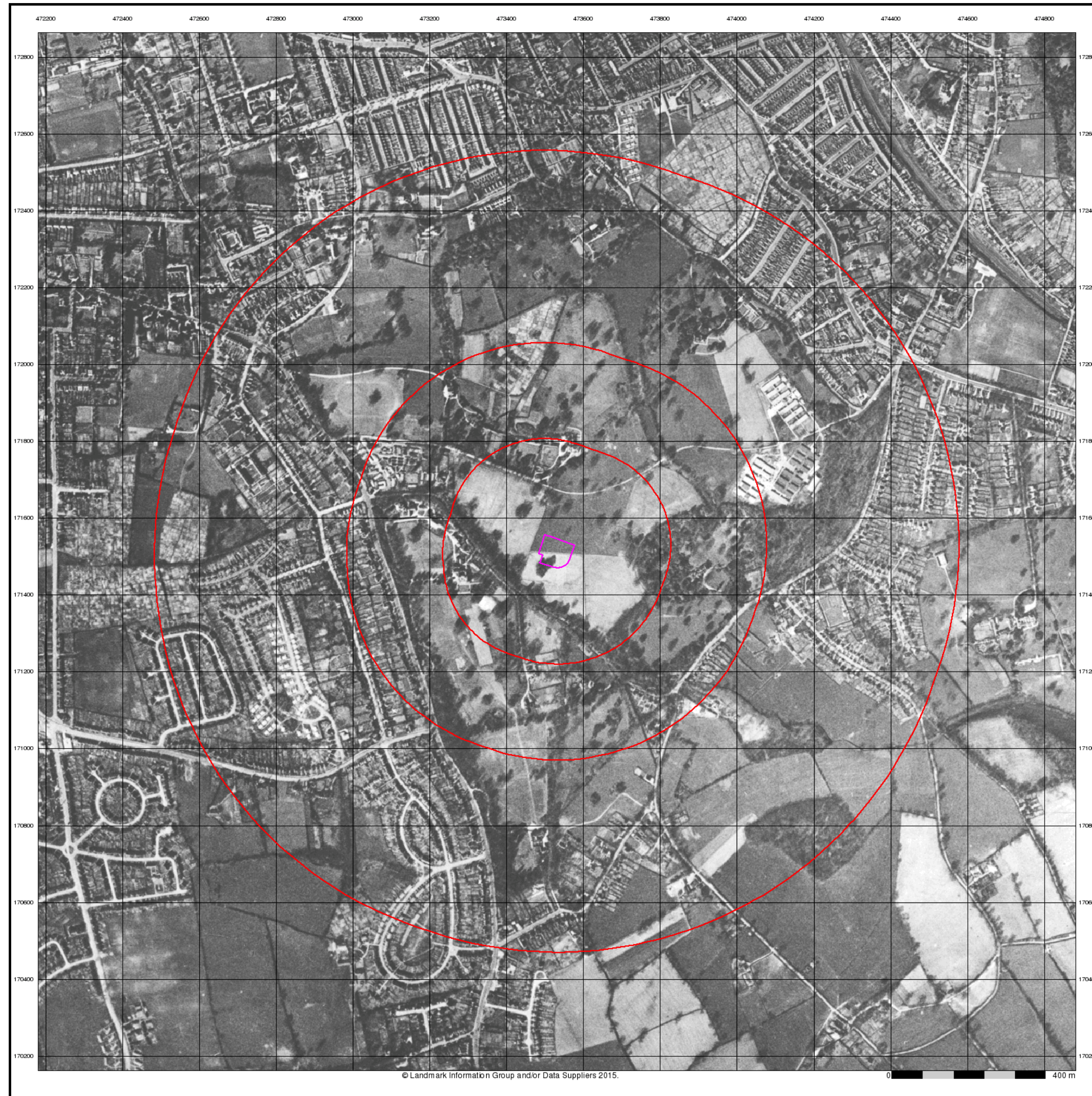


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Customer Ref: 60441574/M001.003
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Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

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0 400 m

Historical Aerial Photography

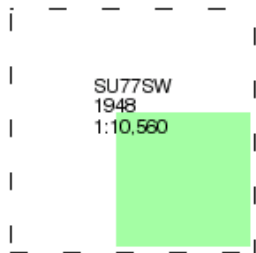
Published 1948

Source map scale - 1:10,560

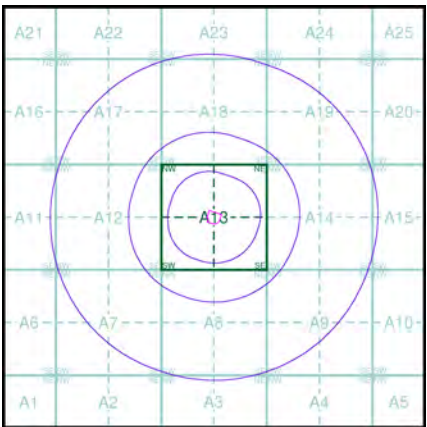
The Historical Aerial Photos were produced by the Ordnance Survey at a scale of 1:1,250 and 1:10,560 from Air Force photography. They were produced between 1944 and 1951 as an interim measure, pending preparation of conventional mapping, due to post war resource shortages. New security measures in the 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)



Historical Aerial Photography - Slice A

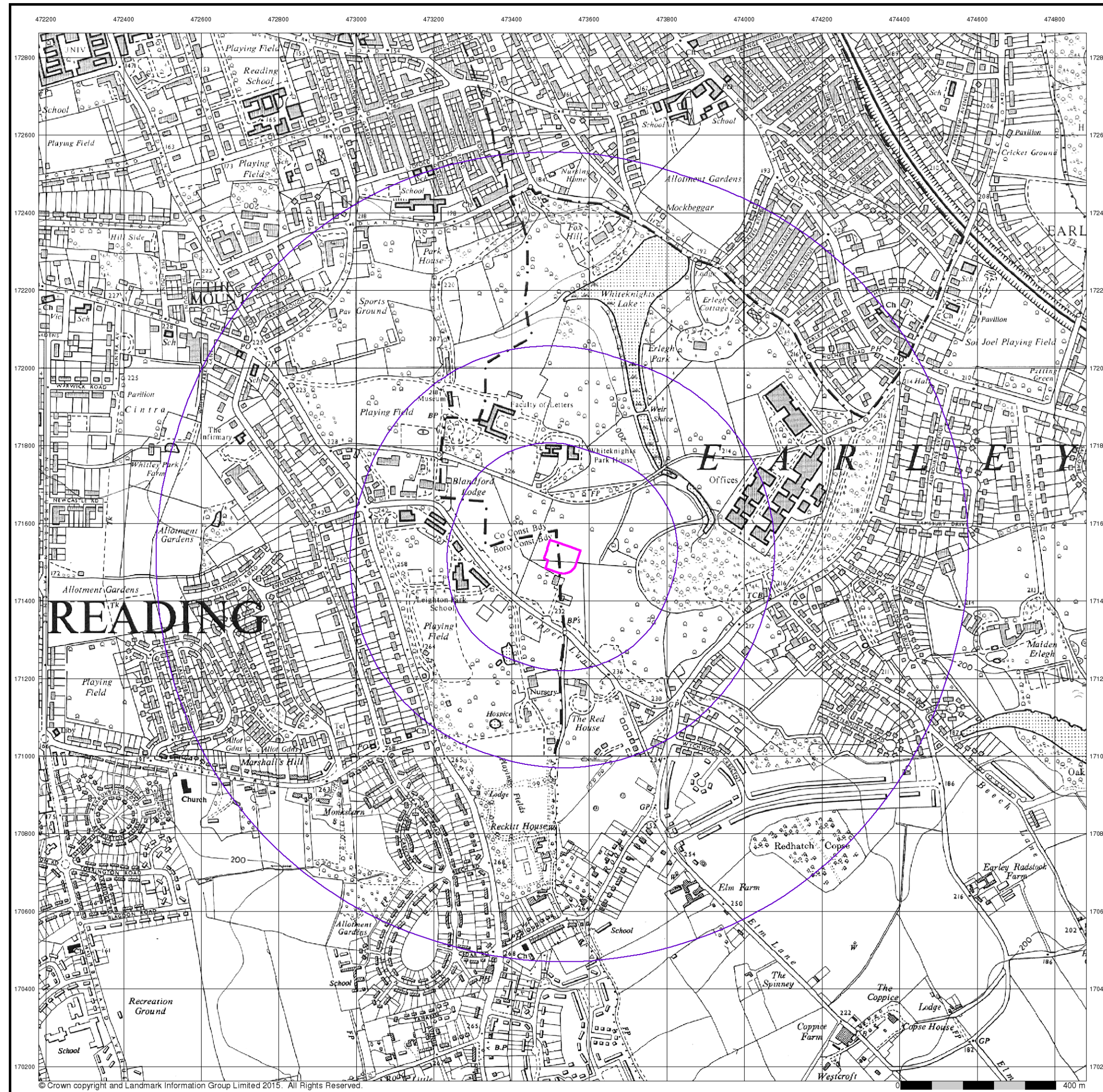


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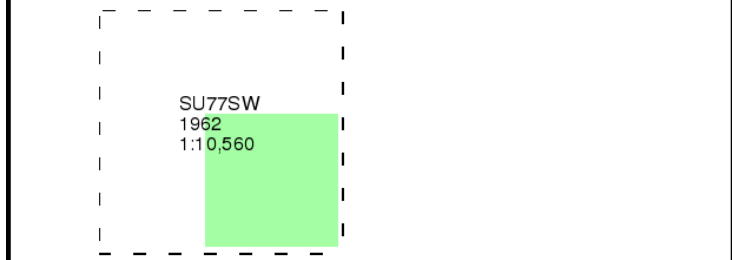
Ordnance Survey Plan

Published 1962

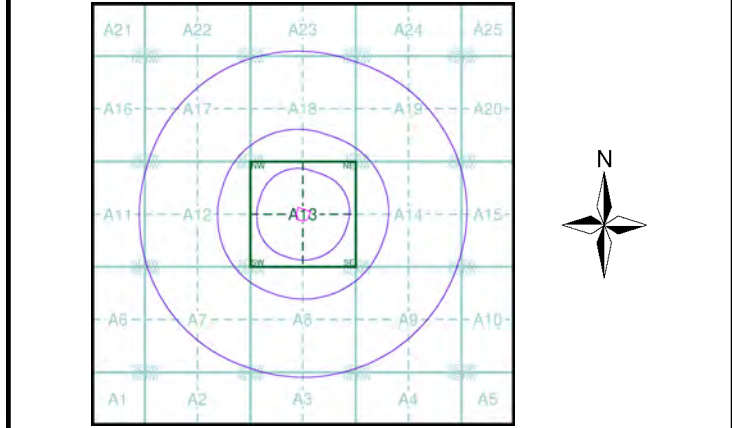
Source map scale - 1:10,000

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Map Name(s) and Date(s)



Historical Map - Slice A

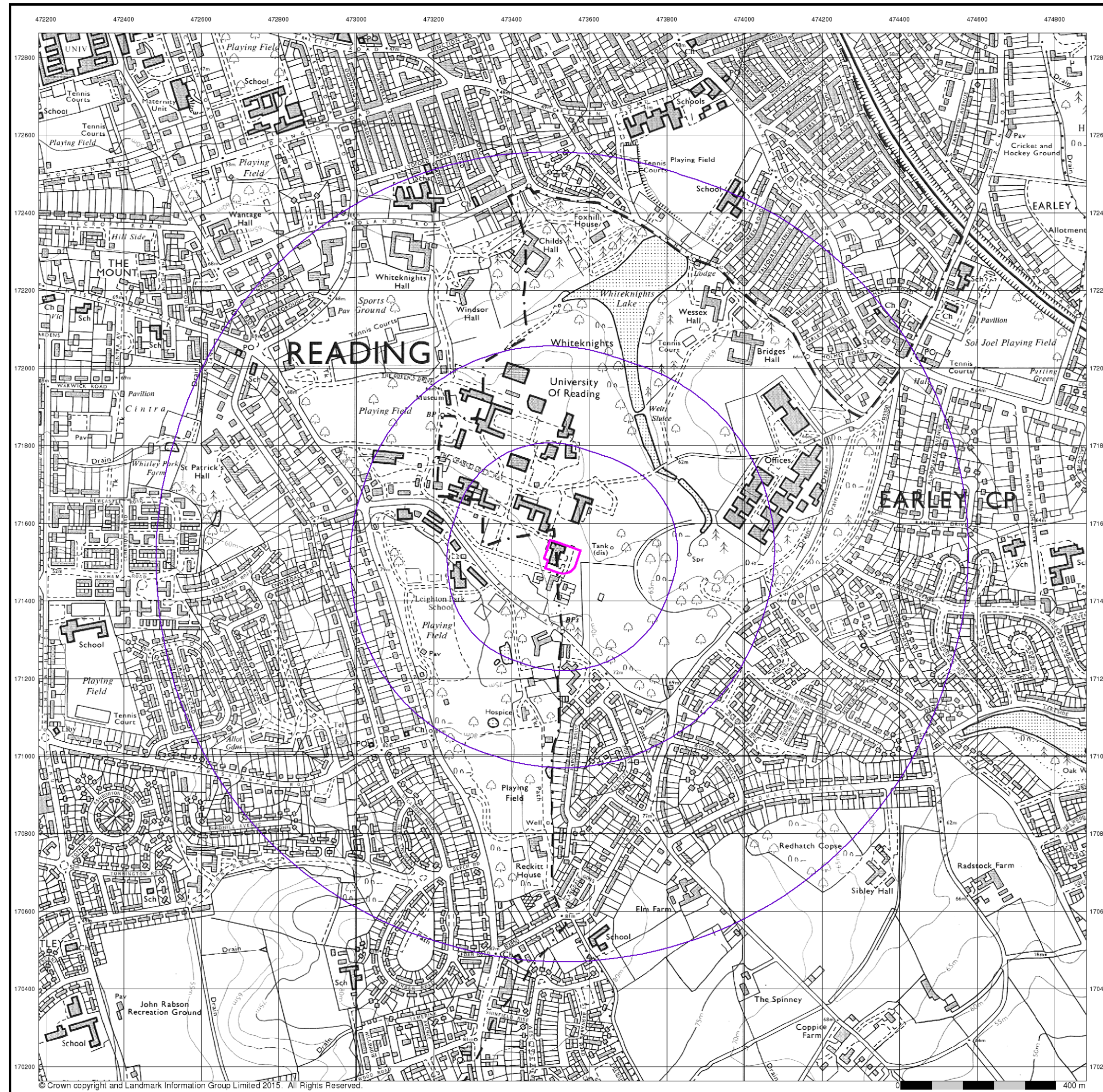


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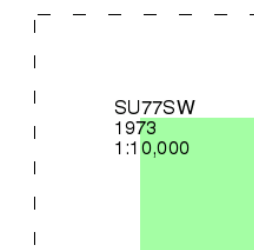
Ordnance Survey Plan

Published 1973

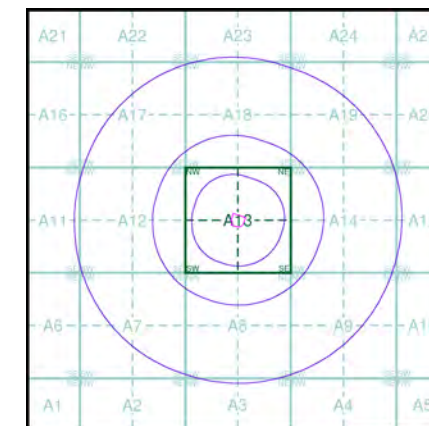
Source map scale - 1:10,000

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

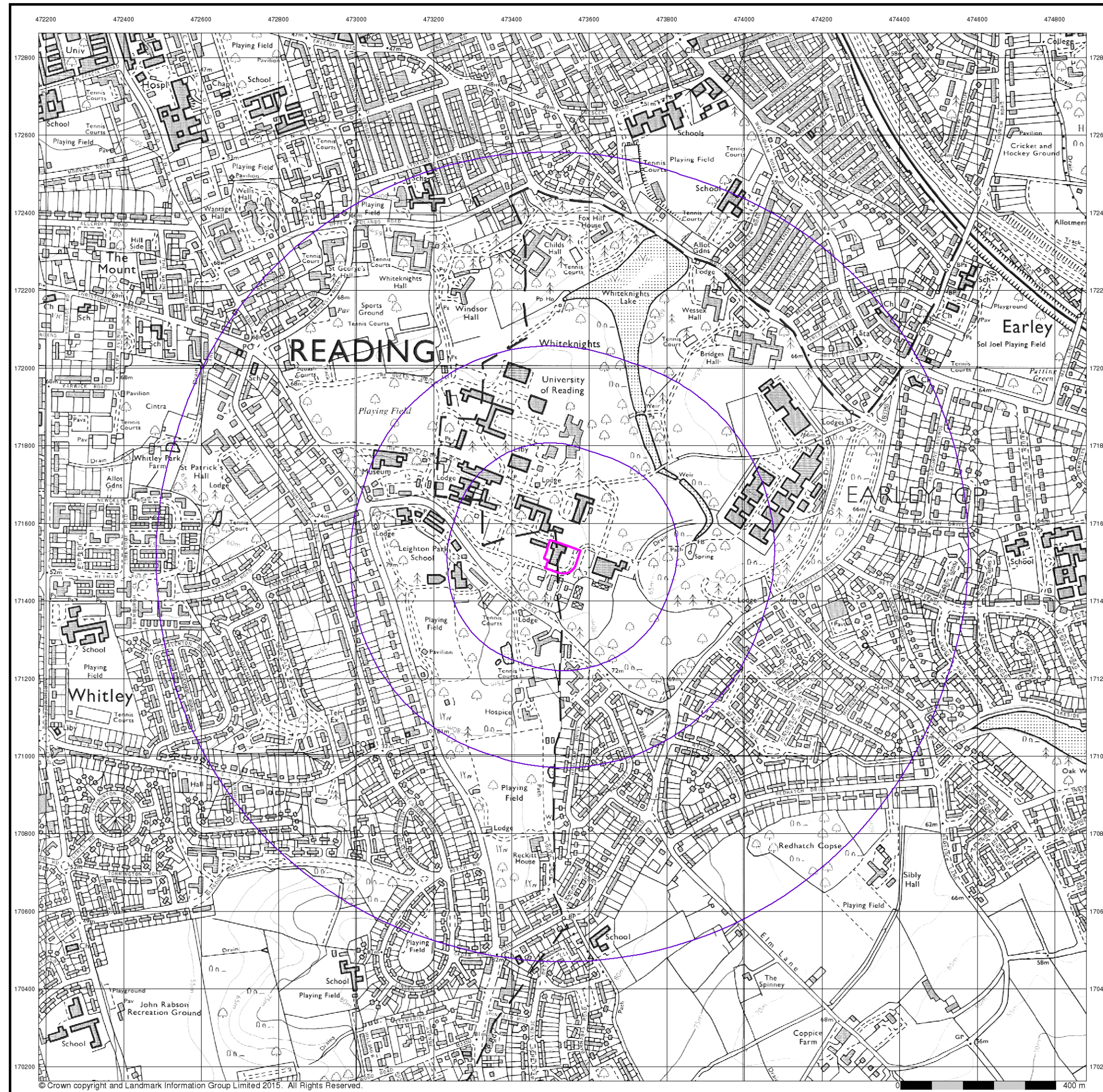
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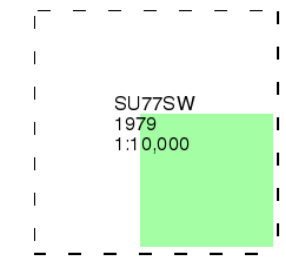
Ordnance Survey Plan

Published 1979

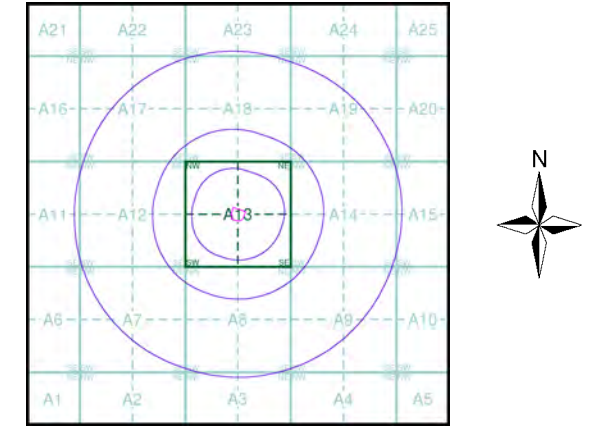
Source map scale - 1:10,000

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)

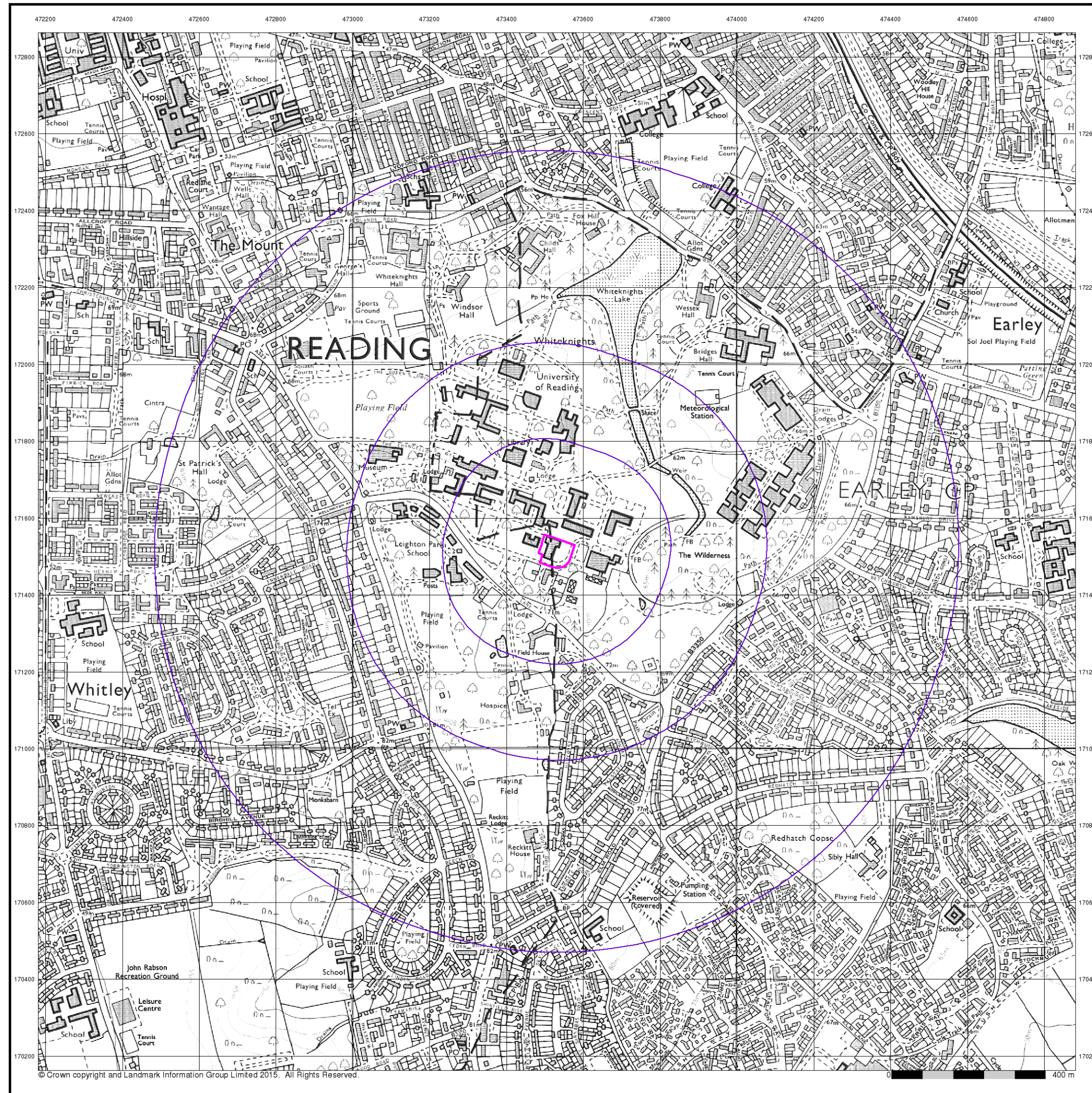


Historical Map - Slice A



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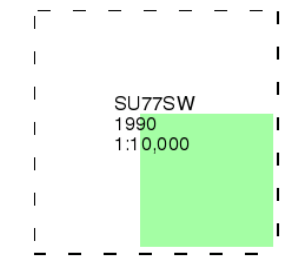
Ordnance Survey Plan

Published 1990

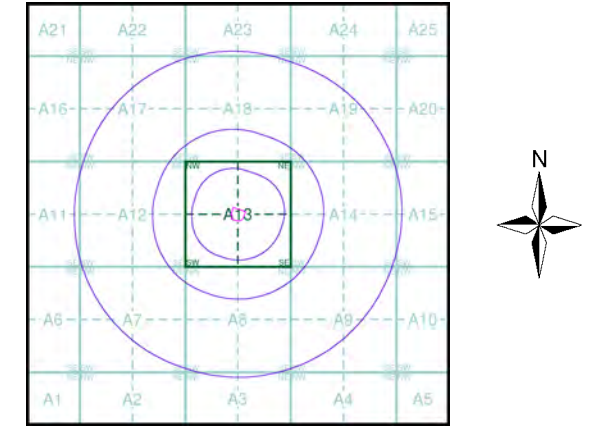
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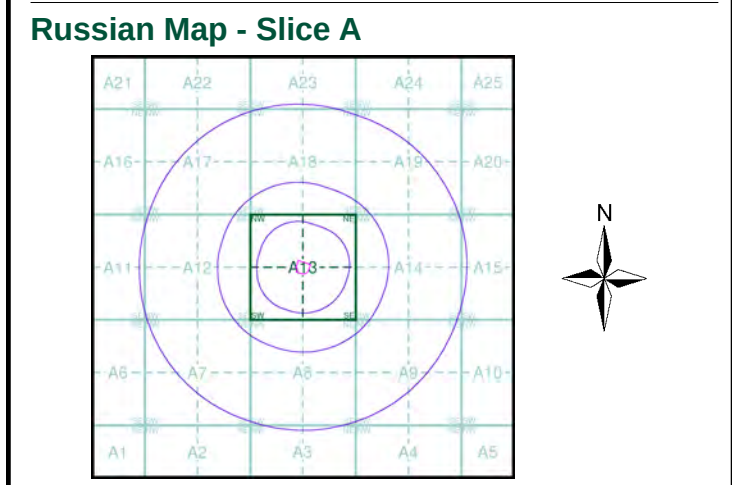
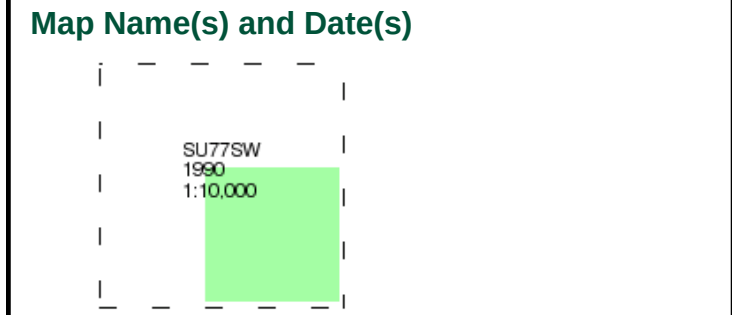
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Reading

Published 1990

Source map scale - 1:10,000

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

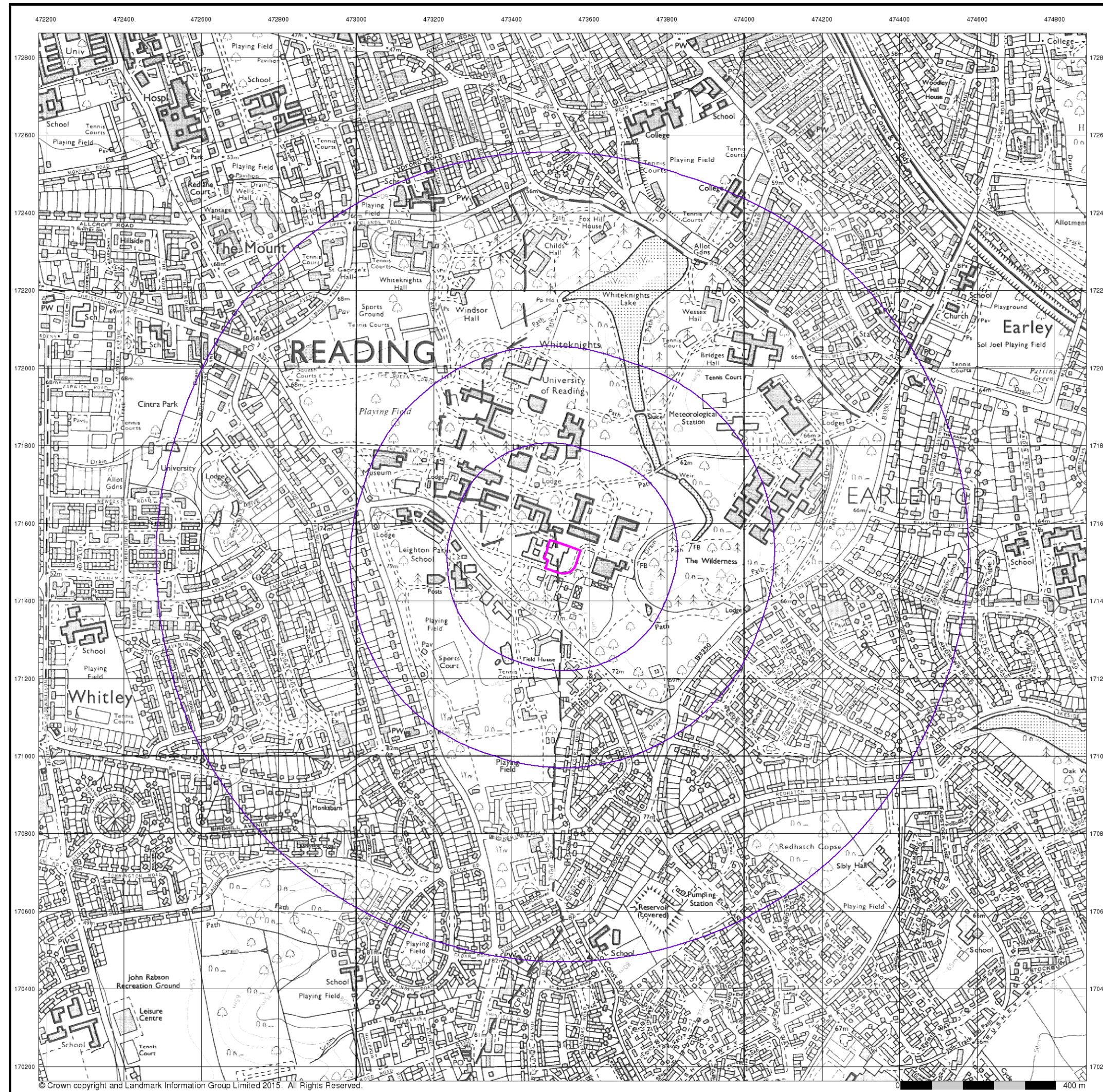


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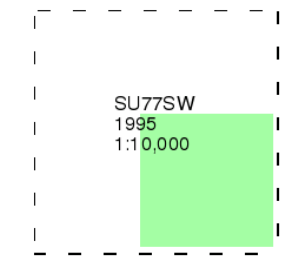
Ordnance Survey Plan

Published 1995

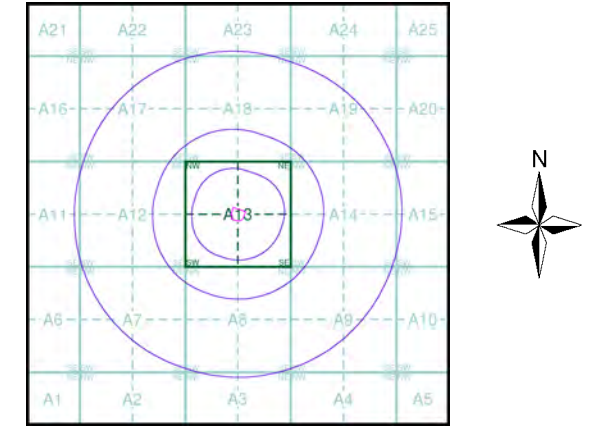
Source map scale - 1:10,000

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	
Order Number:	115805868_1_1
Customer Ref:	60441574/M001.003
National Grid Reference:	473530, 171510
Slice:	A
Site Area (Ha):	0.56
Search Buffer (m):	1000

Site Details
Life Sciences Building, University of Reading, Shinfield Road,
READING, RG6 6UR



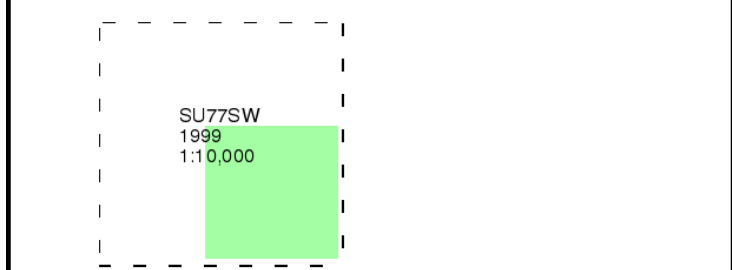
10k Raster Mapping

Published 1999

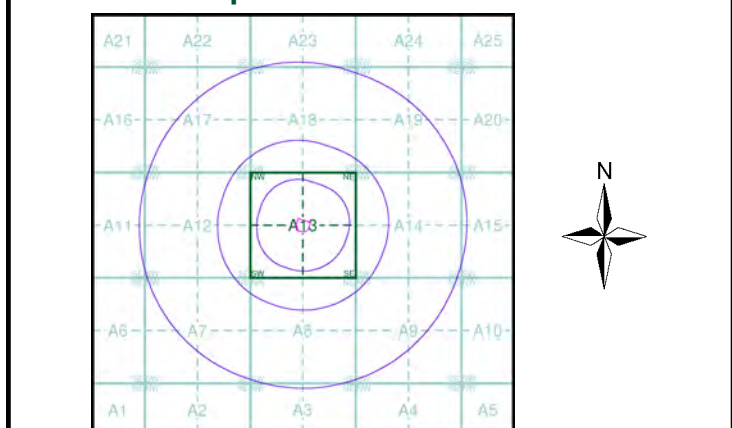
Source map scale - 1:10,000

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

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number: 115805868_1_1

Customer Ref: 60441574/M001.003

National Grid Reference: 473530, 171510

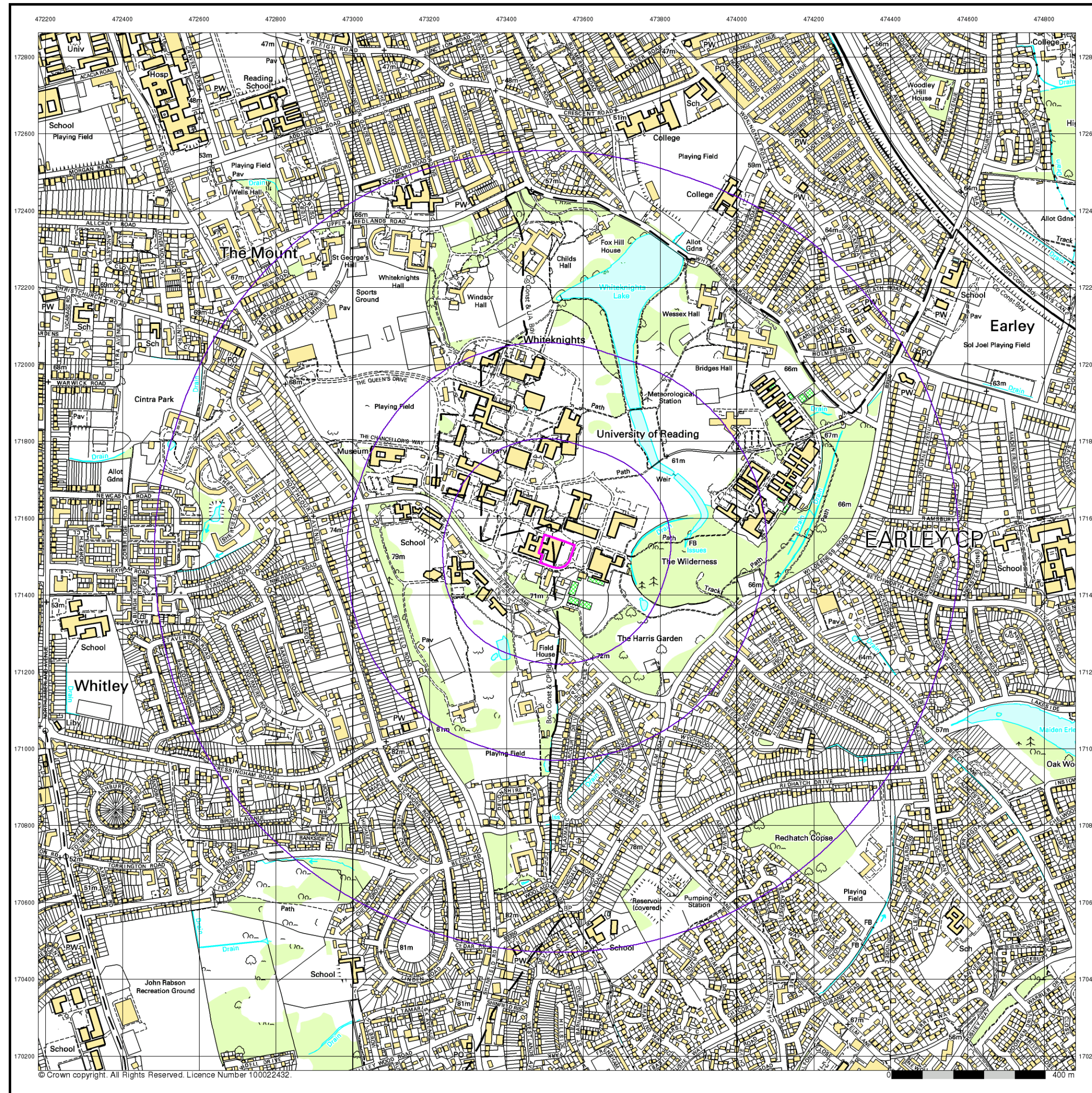
Slice: A

Site Area (Ha): 0.56

Search Buffer (m): 1000

Site Details

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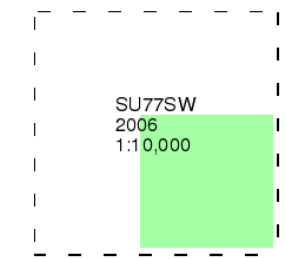
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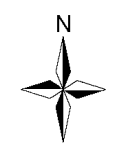
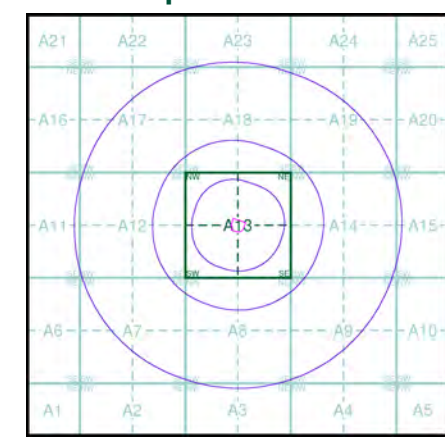
10k Raster Mapping
Published 2006
Source map scale - 1:10,000

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)



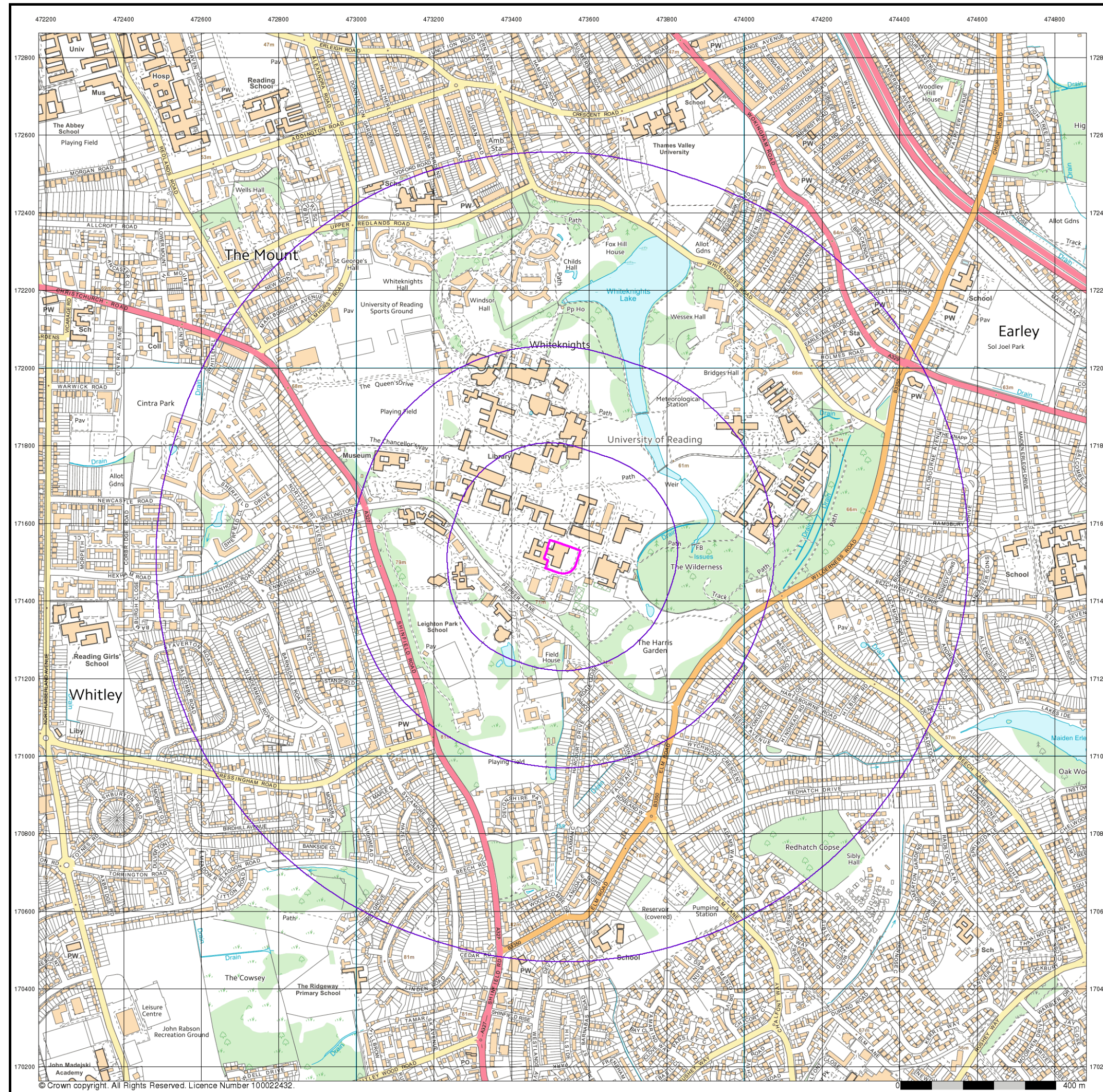
Historical Map - Slice A



Order Details
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

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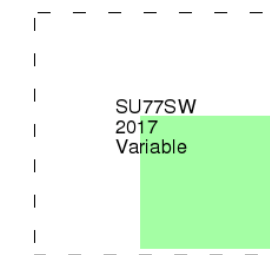
VectorMap Local

Published 2017

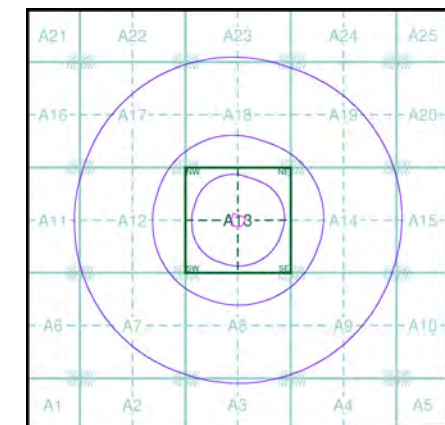
Source map scale - 1:10,000

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)



Historical Map - Slice A



Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

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Historical Mapping Legends

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



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



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



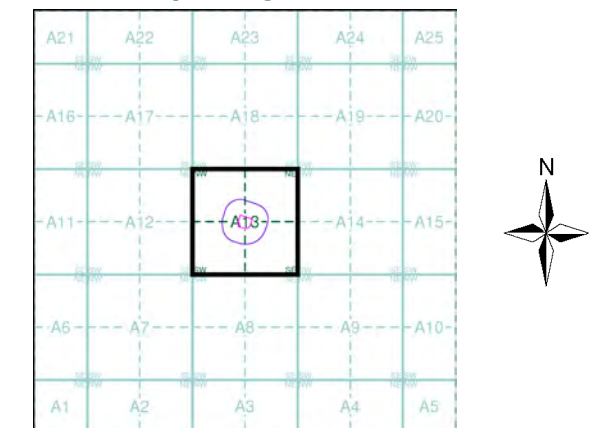
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Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Berkshire	1:2,500	1877	2
Berkshire	1:2,500	1899	3
Berkshire	1:2,500	1912	4
Berkshire	1:2,500	1932	5
Ordnance Survey Plan	1:1,250	1958	6
Ordnance Survey Plan	1:2,500	1959	7
Ordnance Survey Plan	1:1,250	1967 - 1970	8
Supply of Unpublished Survey Information	1:1,250	1974	9
Ordnance Survey Plan	1:1,250	1976	10
Additional SIMs	1:1,250	1987 - 1993	11
Large-Scale National Grid Data	1:1,250	1993	12
Large-Scale National Grid Data	1:1,250	1995	13
Historical Aerial Photography	1:2,500	1999	14

Historical Map - Segment A13



Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 100

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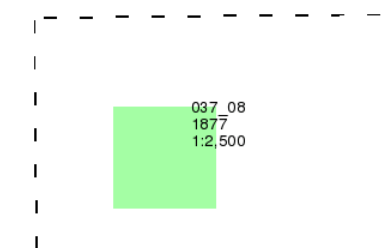
Berkshire

Published 1877

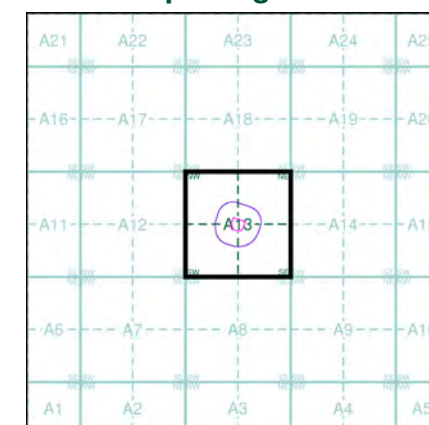
Source map scale - 1:2,500

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

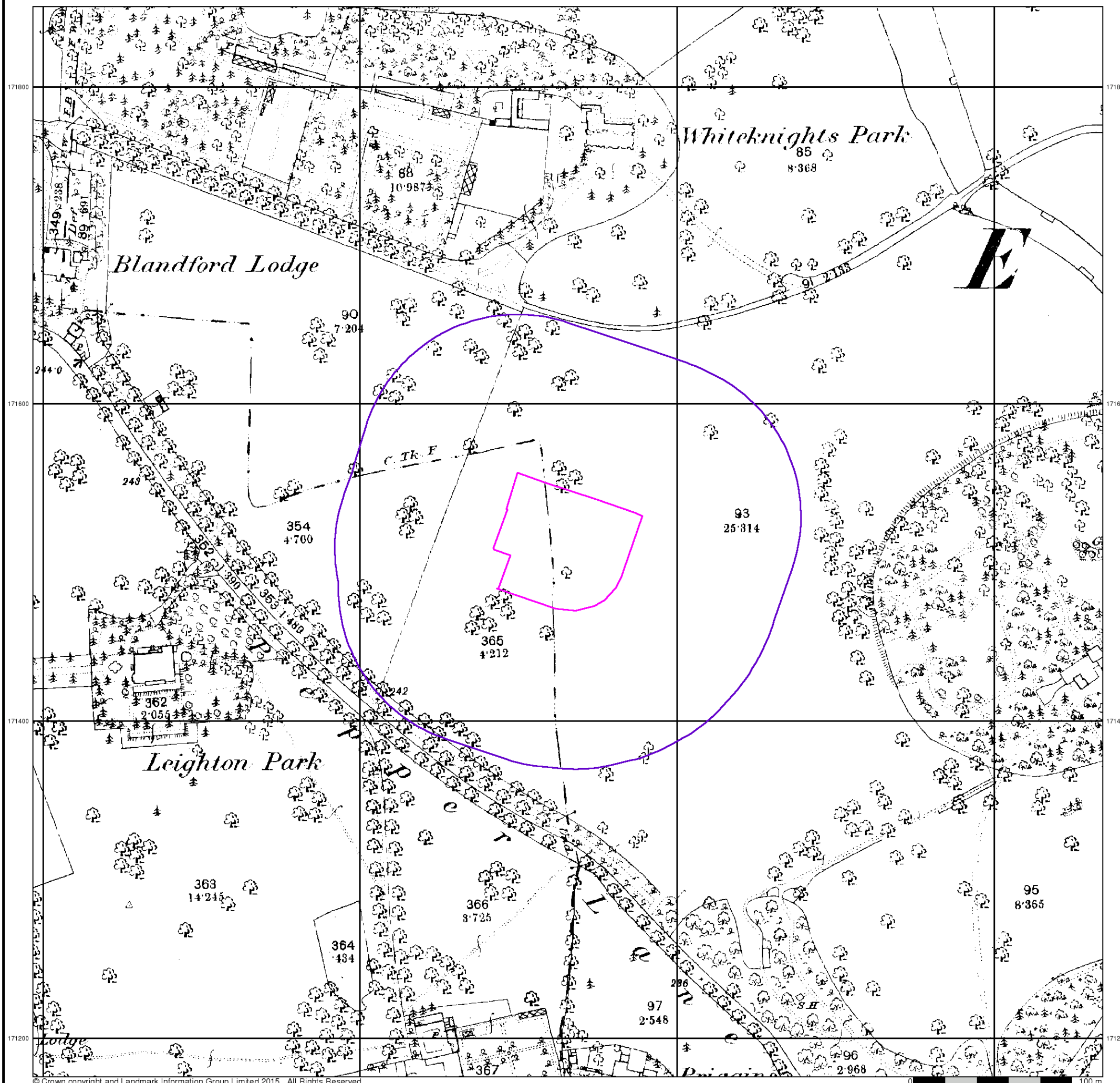
Order Number: 115805868_1_1
 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 100

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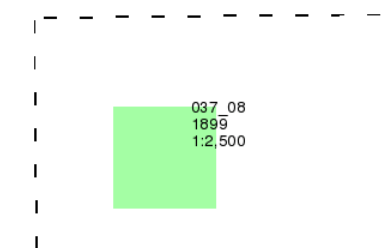
Berkshire

Published 1899

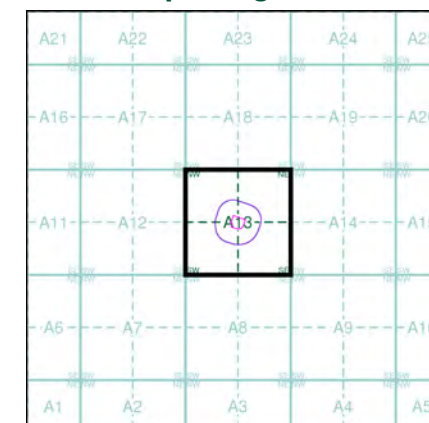
Source map scale - 1:2,500

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

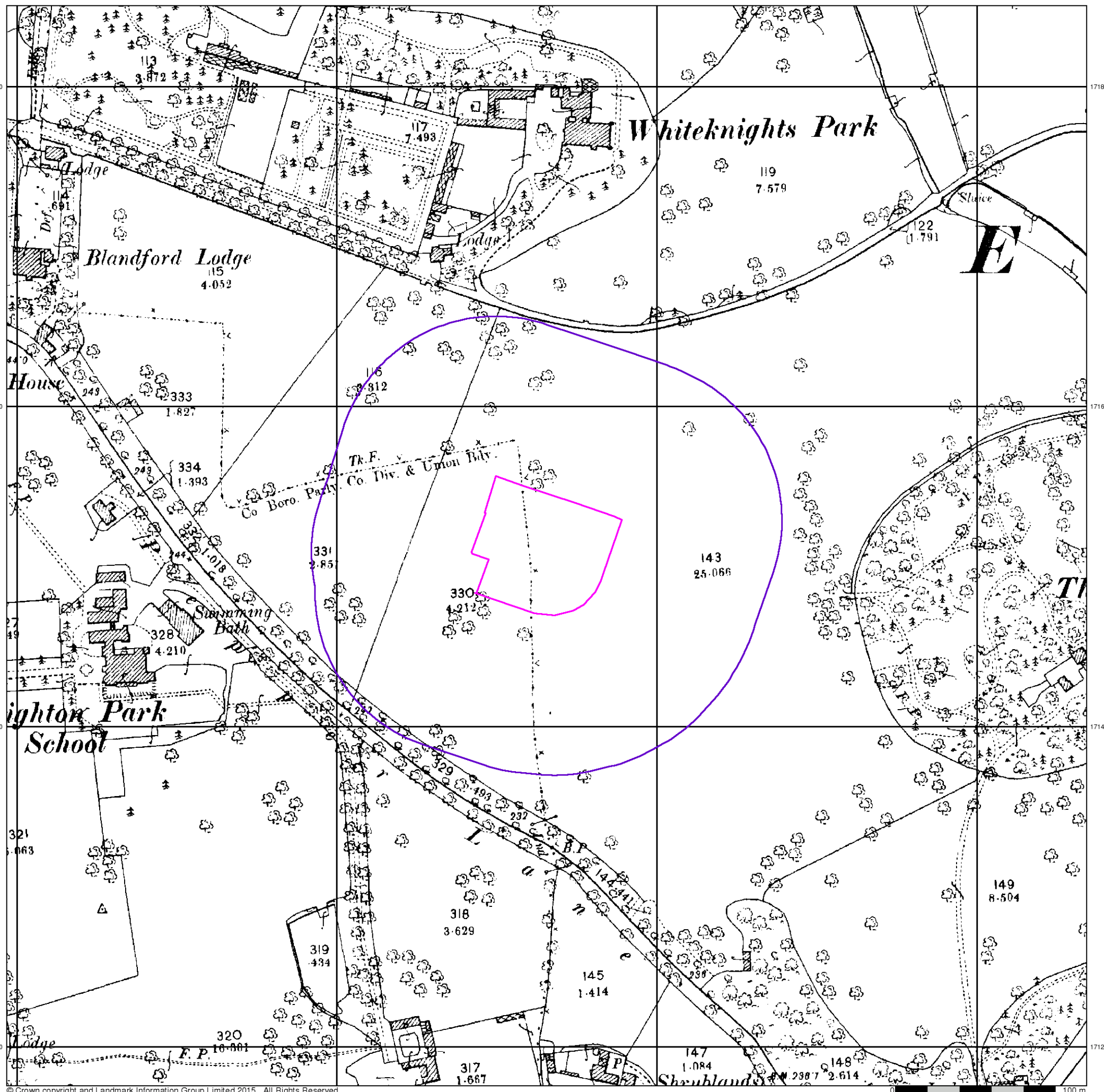
Order Number: 115805868_1_1
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 National Grid Reference: 473530, 171510
 Slice: A
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 Search Buffer (m): 100

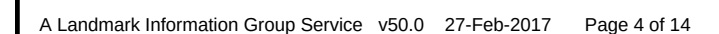
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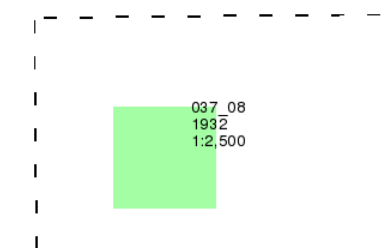
Berkshire

Published 1932

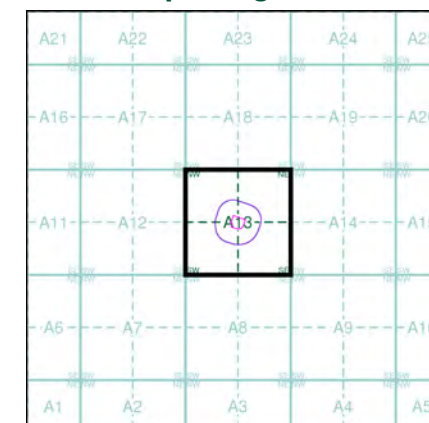
Source map scale - 1:2,500

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

Map Name(s) and Date(s)



Historical Map - Segment A13

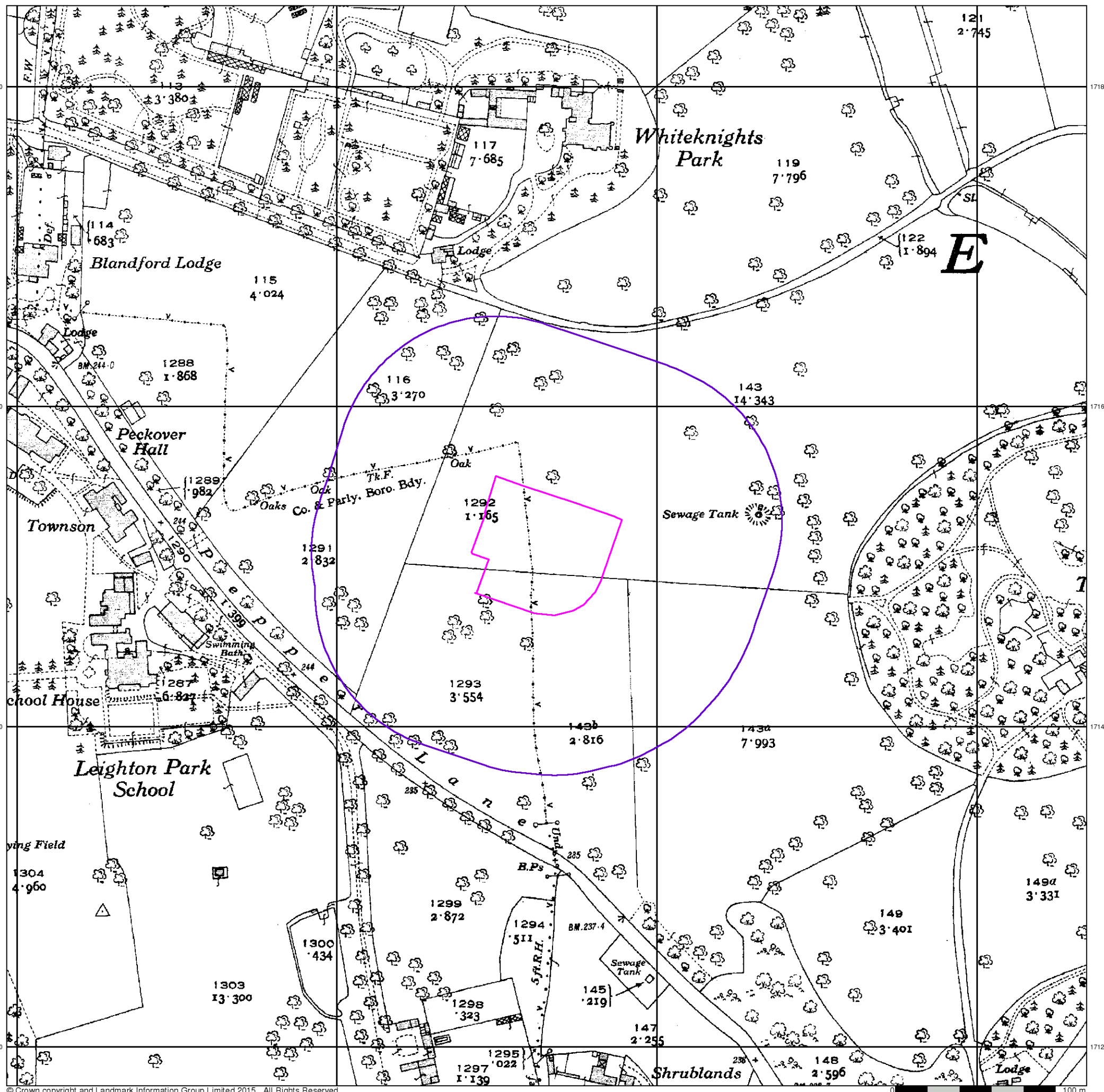


Order Details

Order Number: 115805868_1_1
 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 100

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Ordnance Survey Plan

Published 1958

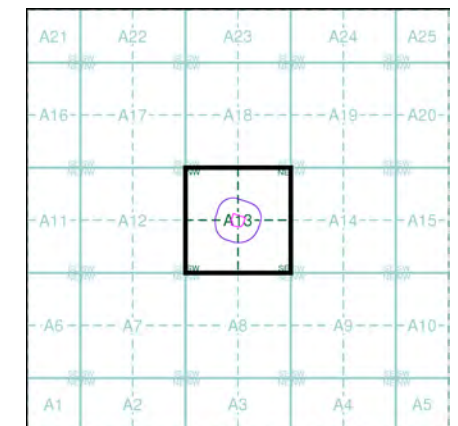
Source map scale - 1:1,250

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)

SU7371NW 1958 1:1,250	SU7371NE 1958 1:1,250
SU7371SW 1958 1:1,250	SU7371SE 1958 1:1,250

Historical Map - Segment A13



Order Details

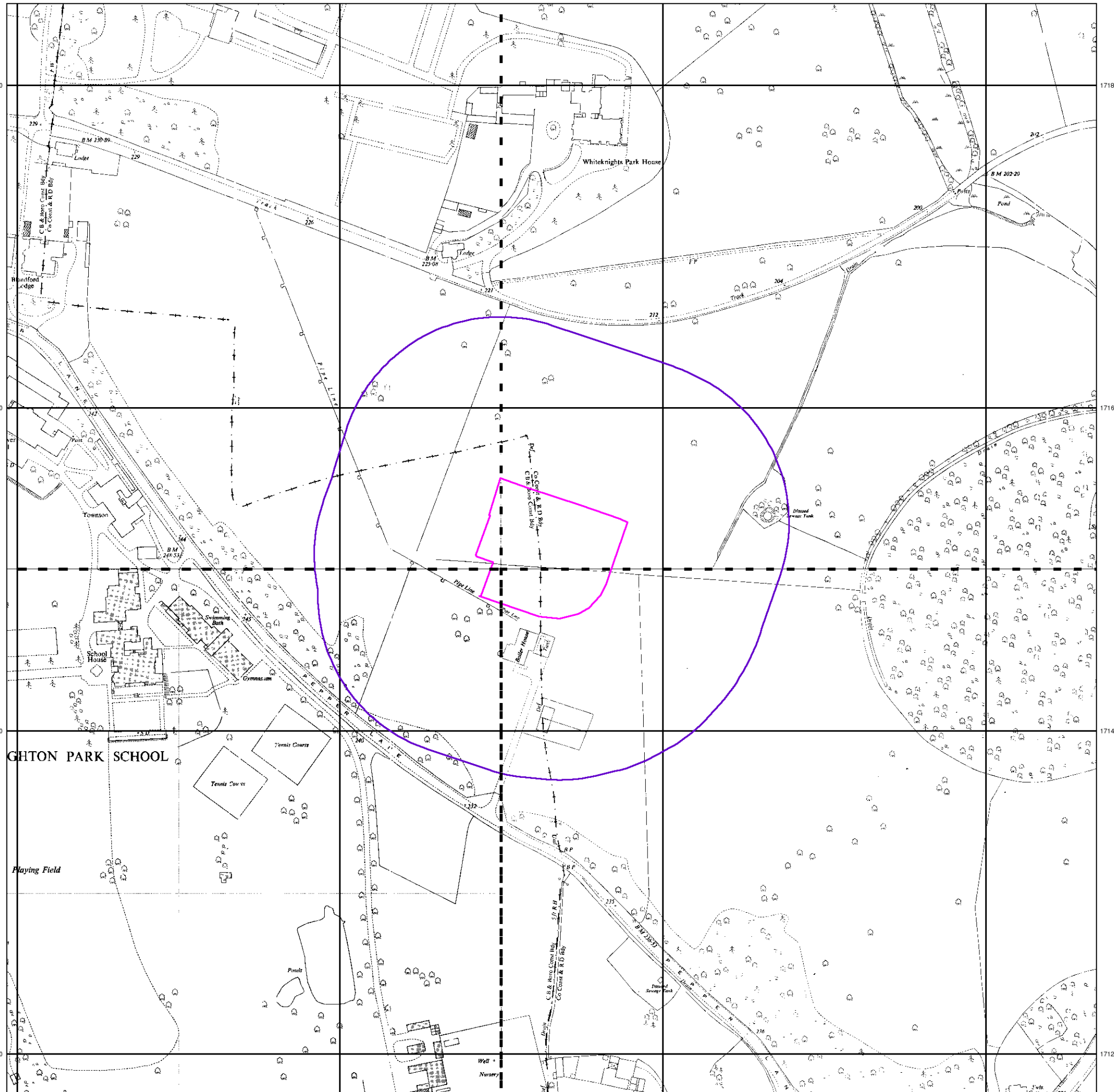
Order Number: 115805868_1_1
 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 100

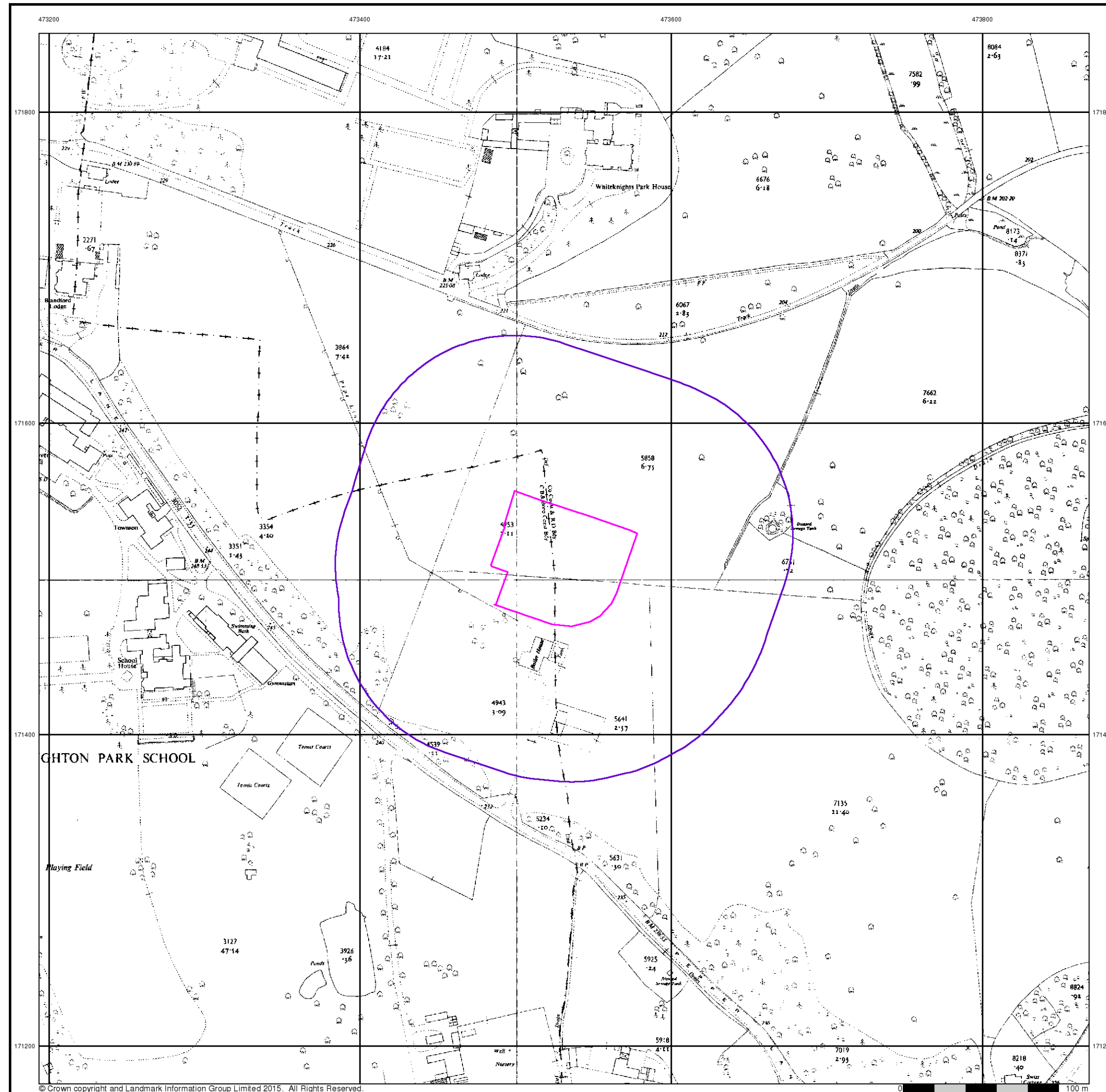
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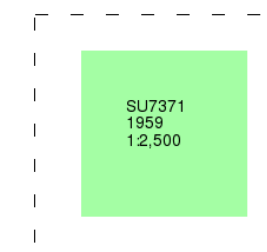
Ordnance Survey Plan

Published 1959

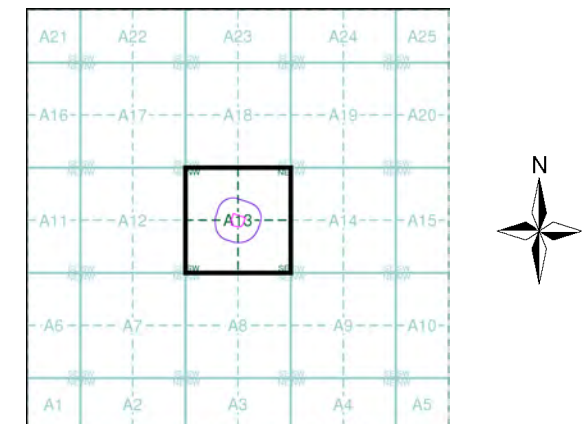
Source map scale - 1:2,500

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

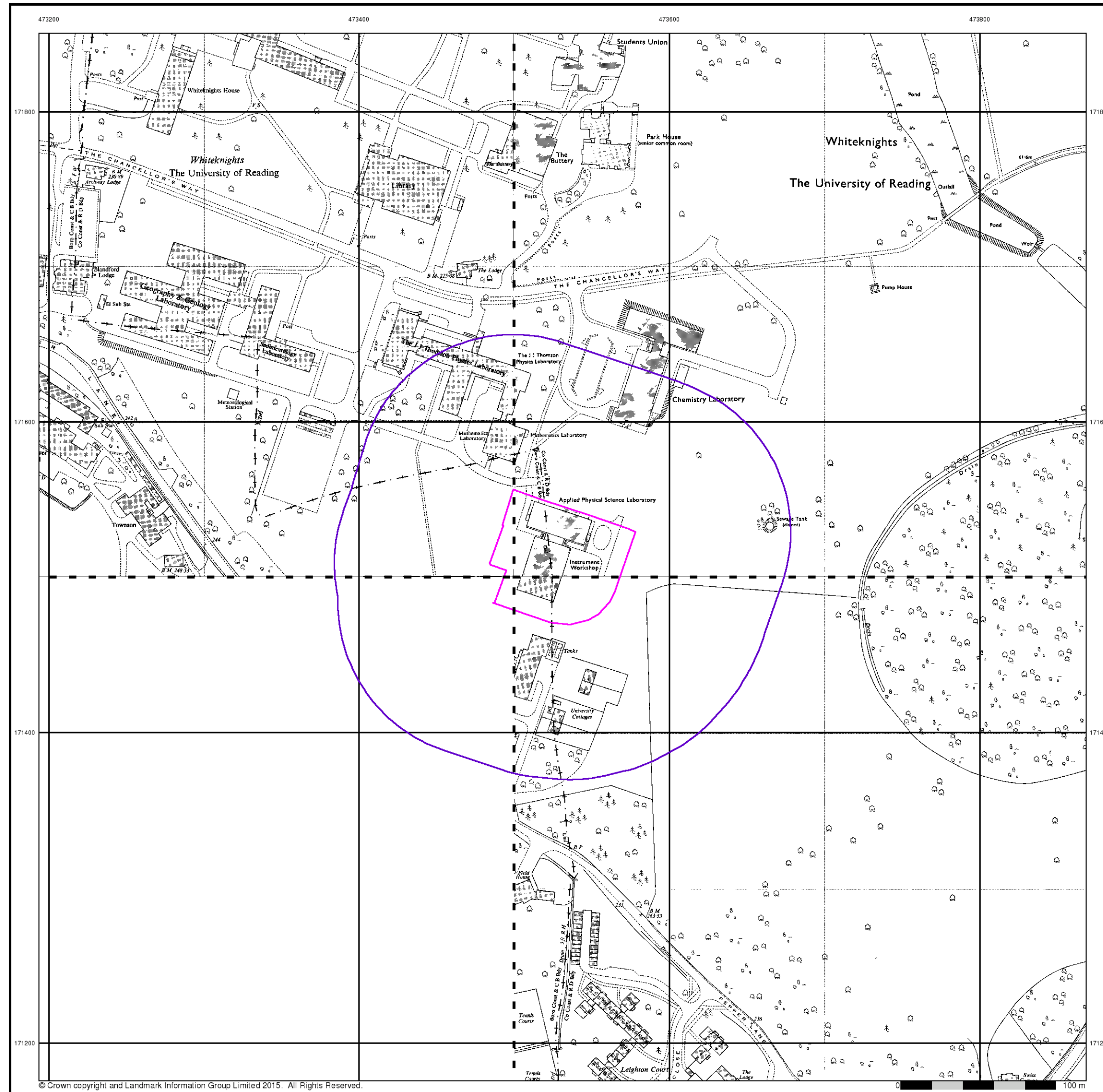
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 100

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Ordnance Survey Plan

Published 1967 - 1970

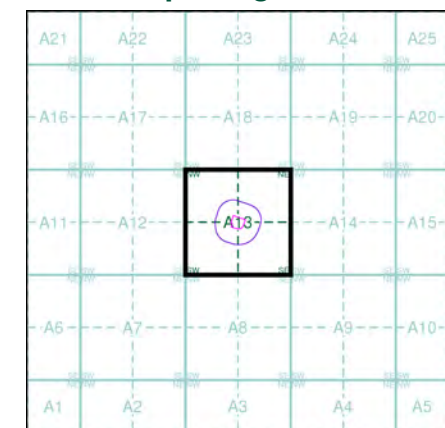
Source map scale - 1:1,250

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)

SU7371NW	SU7371NE
1969	1970
1:1,250	1:1,250
	SU7371SE
	1967
	1:1,250

Historical Map - Segment A13

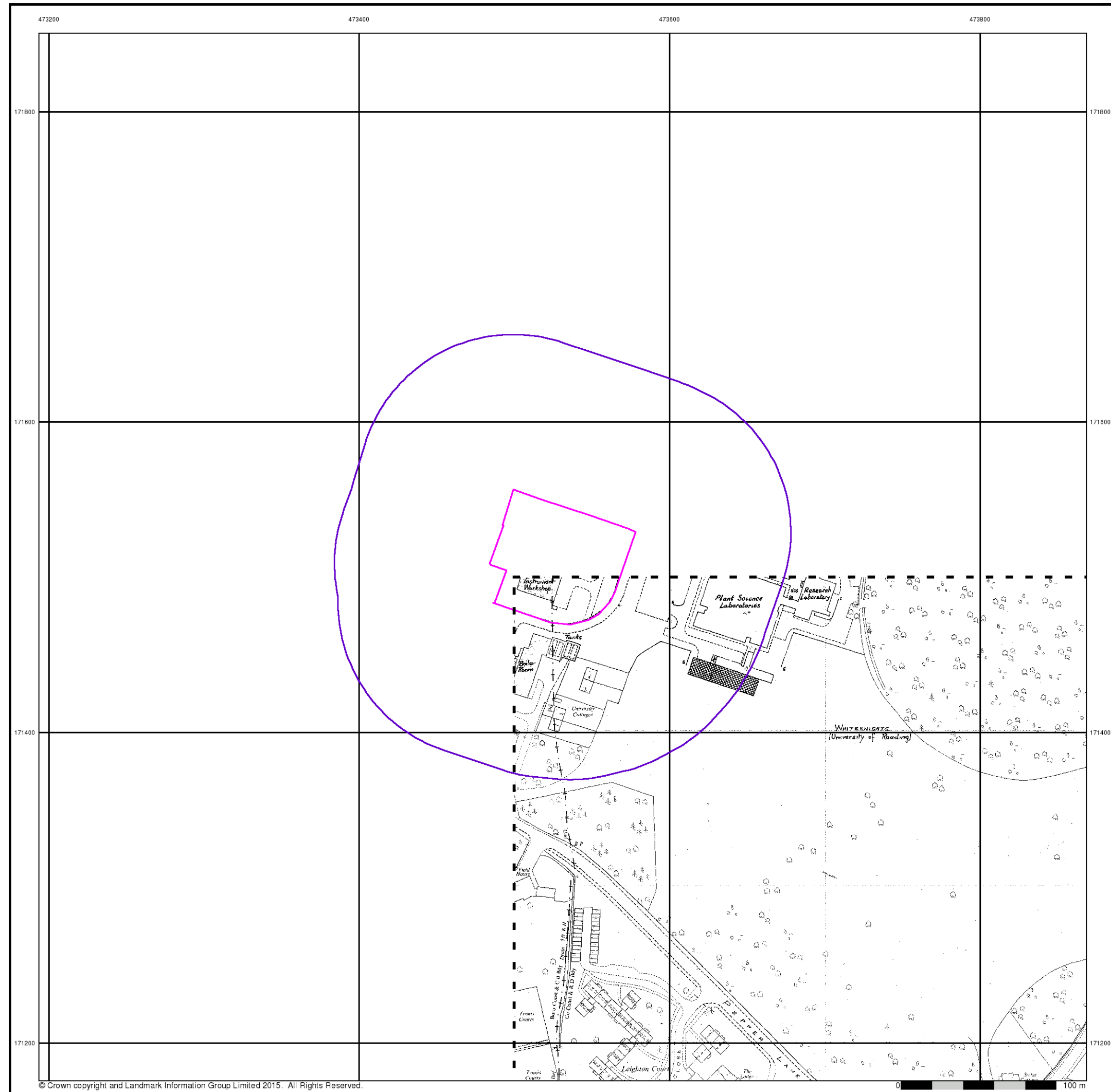


Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 100

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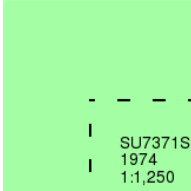
Supply of Unpublished Survey Information

Published 1974

Source map scale - 1:1,250

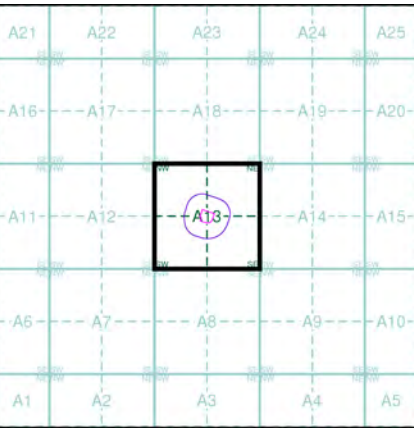
SUSI maps (Supply of Unpublished Survey Information) were produced between 1972 and 1977, mainly for internal use at Ordnance Survey. These were more of a 'work-in-progress' plan as they showed updates of individual areas on a map. These maps were unpublished, and they do not represent a single moment in time. They were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



SU7371SE
1974
1:1,250

Historical Map - Segment A13



Order Details

Order Number:	115805868_1_1
Customer Ref:	60441574/M001.003
National Grid Reference:	473530, 171510
Slice:	A
Site Area (Ha):	0.56
Search Buffer (m):	100

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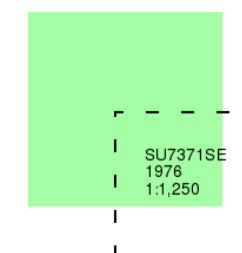
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Ordnance Survey Plan

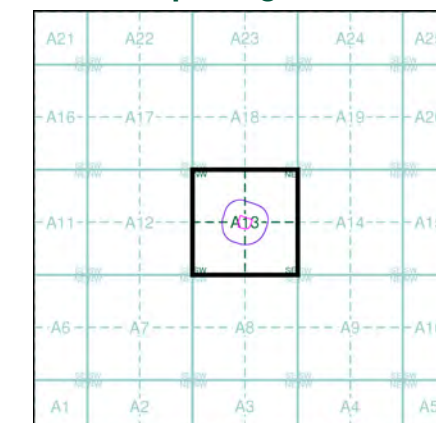
Published 1976**Source map scale - 1:1,250**

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

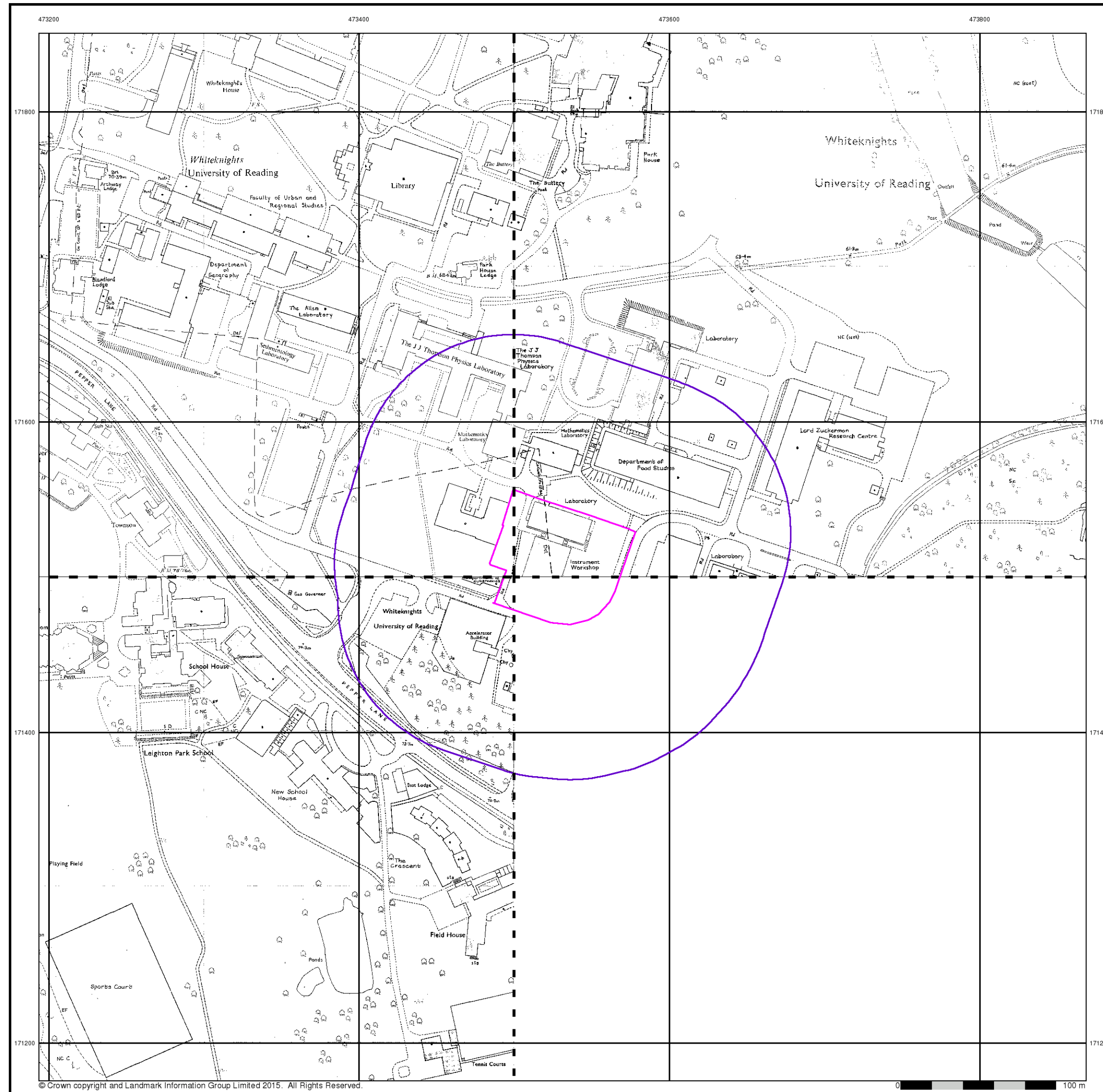
Order Number: 115805868_1_1
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National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
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Additional SIMs
Published 1987 - 1993
Source map scale - 1:1,250
The SIM cards (Ordnance Survey's '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)

SU7371NW	SU7371NE
1987	1987
1:1,250	1:1,250
SU7371SW	
1993	
1:1,250	

Historical Map - Segment A13

A grid of 25 segments labeled A1 to A25. Segment A13 is highlighted with a purple circle. A north arrow is located to the right of the grid.

Order Details
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 100

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Large-Scale National Grid Data

Published 1993

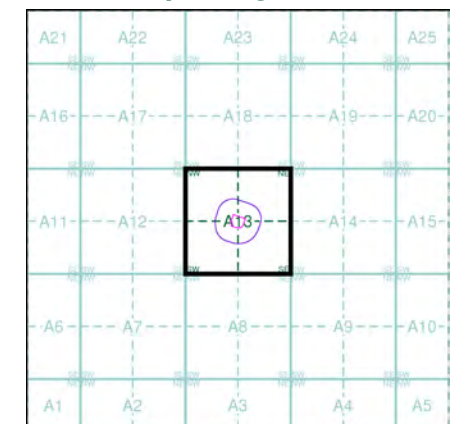
Source map scale - 1:1,250

'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)

SU7371NW	SU7371NE
1993	1993
1:1,250	1:1,250
SU7371SW	SU7371SE
1993	1993
1:1,250	1:1,250

Historical Map - Segment A13



Order Details

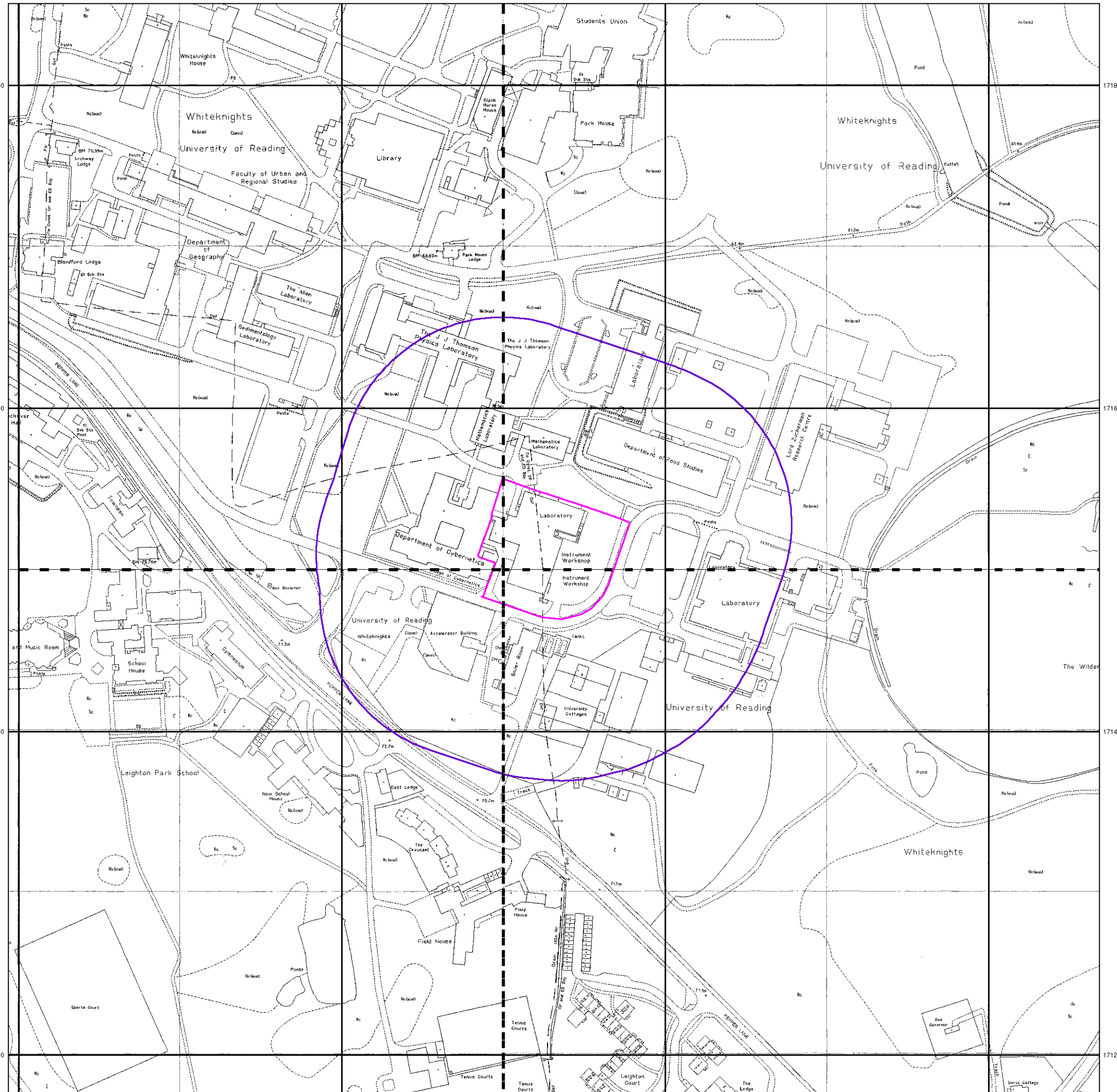
Order Number: 115805868_1_1
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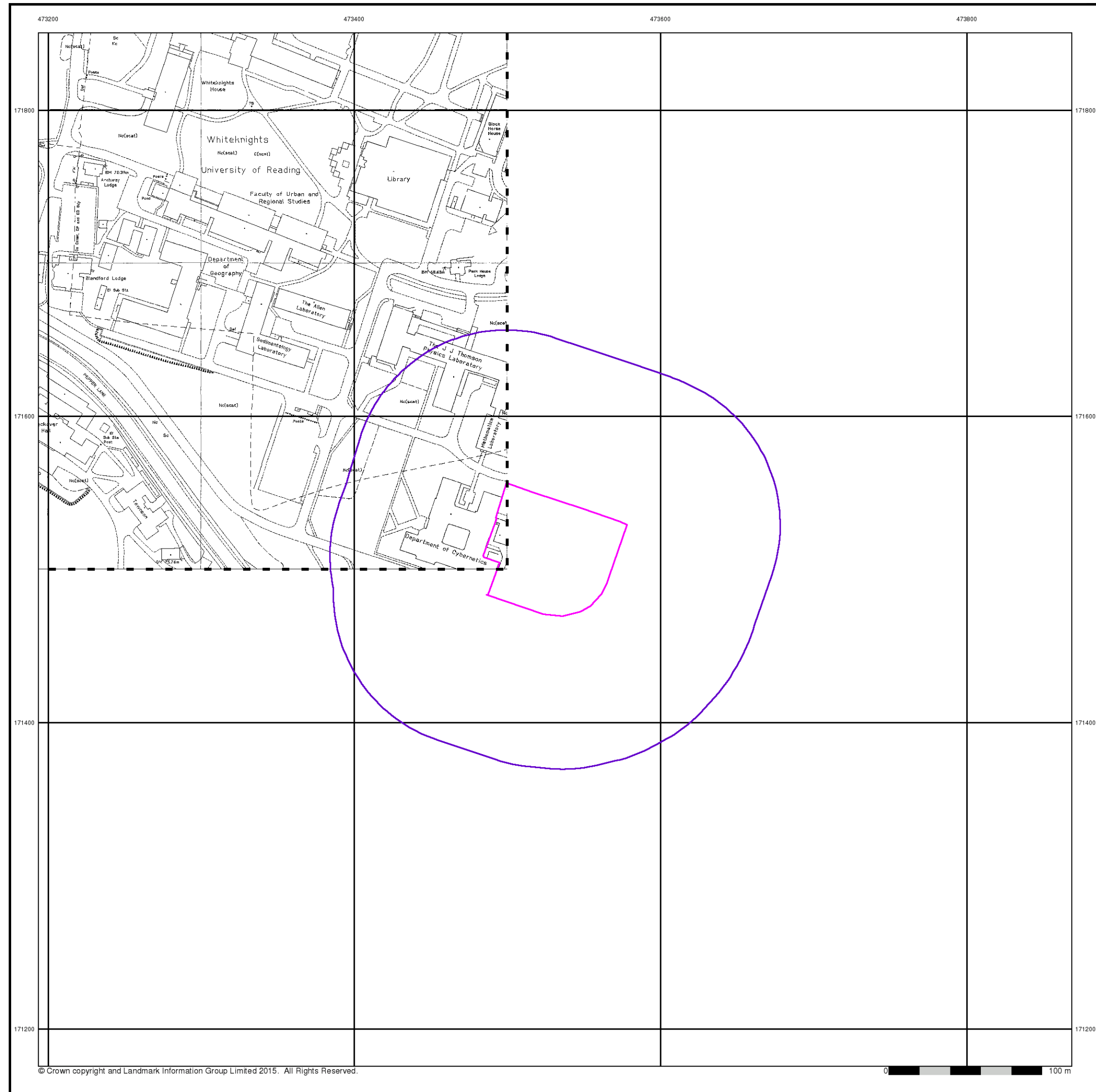
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Large-Scale National Grid Data

Published 1995

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)

SU7371NW
1995
1:1,250

Historical Map - Segment A13

A21A22A23A24A25

A16A17A18A19A20

A11A12A13A14A15

A6A7A8A9A10

A1A2A3A4A5

N

Order Details

Order Number:	115805868_1_1
Customer Ref:	60441574/M001.003
National Grid Reference:	473530, 171510
Slice:	A
Site Area (Ha):	0.56
Search Buffer (m):	100

Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING, RG6 6UR

Landmark[®]

INFORMATION GROUP

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

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473200

473400

473600

473800

171800

171800

171600

171600

171400

171400

171200

171200



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0 100 m

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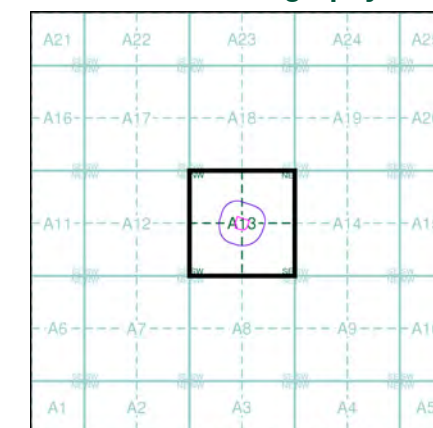
LANDMARK INFORMATION GROUP®

Historical Aerial Photography

Published 1999

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

Historical Aerial Photography - Segment A13



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Envirocheck[®] Report:

Flood Screening Report Datasheet

Order Details:

Order Number:

115805868_1_1

Customer Reference:

60441574/M001.003

National Grid Reference:

473530, 171510

Slice:

A

Site Area (Ha):

0.56

Search Buffer (m):

1000

Site Details:

Life Sciences Building, University of Reading
Shinfield Road
READING
RG6 6UR

Client Details:

MS J Foy
Aecom Infrastructure & Environment UK Ltd
Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Report Section and Details	Page Number
Summary	-
The Summary section provides an overview of the data contained within the report, detailing the number of data set features or the existence of a data set in relation to the buffer(s) selected. For ease of reference, the report is broken down into seven sections of data.	
EA / NRW / CEH Flood Data	-
This section details data from the Environment Agency/Natural Resources Wales and the Centre for Ecology and Hydrology. The EA/NRW data is reported to a distance of 250m from the edge of the site polygon and details both Zone 2 (extreme) and Zone 3 flood extents, as well as flood defences, flood water storage areas and areas benefiting from flood defences. The CEH data is reported to a distance of 250m from the edge of the site polygon and covers flood data for Scotland, divided into levels based on the frequency and magnitude of a predicted 100 year term. All data sets within this section are plotted and feature on the EA / NRW / CEH Flood Data (1:10,000) map. For added value, OS Contour data is also plotted, detailing contours, spot heights and land water boundaries.	
JBA Flood Data	1
This section contains the Comprehensive Flood Map ("CFM") data from JBA Risk Management Limited. The data is based upon the likelihood of a flood occurrence for up to 4 flood return periods depending on the type of flooding; these being 75 years, 100 years, 200 years and 1000 years. Each layer being modelled at a 5m cell resolution. Each return period is depicted on a separate 1:10,000 scale map and reports features to a distance of 250m in the datasheet from the edge of the site polygon. For each return period the following three sources of flooding are identified, surface water or pluvial flooding, undefended river flooding or fluvial flooding and undefended coastal flooding. In each case the extent of the flooding source is displayed with the associated depth range. In addition, a 1:10,000 scale map depicting flooding from a Canal Failure and a coverage check for this dataset is included. Where coverage exists, information is reported in the datasheet where the site could be affected by flooding that results from a dam breach. For added value, OS Contour data is also plotted, detailing contours, spot heights and land water boundaries.	
BGS Flood Data	11
This section contains two BGS data sets; namely Geological Indicators of Flooding and Groundwater Flooding Susceptibility, both of which report features out to a possible 1000m, with coverage in England, Wales and Scotland. Each data set is plotted on a separate BGS Flood Data (1:50,000) map.	
ESI Groundwater Flood Data	13
This section contains data provided by ESI who, building on their expertise, have developed algorithms and calibrated predictions of the risk of groundwater flooding occurring in Great Britain. The resulting map, classifies groundwater flood risk for each 50m x 50m into four categories, negligible, low, moderate and high. These classifications are based on the level of risk, combining severity and uncertainty that a site will suffer groundwater flooding within a return period of about 200 years.	
EA/NRW Detailed River Network Data	14
This section details 3 sources of data that depict and detail the river network of England and Wales, captured primarily from the water features theme of Ordnance Survey's OS MasterMap Topography Layer. The DRN Lines data set details all the types of rivers, drains and streams which can be found in England and Wales. The DRN Nodes data set details the river, drain and stream node intersections which divide the detailed river network data. All nodes are defined as being one of the following: A source, sink, junction, or pseudo node, interactions or not assigned. The DRN Offline Drainage dataset details water features from OS MasterMap that do not connect into the river network and are generally limited in length. All data sets within this section are plotted and feature on the EA/NRW Detailed River Network (1:10,000) map. For added value, OS Contour data is also plotted, detailing contours, spot heights and land water boundaries.	

EA/NRW Historic Flood Events Data	-
This section details Historic Flood data sourced from the Environment Agency/Natural Resources Wales and from data held by Landmark. The EA/NRW Historic Flood Events data is reported to a distance of 1000m from the edge of the site polygon and details recorded historic flood events from 1703 to October 2008. The data also contains information on the source and cause of the flood, and how the flood outline was established. Also included in this section is Landmark's Historical Flood Liabilities data set, which identifies areas that are liable to flood based on systematic analysis of historical mapping dating back to the mid 19th century. Both data sets within this section are plotted and feature on the EA/NRW Historical Flood (1:10,000) map. For added value, OS Contour data is also plotted, detailing contours, spot heights and land water boundaries.	
EA/NRW RoFRS Data	-
This section details the Risk of Flooding from Rivers and Sea (RoFRS) data sourced from the Environment Agency/Natural Resources Wales and is reported to a distance of 1000m from the edge of the site polygon. The RoFRS data provides an indication of areas of land at risk of flooding from rivers and the sea. These areas of land, called impacted cells, are represented as 50 metre squares, or smaller areas where a square is intersected by a river or coastline. The average height information of the impacted cell, modelled river and sea levels and information about over 200,000 flood defences are used as inputs to a computer flood model run by the Environment Agency/Natural Resources Wales. The model compares the probability that the flood defences will overtop or breach and the distance of the impact cell from the river or the sea for 40 scenarios for probabilities of between 100% to 0.1%. The results are then consolidated to calculate a single probability category for each impacted cell. These results have been validated by local staff using their local knowledge and expertise. RoFRS is a national flood risk assessment and does not contain information about property thresholds. Due to variations in the input data and the performance of the computer flood model at particular locations, the resulting category of an impacted cell should only be used at a specific study scale. In certain areas it would only be appropriate to compare risks between towns and counties whereas in other areas they would be more suitable for understanding risk at a street level. The level of suitability for a particular cell is indicated by the cell's suitability scale. The data within this section is plotted and feature on the EA/NRW RoFRS Data (1:50,000) map. This dataset is not available in Scotland.	
Flood Insurance Risk Data	16
This section contains flood risk data from Crawford and Company. This dataset is not plotted on any of the associated Flood maps. Crawford & Co have generated an Insurance Claims rating for Flood Risk. The risk is determined by comparing the number of flood insurance claims made to the number of properties in the postcode sector. The data will also include flood claims from domestic accidents or blocked drains, as well as flooding from river or tidal events. Flood insurance claim ratings are reported for the site only.	
Data Currency	17
Data Suppliers	20
Useful Contacts	21

Report Version v50.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m
EA / NRW / CEH Flood Data					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
JBA Flood Data					
JBA 75 Year Return (undefended) - Pluvial	pg 1		38	n/a	n/a
JBA 75 Year Return (undefended) - Fluvial				n/a	n/a
JBA 75 Year Return (undefended) - Coastal				n/a	n/a
JBA 100 Year Return (undefended) - Fluvial				n/a	n/a
JBA 100 Year Return (undefended) - Coastal				n/a	n/a
JBA 200 Year Return (undefended) - Pluvial	pg 2		47	n/a	n/a
JBA 200 Year Return (undefended) - Fluvial				n/a	n/a
JBA 200 Year Return (undefended) - Coastal				n/a	n/a
JBA 1000 Year Return (undefended) - Pluvial	pg 5		114	n/a	n/a
JBA 1000 Year Return (undefended) - Fluvial				n/a	n/a
JBA 1000 Year Return (undefended) - Coastal				n/a	n/a
JBA Canal Failure					
JBA Dam Break	pg 10				1
BGS Flood Data					
BGS Geological Indicators of Flooding					
BGS Groundwater Flooding Susceptibility	pg 11	3	5	11	19
ESI Groundwater Flood Data					
ESI Groundwater Flood Risk	pg 13	1			
EA/NRW Detailed River Network Data					
Detailed River Network Lines	pg 14				1
Detailed River Network Nodes	pg 14				1
Detailed River Network Offline Drainage	pg 14		1	2	20
EA/NRW Historic Flood Events Data					
Historic Flood Events					
Historical Flood Liabilities					
EA/NRW RoFRS Data					
RoFRS - Risk of Flooding from Rivers and Sea					
Flood Insurance Risk Data					
Postcode Sector Flood Insurance Claim Ratings	pg 16	1	n/a	n/a	n/a

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	39	1	473595 171465
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	55	1	473610 171460
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	60	1	473610 171450
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	82	1	473635 171450
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	86	1	473640 171450
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	94	1	473435 171625
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NW (NW)	98	1	473430 171625
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	101	1	473595 171630
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	102	1	473425 171625
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	106	1	473595 171635
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	112	1	473585 171645
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	112	1	473615 171635
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	112	1	473420 171635
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	118	1	473630 171635
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	120	1	473595 171650
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	168	1	473420 171330
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	185	1	473335 171640
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	194	1	473425 171300
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NW (NW)	196	1	473325 171645
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	200	1	473320 171645
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	216	1	473750 171380
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	217	1	473785 171465

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	217	1	473400 171285
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	218	1	473750 171375
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	219	1	473790 171475
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	219	1	473405 171280
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	221	1	473750 171370
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	224	1	473795 171475
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	224	1	473785 171445
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	224	1	473405 171275
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	225	1	473790 171455
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	228	1	473755 171365
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	229	1	473405 171270
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	230	1	473795 171455
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	233	1	473800 171460
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	235	1	473800 171455
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	238	1	473805 171460
	JBA 75 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	242	1	473395 171260
	JBA 75 Year Return (undefended) - Fluvial None				
	JBA 75 Year Return (undefended) - Coastal None				
	JBA 100 Year Return (undefended) - Fluvial None				
	JBA 100 Year Return (undefended) - Coastal None				
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	39	1	473595 171465
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	68	1	473620 171450
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	82	1	473635 171450

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	84	1	473635 171445
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	86	1	473640 171450
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	88	1	473640 171445
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NW (NW)	94	1	473435 171625
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	95	1	473645 171440
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	97	1	473650 171445
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	98	1	473435 171630
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	101	1	473595 171630
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	102	1	473600 171630
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	106	1	473610 171630
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	109	1	473425 171635
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	112	1	473585 171645
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	112	1	473615 171635
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	116	1	473635 171630
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	118	1	473630 171635
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	120	1	473595 171650
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	168	1	473420 171330
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	185	1	473335 171640
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NW (NW)	196	1	473325 171645
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	200	1	473320 171645
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	216	1	473750 171380
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	217	1	473400 171285

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	217	1	473785 171465
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	218	1	473750 171375
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	219	1	473395 171285
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	219	1	473790 171475
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	220	1	473405 171280
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	221	1	473750 171370
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	224	1	473795 171475
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	224	1	473785 171445
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	227	1	473795 171465
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	227	1	473790 171450
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	228	1	473800 171480
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	228	1	473795 171460
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	230	1	473800 171470
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	231	1	473400 171270
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	232	1	473800 171465
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	232	1	473760 171365
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	233	1	473800 171460
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	234	1	473405 171265
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	235	1	473800 171455
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	238	1	473805 171460
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	239	1	473805 171455
	JBA 200 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	242	1	473395 171260

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 200 Year Return (undefended) - Fluvial None				
	JBA 200 Year Return (undefended) - Coastal None				
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	26	1	473560 171450
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	34	1	473585 171460
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	39	1	473565 171575
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	40	1	473560 171435
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	44	1	473600 171465
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (S)	53	1	473555 171420
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	59	1	473615 171460
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (S)	59	1	473560 171415
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	73	1	473625 171450
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	73	1	473615 171435
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	73	1	473620 171590
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	84	1	473635 171445
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	87	1	473595 171615
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	89	1	473635 171435
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	90	1	473665 171550
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	91	1	473440 171625
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NW (NW)	91	1	473435 171620
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	93	1	473600 171620
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	95	1	473650 171590
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	99	1	473665 171575
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	101	1	473595 171630

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	104	1	473590 171635
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	106	1	473610 171630
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	109	1	473425 171635
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	112	1	473585 171645
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	112	1	473615 171635
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	112	1	473625 171630
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	114	1	473630 171630
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	116	1	473420 171640
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	116	1	473635 171630
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	118	1	473590 171650
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	118	1	473630 171635
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (N)	121	1	473570 171660
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	121	1	473635 171635
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	123	1	473605 171650
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	126	1	473600 171655
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	129	1	473705 171510
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (N)	131	1	473585 171665
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	131	1	473600 171660
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	132	1	473695 171465
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	132	1	473605 171660
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (N)	135	1	473585 171670
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	136	1	473600 171665

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	138	1	473715 171513
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	142	1	473720 171520
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	143	1	473720 171513
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	144	1	473715 171485
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	146	1	473630 171665
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	149	1	473725 171510
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	150	1	473640 171665
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	153	1	473665 171655
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	153	1	473725 171570
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	153	1	473730 171530
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	155	1	473690 171635
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	156	1	473670 171655
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (E)	157	1	473735 171520
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	160	1	473735 171555
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	162	1	473740 171525
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	163	1	473740 171535
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (E)	163	1	473740 171530
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	166	1	473425 171330
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (S)	173	1	473475 171305
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (E)	173	1	473750 171545
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	174	1	473740 171590
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (S)	175	1	473470 171305

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	177	1	473420 171320
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	178	1	473755 171535
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	180	1	473340 171640
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	184	1	473760 171555
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (S)	185	1	473535 171285
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	186	1	473420 171310
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	188	1	473415 171310
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	188	1	473430 171305
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (E)	189	1	473765 171555
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (NE)	190	1	473705 171670
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	194	1	473325 171640
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NE (E)	195	1	473770 171560
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NW (NW)	196	1	473325 171645
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	197	1	473430 171295
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	200	1	473320 171645
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (E)	200	1	473775 171560
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	202	1	473755 171425
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13NW (NW)	203	1	473320 171650
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NW (NW)	205	1	473320 171655
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (S)	205	1	473545 171265
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	216	1	473750 171380
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	217	1	473785 171465

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	217	1	473400 171285
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	218	1	473770 171420
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	219	1	473790 171475
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	222	1	473785 171450
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	222	1	473775 171420
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	222	1	473760 171385
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	224	1	473795 171475
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	224	1	473785 171445
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	225	1	473795 171470
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	225	1	473780 171425
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	225	1	473765 171390
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SW (SW)	226	1	473390 171280
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	228	1	473800 171480
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	228	1	473795 171460
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	228	1	473385 171280
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (SE)	231	1	473770 171385
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	232	1	473800 171465
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	233	1	473800 171460
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	234	1	473805 171475
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	235	1	473800 171455
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (SE)	236	1	473775 171385
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	238	1	473805 171460

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	238	1	473795 171430
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SE (E)	239	1	473805 171455
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.3m and Less than or equal to 1.0m	A13SW (SW)	245	1	473400 171255
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13SE (E)	247	1	473805 171430
	JBA 1000 Year Return (undefended) - Pluvial Flood Depth: Greater than 0.1m and Less than or equal to 0.3m	A13NE (NE)	249	1	473725 171730
	JBA 1000 Year Return (undefended) - Fluvial None				
	JBA 1000 Year Return (undefended) - Coastal None				
	JBA Canal Failure Coverage Coverage: This area has been mapped for risk of flooding from canal or aqueduct failure or breach. Please note that all canals in this area may not have been mapped for failure or breach.	A13SW (NE)	0	1	473527 171513
	JBA Canal Failure None				
	JBA Dam Break Coverage Coverage: This area has been mapped for flooding from dam or reservoir embankment failure or breach.	A13SW (NE)	0	1	473527 171513
	JBA Dam Break Assessment: This area is regarded as being at some risk of flooding in the event of an instantaneous catastrophic breach of dam or reservoir embankment. Flooded Area Size: 643575m2	A18NE (N)	865	1	473865 172345

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13SW (W)	0	2	473500 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SW (NE)	0	2	473527 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	0	2	473550 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13NE (NE)	72	2	473600 171600
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13SW (W)	84	2	473400 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (NW)	106	2	473450 171650
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13SW (W)	190	2	473300 171450
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (SE)	201	2	473650 171300
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (NW)	267	2	473250 171650
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13SW (S)	272	2	473500 171200
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	300	2	473850 171400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (S)	320	2	473527 171150
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A8NW (S)	330	2	473450 171150
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14NW (NE)	365	2	473900 171700
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14SW (E)	372	2	473950 171513
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (NW)	386	2	473200 171800
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A18SW (NW)	398	2	473300 171900
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NE (S)	420	2	473550 171050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A14SW (SE)	498	2	474000 171250
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (S)	520	2	473527 170950
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A14NW (E)	573	2	474150 171550
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A8NE (S)	574	2	473600 170900

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A17SE (NW)	605	2	473150 172050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SW (NW)	665	2	473200 172150
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A19SW (NE)	700	2	473900 172150
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A18NW (NW)	710	2	473200 172200
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A19SW (NE)	738	2	474100 172050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A19NW (NE)	768	2	473950 172200
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A7NE (SW)	793	2	472950 170900
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A7SE (SW)	807	2	473150 170750
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A19NW (NE)	821	2	474050 172200
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A8SE (S)	836	2	473700 170650
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A17SW (NW)	856	2	472800 172050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A19NW (NE)	879	2	474000 172300
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A19NW (NE)	882	2	474150 172200
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A17NE (NW)	934	2	473100 172400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A17NE (NW)	956	2	473050 172400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A15SW (E)	999	2	474550 171300

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	ESI Groundwater Flood Data Risk: Negligible Risk Risk Details: There is a negligible risk of groundwater flooding in this area and any groundwater flooding incidence has a chance of less than 1 in 100 (<1%) probability of occurrence.	A13SW (NE)	0	1	473527 171513

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	Detailed River Network Lines River Type: Tertiary River River Name: Not Supplied Hydrographic Area: B06 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk: Other Rivers Management Status: Water Course: Not Supplied Name: Water Course: Not Supplied Reference:	A9NE (SE)	827	3	474231 170999
2	Detailed River Network Nodes River Node Type: Source Hydrographic Area: D006	A9NE (SE)	827	3	474231 170999
3	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A13SE (S)	186	3	473536 171284
4	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A8NW (S)	307	3	473531 171163
5	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A14NW (E)	355	3	473917 171634
6	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A8NE (S)	502	3	473668 170985
7	Detailed River Network Offline Drainage River Type: Secondary River Hydrographic Area: D006	A14SW (E)	532	3	474101 171431
8	Detailed River Network Offline Drainage River Type: Secondary River Hydrographic Area: D006	A14SW (E)	556	3	474133 171504
9	Detailed River Network Offline Drainage River Type: Secondary River Hydrographic Area: D006	A14NW (E)	563	3	474140 171541
10	Detailed River Network Offline Drainage River Type: Secondary River Hydrographic Area: D006	A14NW (E)	573	3	474151 171537
11	Detailed River Network Offline Drainage River Type: Secondary River Hydrographic Area: D006	A14NW (E)	616	3	474187 171618
12	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A14NW (E)	617	3	474188 171622
13	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A14NW (E)	618	3	474189 171621
14	Detailed River Network Offline Drainage River Type: Secondary River Hydrographic Area: D006	A14NW (E)	629	3	474202 171603
15	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A8SW (S)	654	3	473516 170816
16	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A8SW (S)	667	3	473516 170804
17	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A8SW (S)	667	3	473516 170804
18	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A12NW (W)	748	3	472737 171536

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
19	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A14SE (E)	785	3	474322 171282
20	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A19NW (NE)	814	3	473876 172286
21	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A12NW (W)	834	3	472661 171643
22	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A19SE (NE)	842	3	474339 171889
23	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A12NW (W)	862	3	472626 171593
24	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A7SE (SW)	934	3	472998 170688
25	Detailed River Network Offline Drainage River Type: Tertiary River Hydrographic Area: D006	A17SW (NW)	964	3	472600 171901

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Postcode Sector Flood Insurance Claim Ratings Insurance Rating: No Flood Insurance Claim Assessment - too few properties Postcode Sector: RG6 6	A13SW (NE)	0	1	473527 171513

EA / NRW / CEH Flood Data	Version	Update Cycle
Extreme Flooding from Rivers or Sea without Defences Environment Agency - Head Office	November 2016	Quarterly
Flooding from Rivers or Sea without Defences Environment Agency - Head Office	November 2016	Quarterly
Areas Benefiting from Flood Defences Environment Agency - Head Office	November 2016	Quarterly
Flood Water Storage Areas Environment Agency - Head Office	November 2016	Quarterly
Flood Defences Environment Agency - Head Office	November 2016	Quarterly
EA / NRW Surface Water Flood Data	Version	Update Cycle
Surface Water 1 in 30 year Flood Depth Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 100 year Flood Depth Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 1000 year Flood Depth Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 30 year Flood Velocity Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 100 year Flood Velocity Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 1000 year Flood Velocity Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 30 year Flood Flow Direction 25m Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 100 year Flood Flow Direction 25m Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 1000 year Flood Flow Direction 25m Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 30 year Flood Hazard Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 100 year Flood Hazard Environment Agency - Head Office	October 2013	As notified
Surface Water 1 in 1000 year Flood Hazard Environment Agency - Head Office	October 2013	As notified
Surface Water Suitability Environment Agency - Head Office	October 2013	As notified

JBA Flood Data	Version	Update Cycle
JBA 75 Year Return (undefended) - Pluvial JBA Risk Management Limited	September 2015	Annually
JBA 75 Year Return (undefended) - Fluvial JBA Risk Management Limited	September 2015	Annually
JBA 75 Year Return (undefended) - Coastal JBA Risk Management Limited	September 2015	Annually
JBA 100 Year Return (undefended) - Fluvial JBA Risk Management Limited	September 2015	Annually
JBA 100 Year Return (undefended) - Coastal JBA Risk Management Limited	September 2015	Annually
JBA 200 Year Return (undefended) - Pluvial JBA Risk Management Limited	September 2015	Annually
JBA 200 Year Return (undefended) - Fluvial JBA Risk Management Limited	September 2015	Annually
JBA 200 Year Return (undefended) - Coastal JBA Risk Management Limited	September 2015	Annually
JBA 1000 Year Return (undefended) - Pluvial JBA Risk Management Limited	September 2015	Annually
JBA 1000 Year Return (undefended) - Fluvial JBA Risk Management Limited	September 2015	Annually
JBA 1000 Year Return (undefended) - Coastal JBA Risk Management Limited	September 2015	Annually
JBA Canal Failure JBA Risk Management Limited	September 2016	Annually
JBA Dam Break JBA Risk Management Limited	September 2016	Annually
BGS Flood Data	Version	Update Cycle
BGS Geological Indicators of Flooding British Geological Survey - National Geoscience Information Service	February 2011	Annually
BGS Groundwater Flooding Susceptibility British Geological Survey - National Geoscience Information Service	May 2013	Annually
ESI Groundwater Flooding Data	Version	Update Cycle
ESI Groundwater Flood Risk GeoSmart Information Ltd	May 2015	Bi-Annually
EA/NRW Detailed River Network Data	Version	Update Cycle
Detailed River Network Lines Environment Agency - Head Office	September 2014	Annually
Detailed River Network Nodes Environment Agency - Head Office	March 2012	Annually
Detailed River Network Offline Drainage Environment Agency - Head Office	March 2012	Annually
EA/NRW Historic Flood Events Data	Version	Update Cycle
Historic Flood Events Environment Agency - Head Office	November 2016	Quarterly
Historical Flood Liabilities Landmark Information Group Limited	December 1999	Not Applicable

EA/NRW Risk of Flooding from Rivers and Sea (RoFRS)	Version	Update Cycle
RoFRS - Risk of Flooding from Rivers and Sea Environment Agency - Head Office	September 2016	Annually
Flood Insurance Risk Data	Version	Update Cycle
Postcode Sector Flood Insurance Claim Ratings Crawford and Company	October 2016	Quarterly

A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	
Environment Agency	
Natural Resources Wales	
Centre for Ecology and Hydrology	
British Geological Survey	
Environmental Simulations International	
JBA Risk Management	

Contact	Name and Address	Contact Details
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2	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
3	Environment Agency - National Customer Contact Centre (NCCC) PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 03708 506 506 Email: enquiries@environment-agency.gov.uk
4	Environment Agency - Head Office Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol, Avon, BS32 4UD	Telephone: 01454 624400 Fax: 01454 624409

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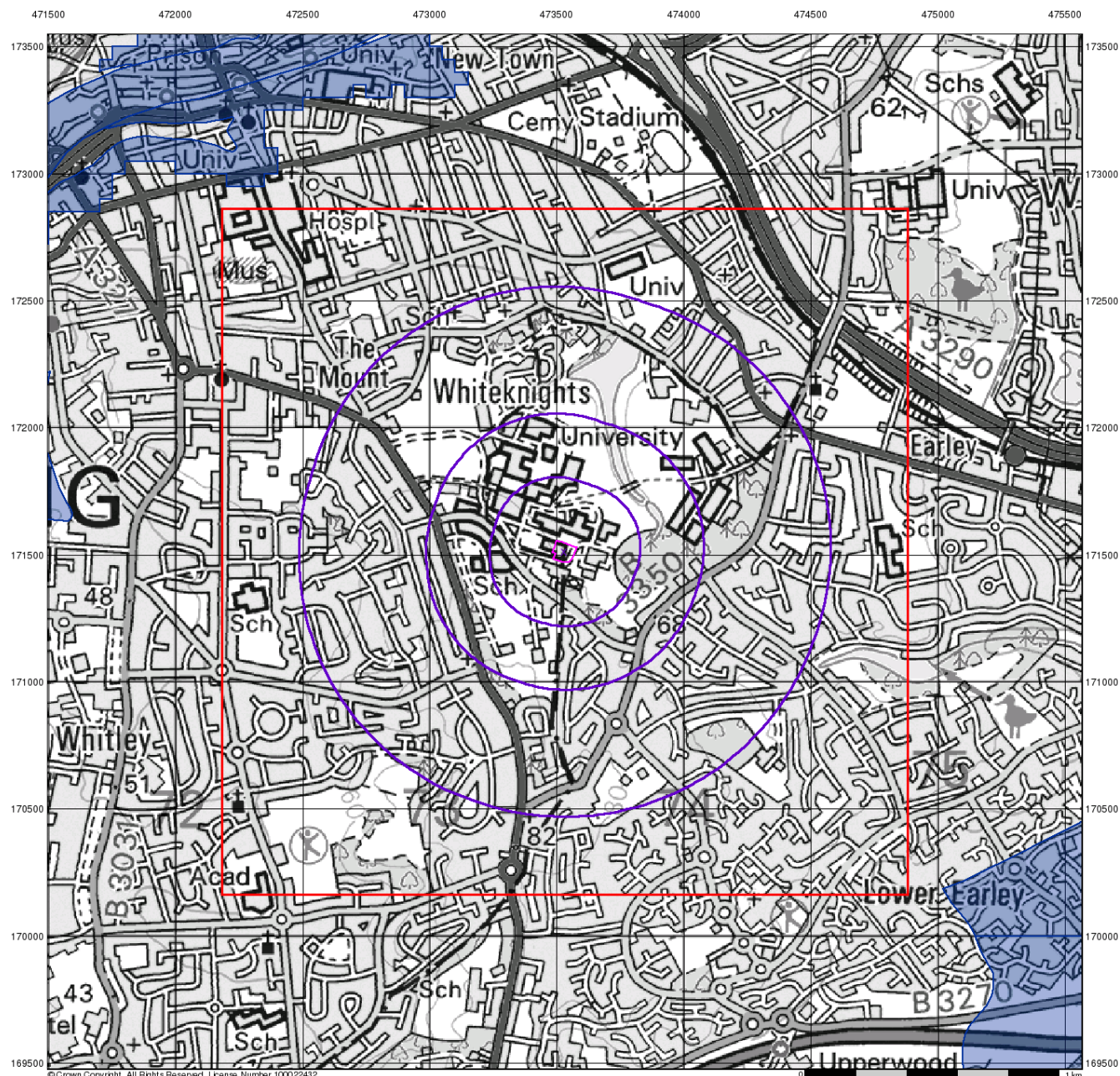
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BGS Flood Data (1:50,000)

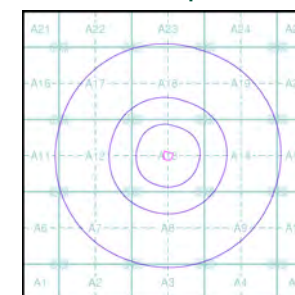
General

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

BGS Geological Indicators of Flooding

- Coastal
- Inland
- Bodies of Water

BGS Flood Data Map - Slice A



Order Details

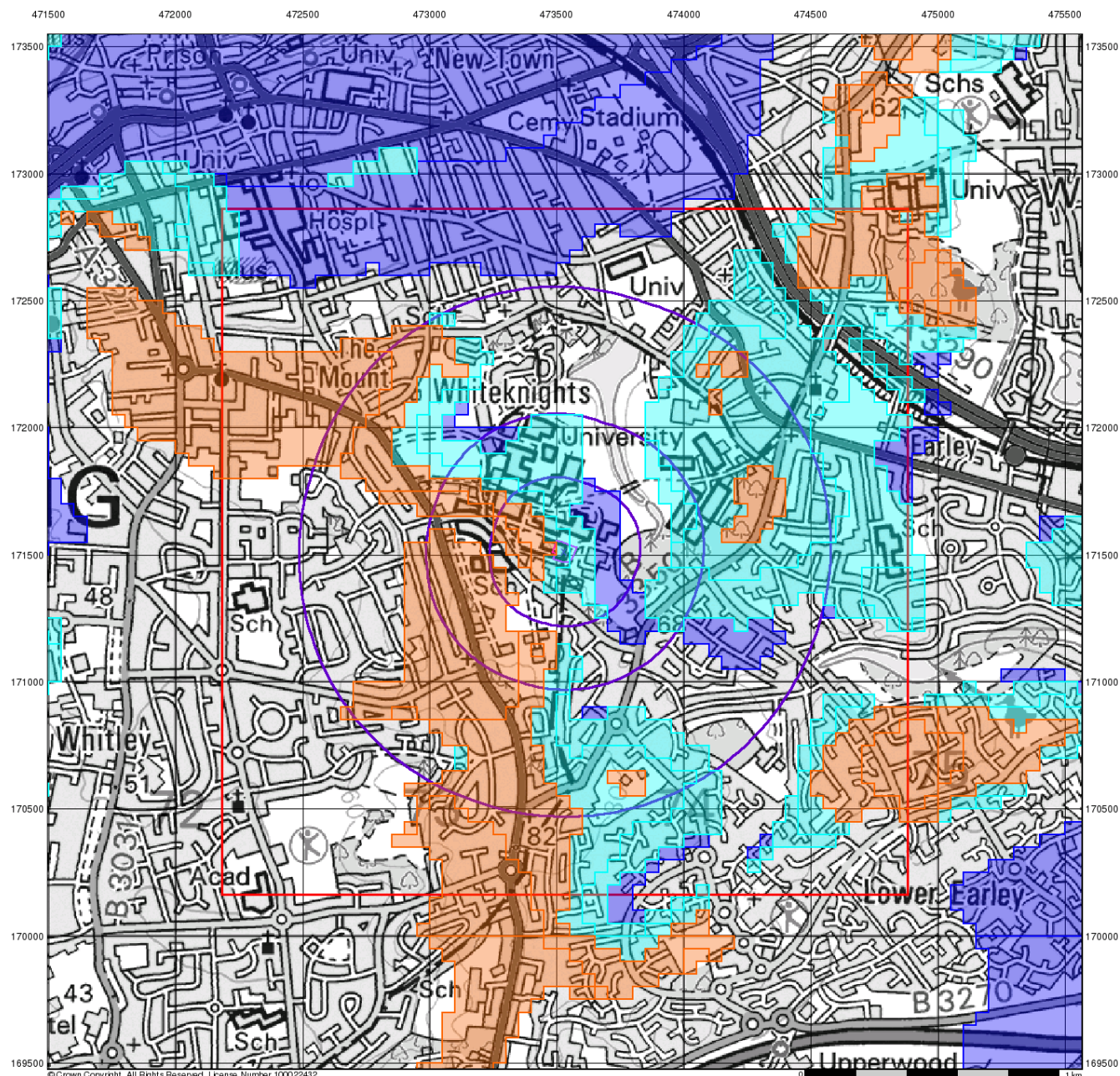
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 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
 Site Area (Ha): 0.56
 Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING RG6 6UR

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BGS Flood Data (1:50,000)

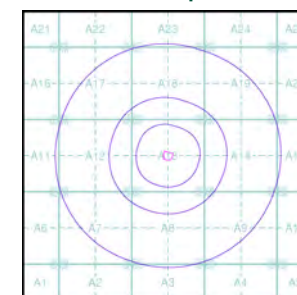
General

- ◇ Specified Site
- Specified Buffer(s)
- X Bearing Reference Point
- Slice
- B Map ID

BGS Groundwater Flooding Susceptibility

- Potential for Groundwater Flooding to Occur at Surface
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Limited Potential for Groundwater Flooding to Occur

BGS Flood Data Map - Slice A



Order Details

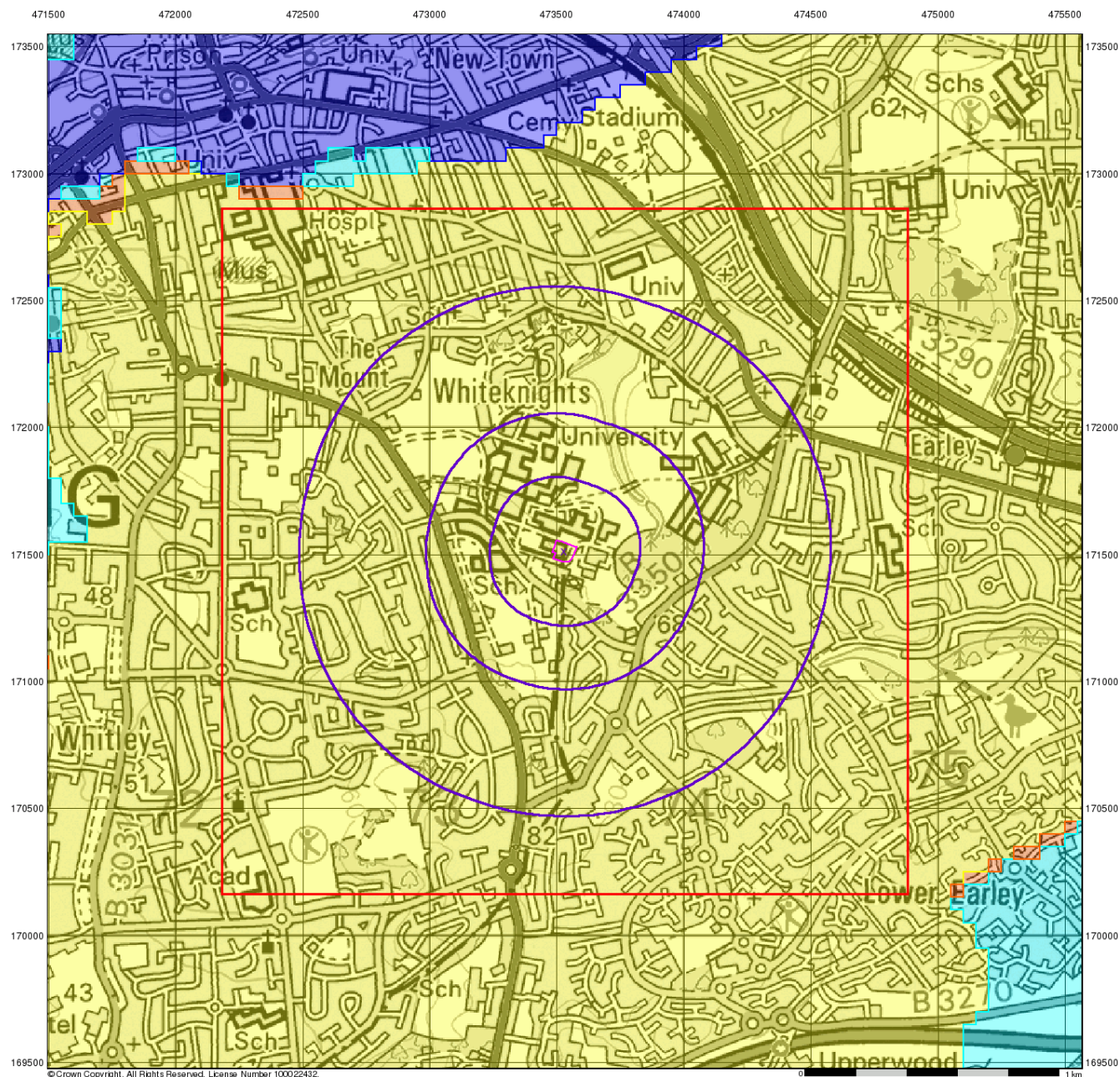
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ESI Groundwater Flood Map (1:50,000)

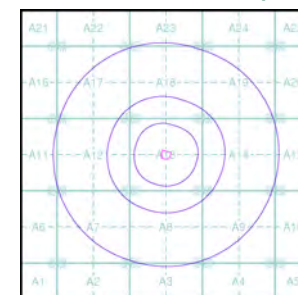
General

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

ESI Groundwater Flooding Risk

- High Risk
- Moderate Risk
- Low Risk
- Negligible Risk

ESI Groundwater Flood Map - Slice A

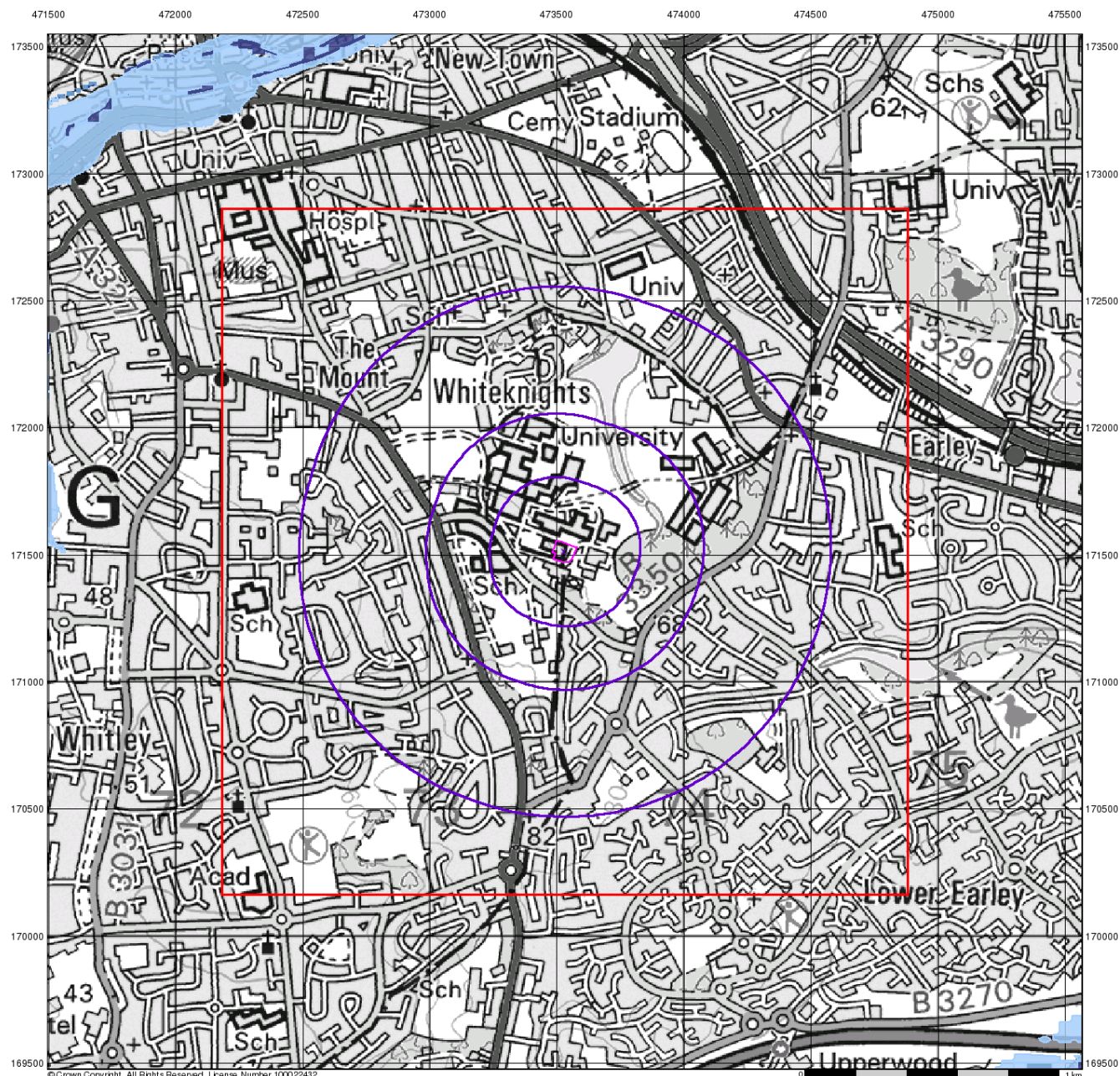


Order Details

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 Customer Ref: 60441574/M001.003
 National Grid Reference: 473530, 171510
 Slice: A
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EA/NRW RoFRS Data (1:50,000)

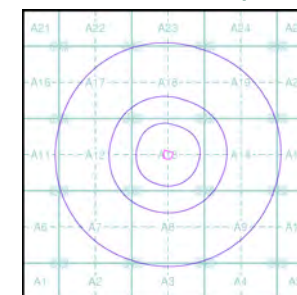
General

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

Risk of Flooding from Rivers and Sea (RoFRS)

- High Risk
- Medium Risk
- Low Risk
- Very Low Risk

EA/NRW RoFRS Data Map - Slice A

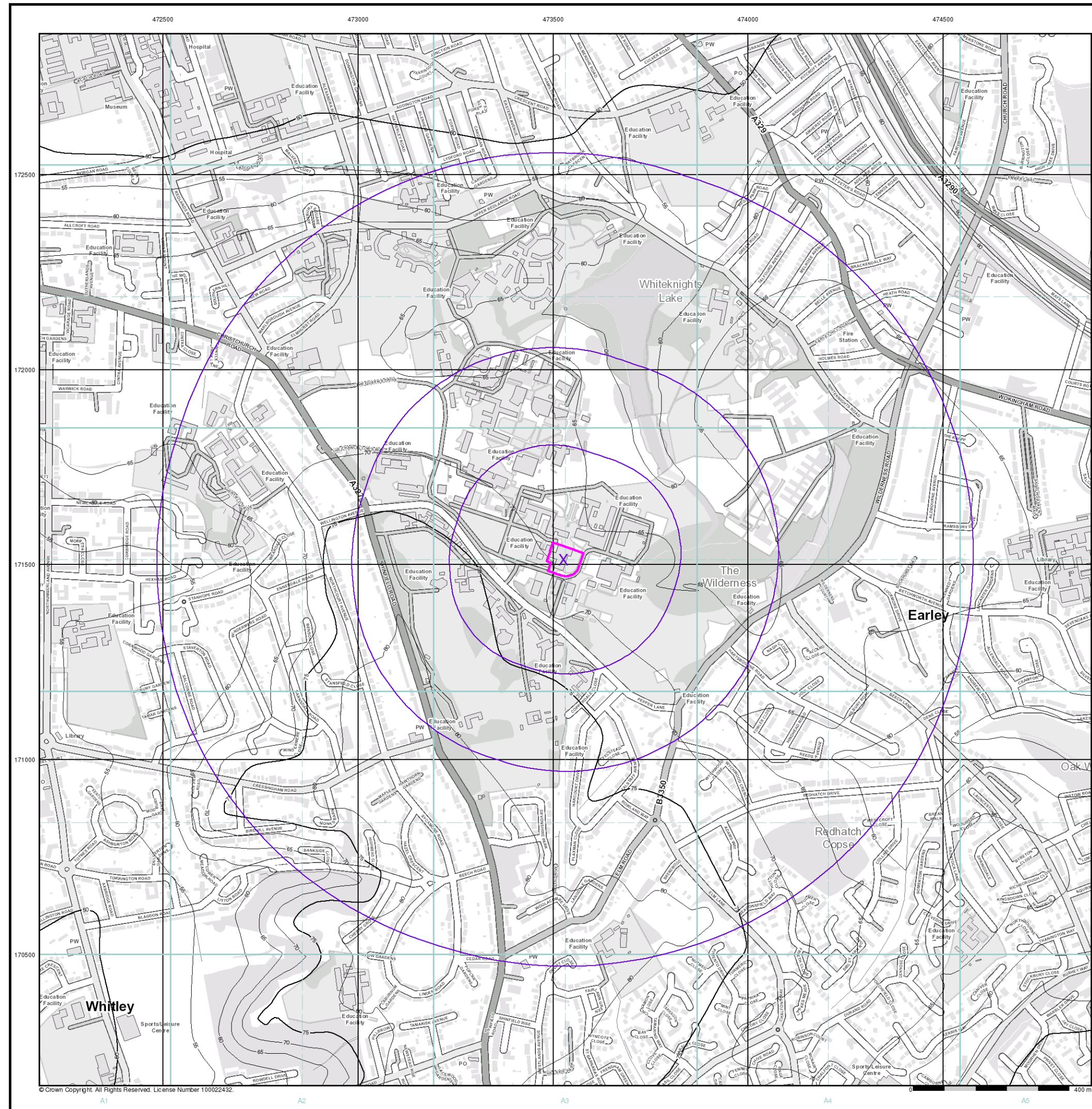


Order Details

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EA/NRW Flood Data Map (1:10,000)

General

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

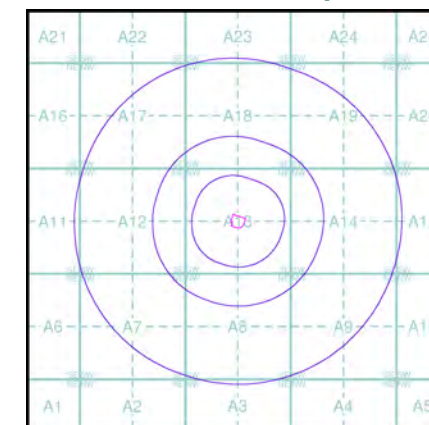
Flood Data

- 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

Contours (height in metres)

- Standard Contour: 105, 100, 95
- Master Contour: 105, 100, 95
- Spot Height: 167.8
- MLW: Mean Low Water
- MHW: Mean High Water

EA/NRW Flood Data Map - Slice A



Order Details

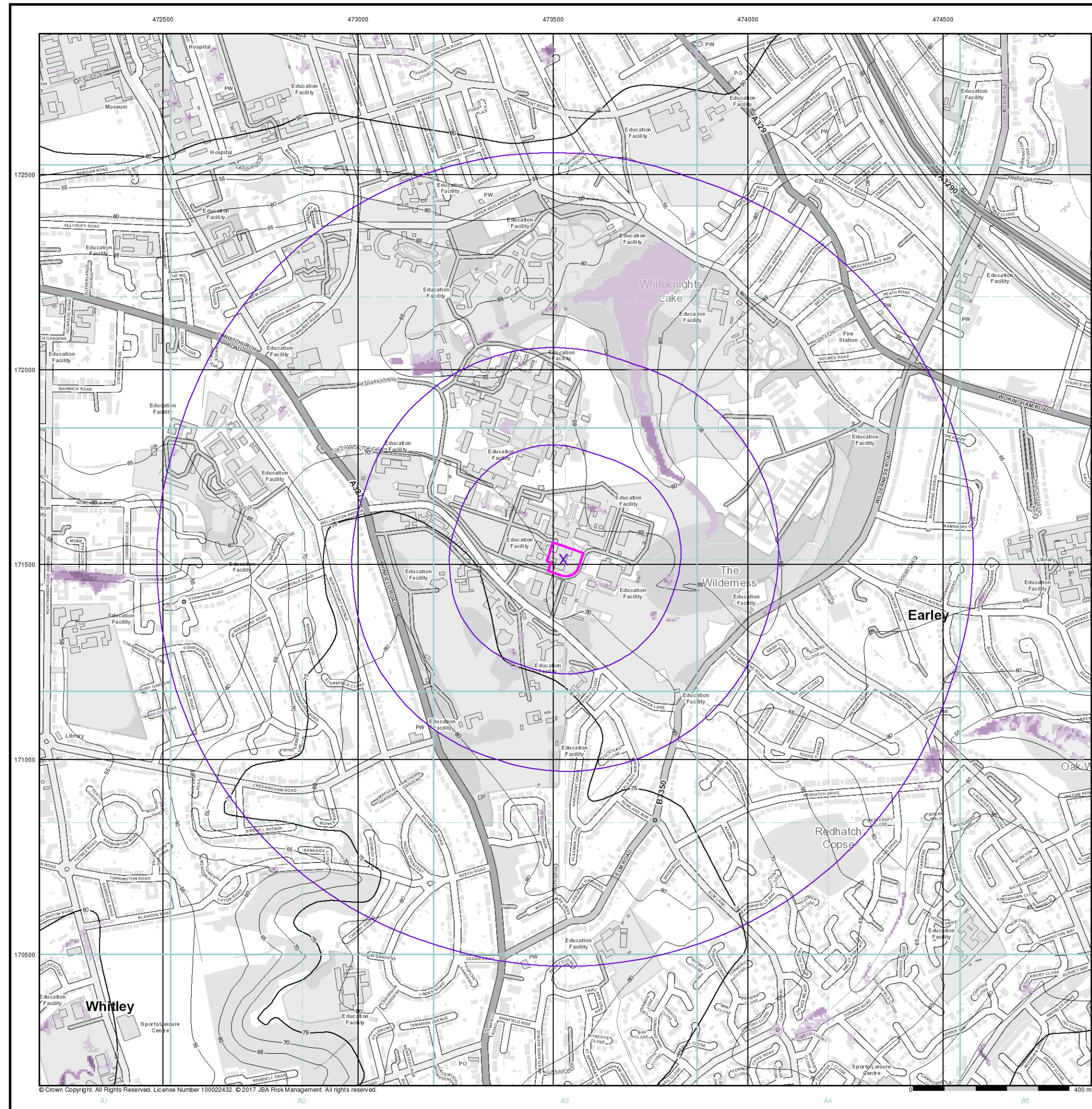
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JBA 75 Year Return Flood Map (Undefended) (1:10,000)

General

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

Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

Standard Contour: 105, 100, 95

Master Contour: 105, 100, 95

Spot Height: 167.8

MLW: Mean Low Water

MHW: Mean High Water

JBA 75 Year Return Flood Map (Undefended) - Slice A

Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road,
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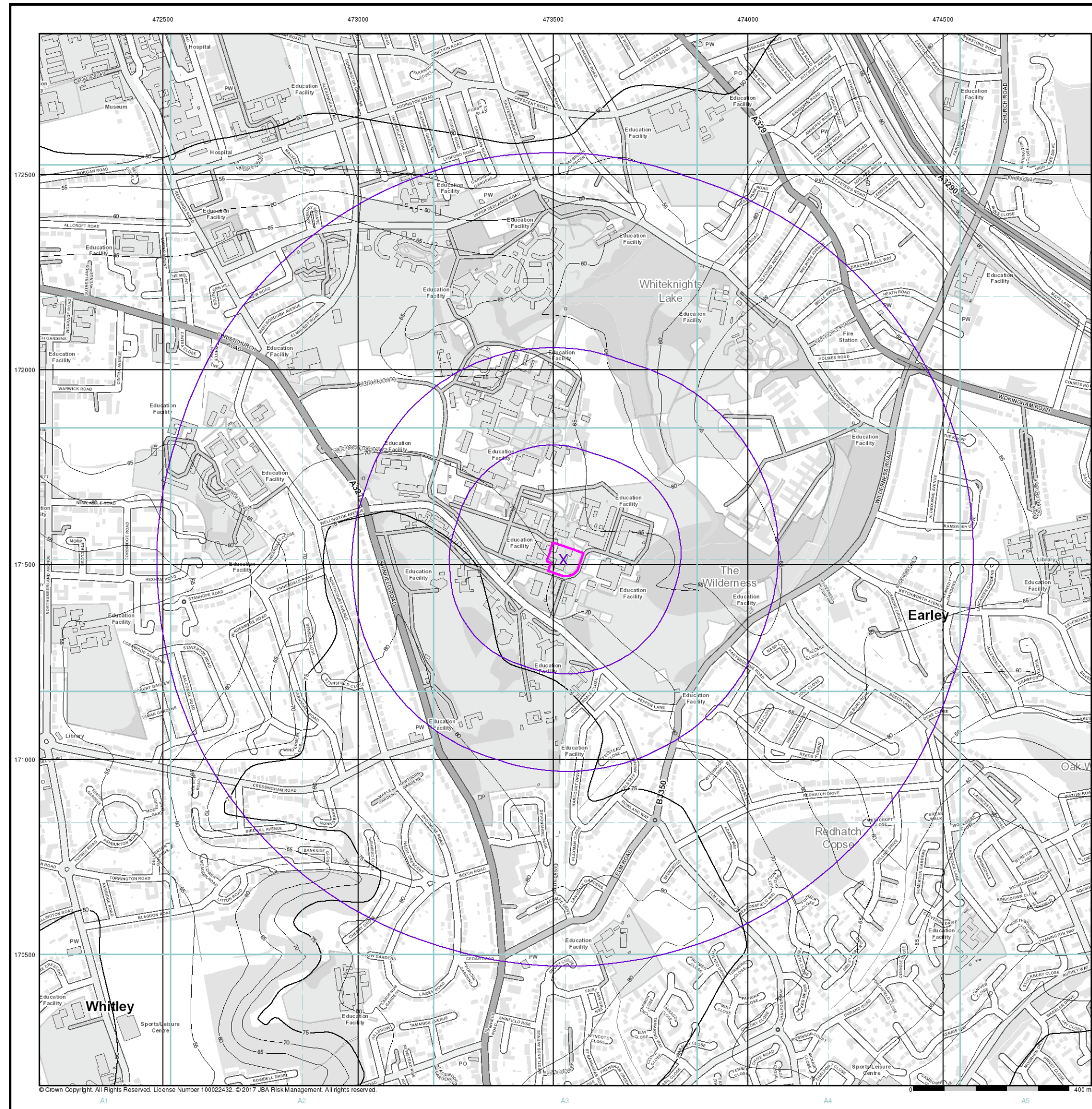
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JBA 100 Year Return Flood Map (Undefended) (1:10,000)

General

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

Modelled Flood Depth

Fluvial Depth	Coastal Depth
0.01m - 0.05m	0.01m - 0.05m
0.05m - 0.1m	0.05m - 0.1m
0.1m - 0.3m	0.1m - 0.3m
0.3m - 1m	0.3m - 1m
>1m	>1m

Contours (height in metres)

Standard Contour: 105, 100, 95

Master Contour: 100, 95

Spot Height: 167.8

MLW: Mean Low Water

MHW: Mean High Water

JBA 100 Year Return Flood Map (Undefended) - Slice A

Order Details

Order Number: 115805868_1_1

Customer Ref: 60441574/M001.003

National Grid Reference: 473530, 171510

Slice: A

Site Area (Ha): 0.56

Search Buffer (m): 1000

Site Details

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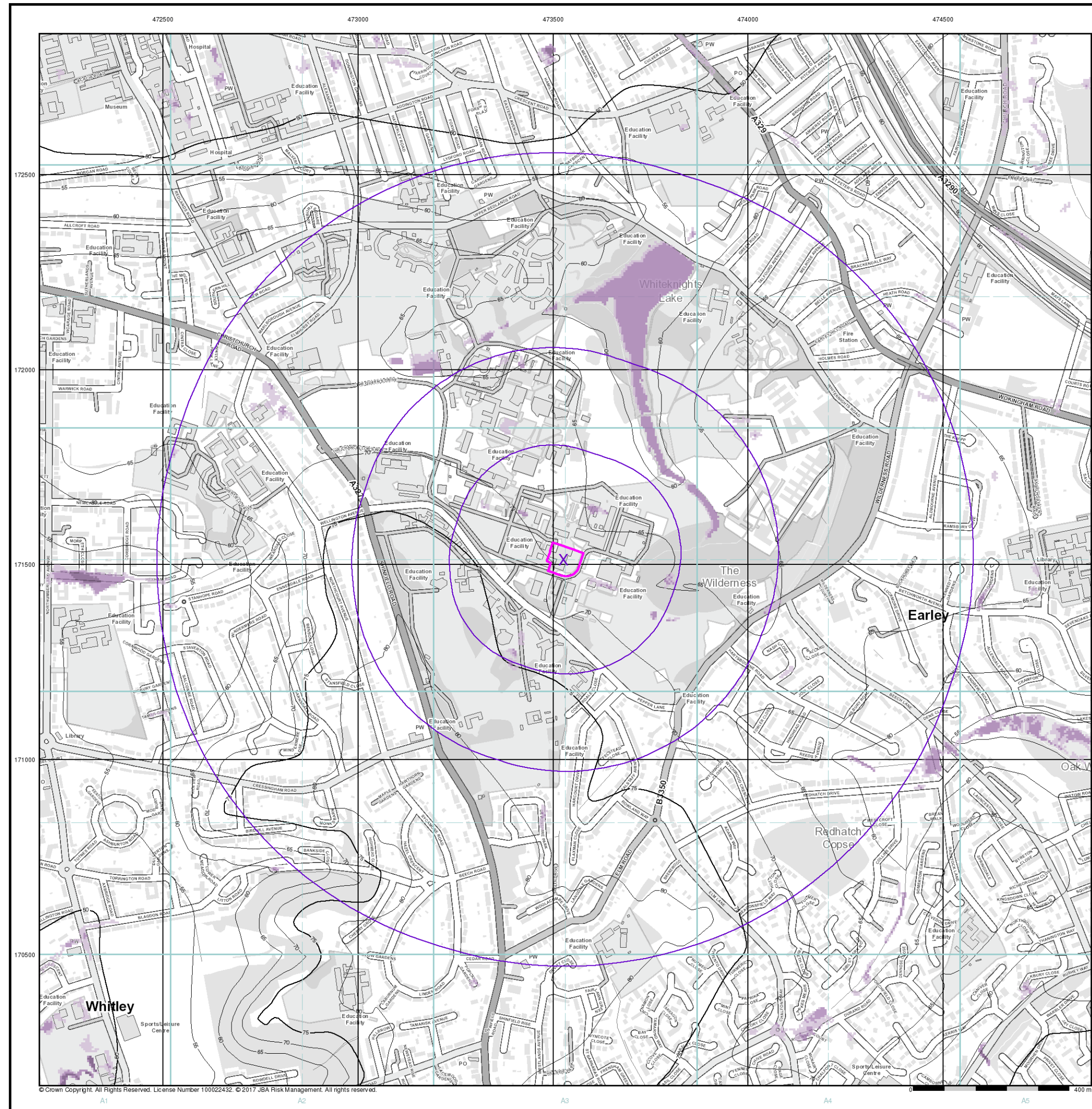
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JBA 200 Year Return Flood Map (Un defended) (1:10,000)

General

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

Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

Standard Contour: 105, 100, 95

Master Contour: 105, 100, 95

Spot Height: 167.8

MLW: Mean Low Water

MHW: Mean High Water

JBA 200 Year Return Flood Map (Un defended) - Slice A

Order Details

Order Number: 115805868_1_1

Customer Ref: 60441574/M001.003

National Grid Reference: 473530, 171510

Slice: A

Site Area (Ha): 0.56

Search Buffer (m): 1000

Site Details

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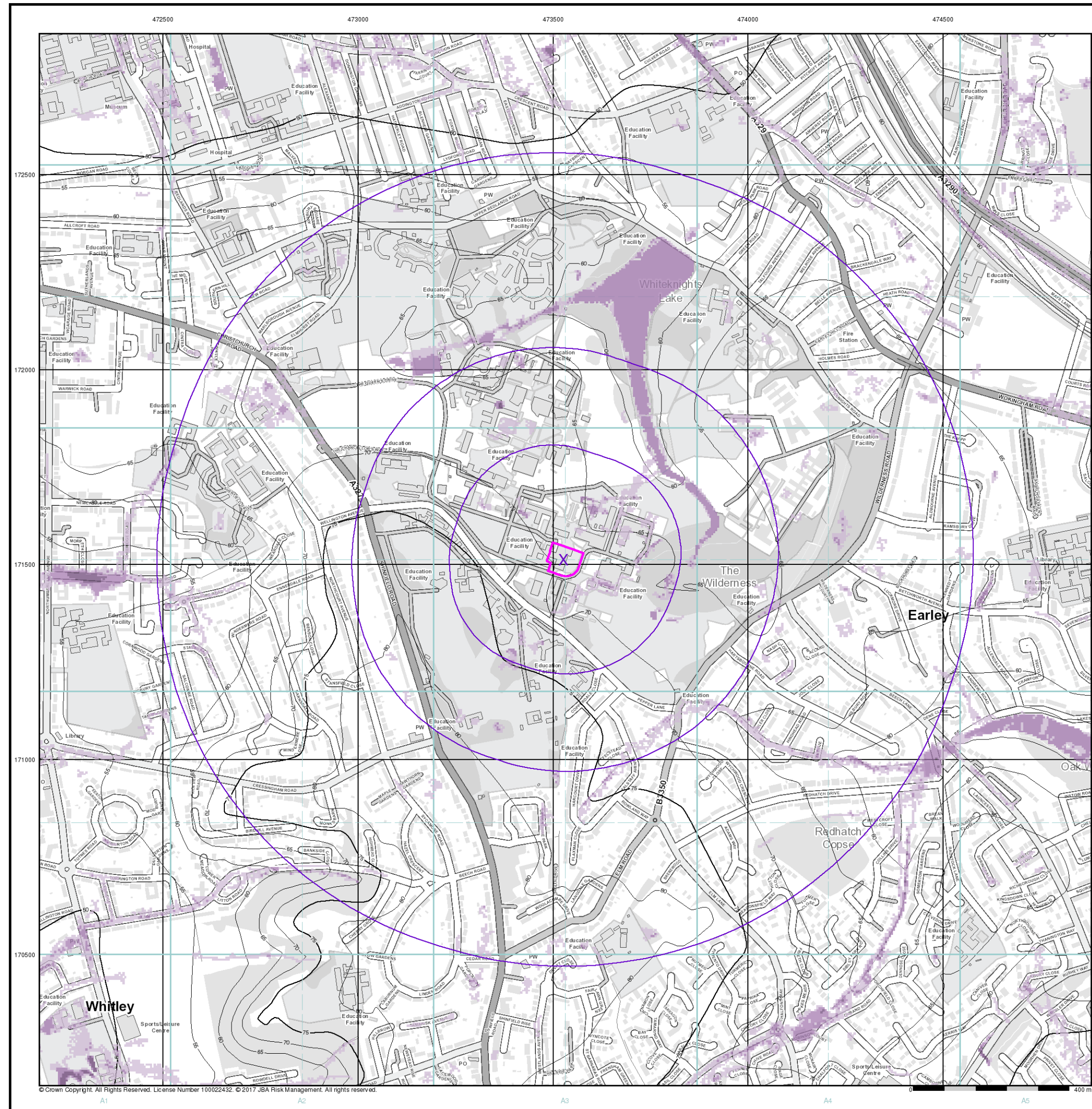
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JBA 1000 Year Return Flood Map (Undefended) (1:10,000)

General

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

Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

Standard Contour: 105, 100, 95

Master Contour: 105, 100, 95

Spot Height: 167.8

MLW: Mean Low Water

MHW: Mean High Water

JBA 1000 Year Return Flood Map (Undefended) - Slice A

Order Details

Order Number: 115805868_1_1

Customer Ref: 60441574/M001.003

National Grid Reference: 473530, 171510

Slice: A

Site Area (Ha): 0.56

Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING, RG6 6UR

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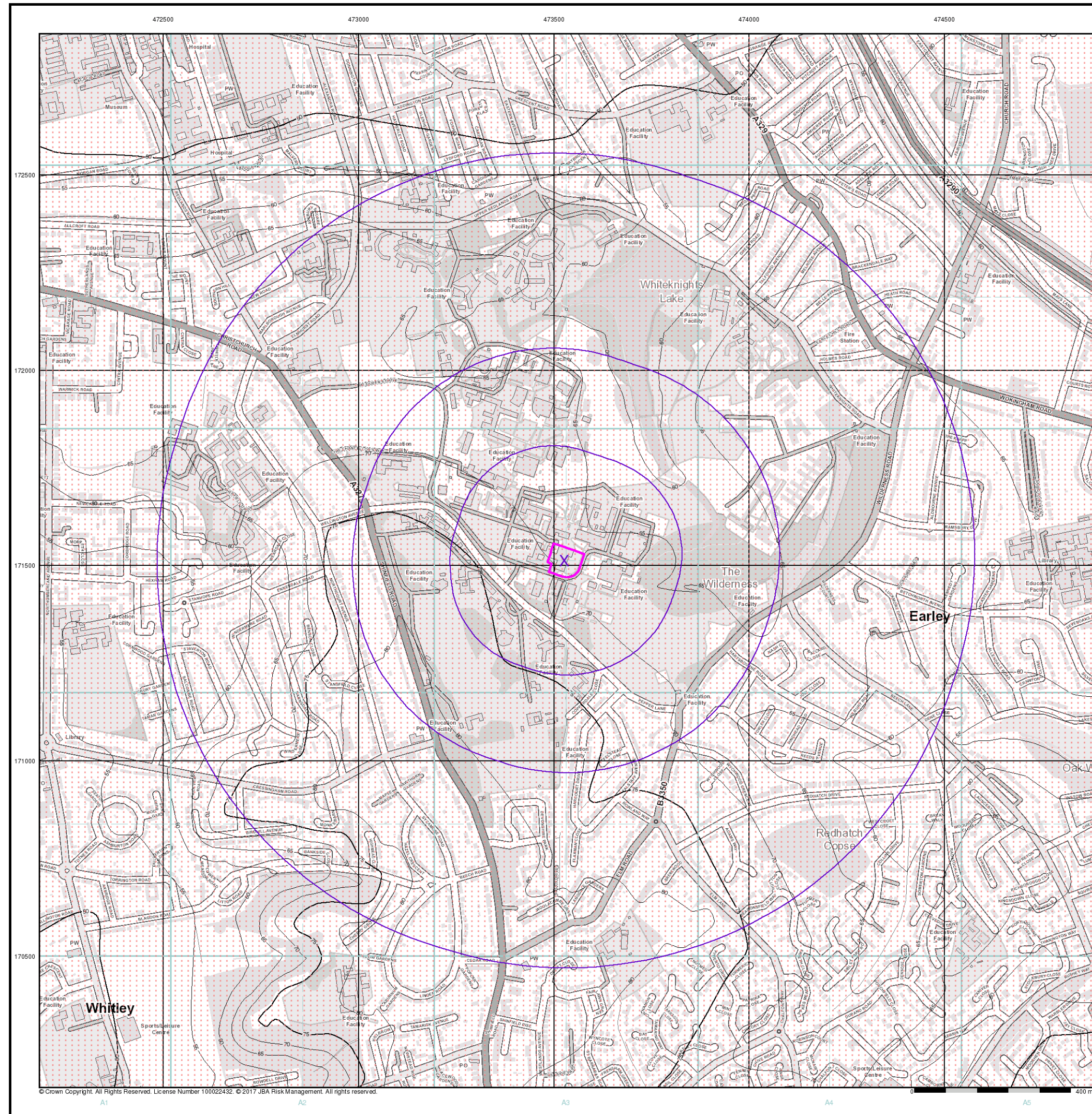
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JBA Canal Failure Map (1:10,000)

General

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

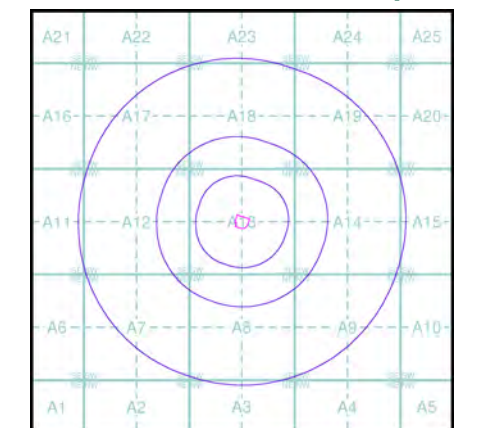
Flood Data

- Canal Failure
- Coverage

Contours (height in metres)

- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

JBA Canal Failure Flood Map - Slice A



Order Details

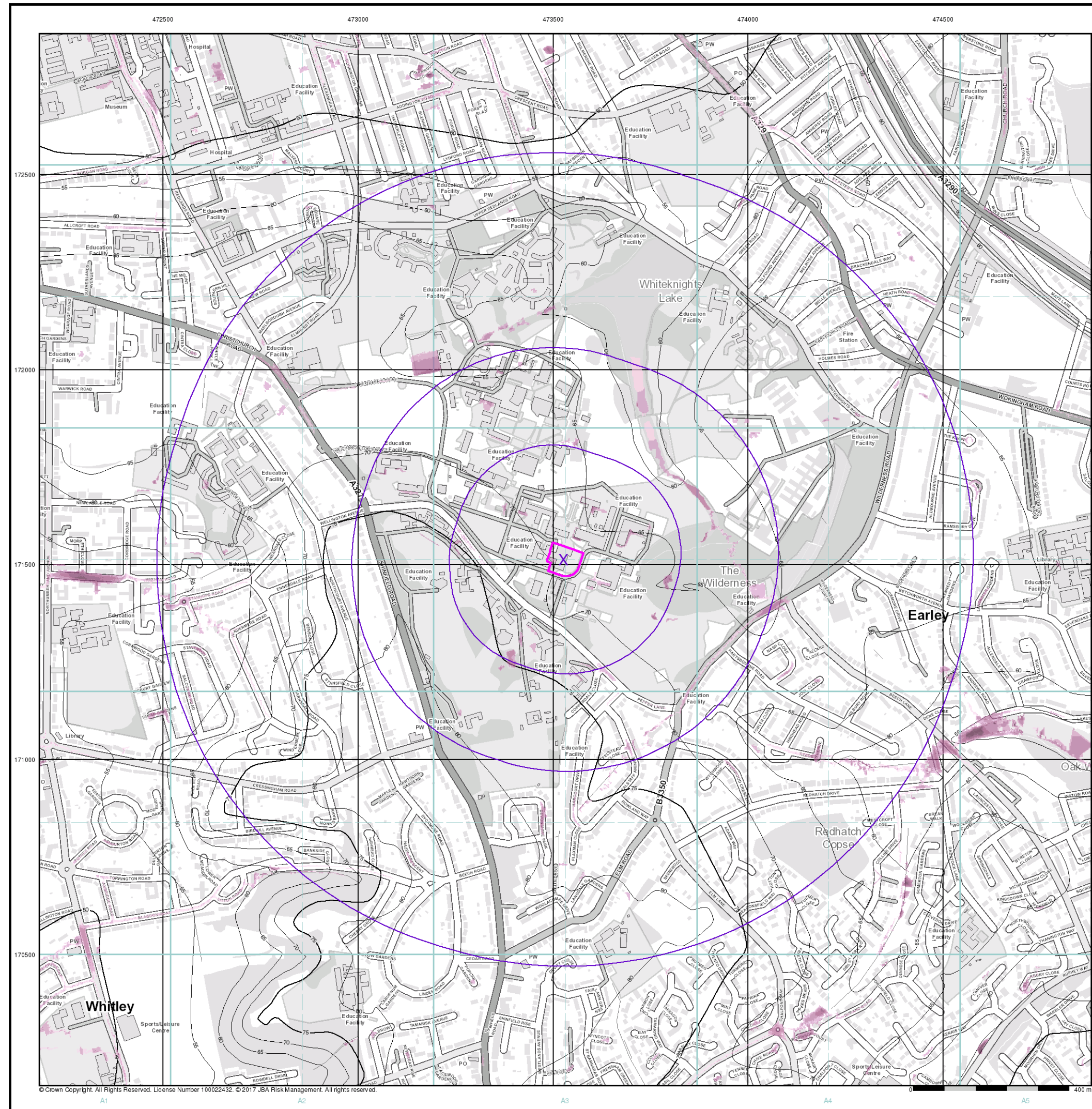
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Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING, RG6 6UR

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EA/NRW Surface Water 30 Year Return Depth Map (1:10,000)

General
Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Depth

0 - 0.15m
0.15 - 0.30m
0.30 - 0.60m
0.60 - 0.90m
0.90 - 1.20m
> 1.20m

Contours (height in metres)

Standard Contour 105 100 95

Master Contour 105 100 95

Spot Height *167.8

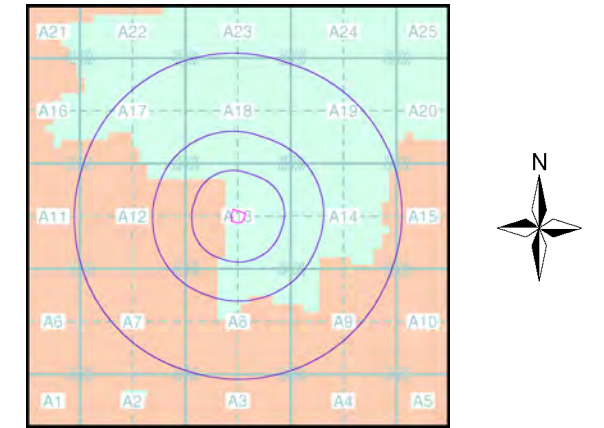
MLW Mean Low Water

MHW Mean High Water

Suitability
See the suitability map below

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

EA/NRW Suitability Map - Slice A



Order Details

Order Number: 115805868_1_1

Customer Ref: 60441574/M001.003

National Grid Reference: 473530, 171510

Slice: A

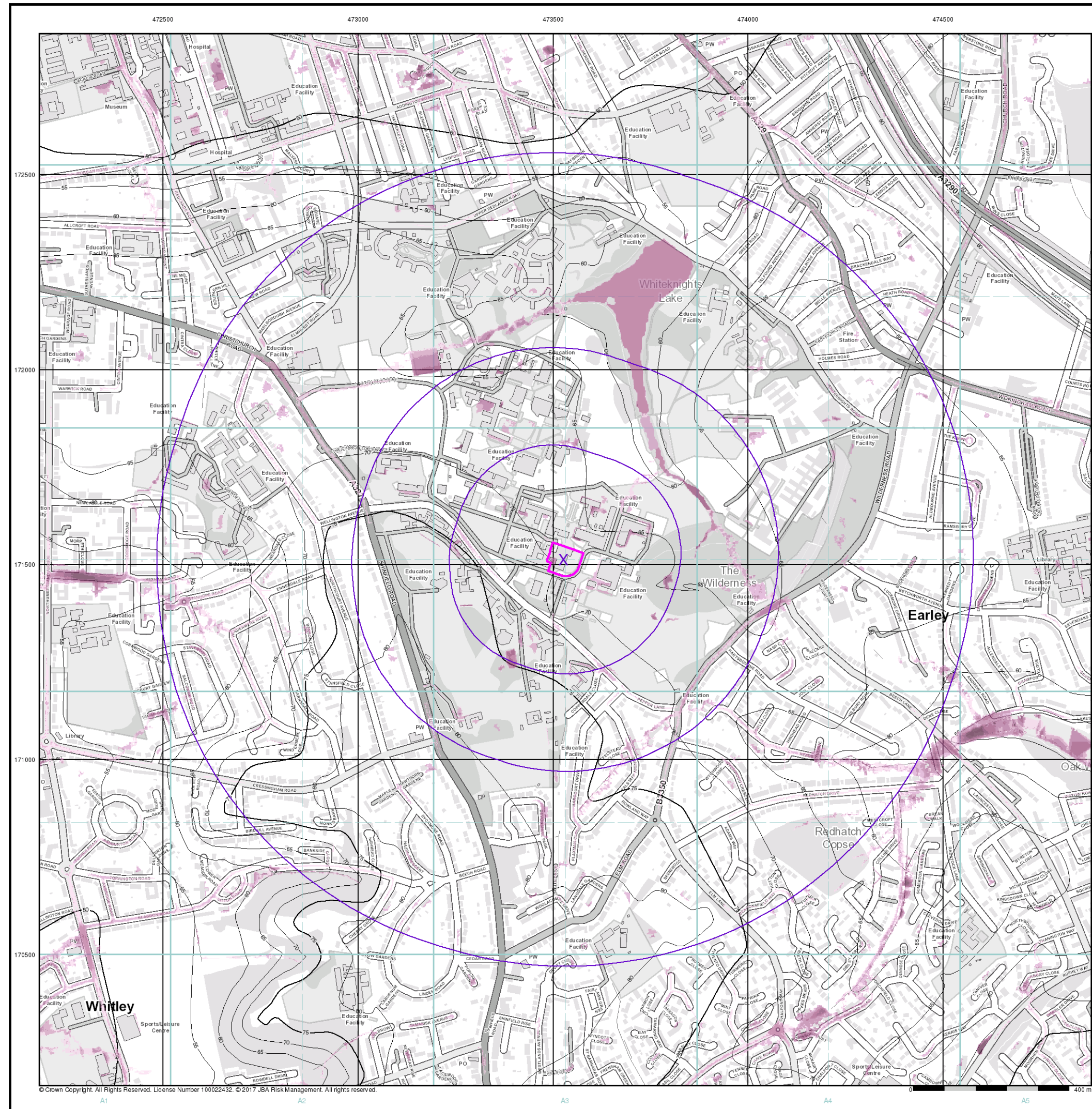
Site Area (Ha): 0.56

Search Buffer (m): 1000

Site Details
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EA/NRW Surface Water 100 Year Return Depth Map

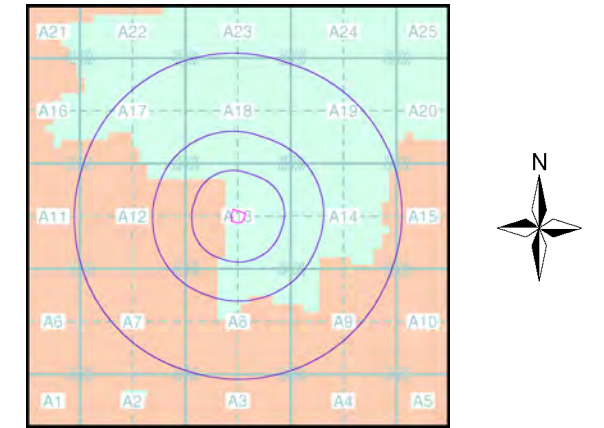
General
Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Depth
0 - 0.15m
0.15 - 0.30m
0.30 - 0.60m
0.60 - 0.90m
0.90 - 1.20m
> 1.20m

Contours (height in metres)
Standard Contour 105 100 95
Master Contour 100 95
Spot Height *167.8
MLW Mean Low Water
MHW Mean High Water

Suitability
See the suitability map below
National to county
County to town
Town to street
Street to parcels of land
Property

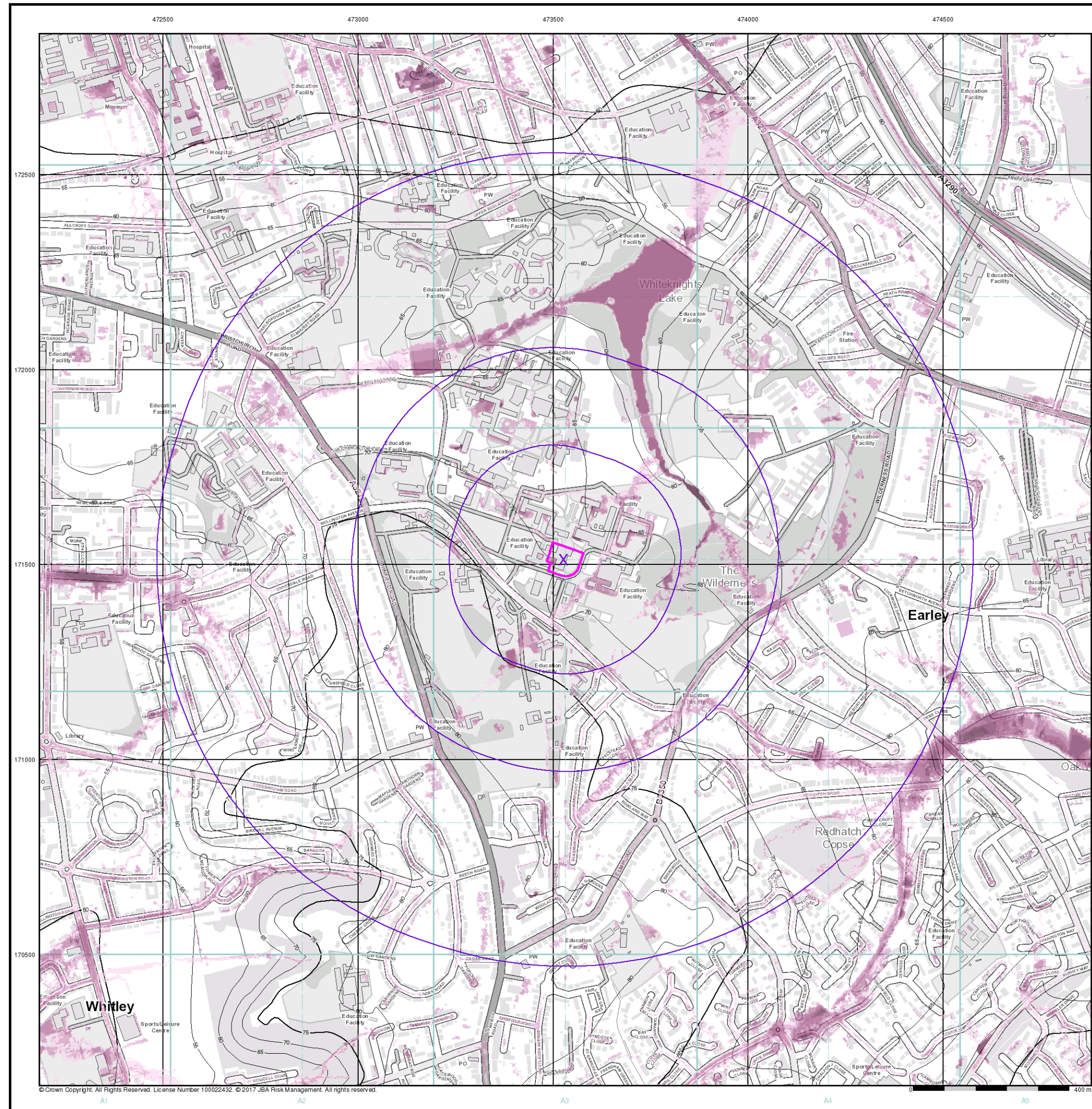
EA/NRW Suitability Map - Slice A



Order Details
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

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EA/NRW Surface Water 1000 Year Return Depth Map (1:10,000)

General
Specified Site Specified Buffer(s) X Bearing Reference Point

Surface Water Depth

0 - 0.15m
0.15 - 0.30m
0.30 - 0.60m
0.60 - 0.90m
0.90 - 1.20m
> 1.20m

Contours (height in metres)

Standard Contour 105 100 95

Master Contour 105 100 95

Spot Height *167.8

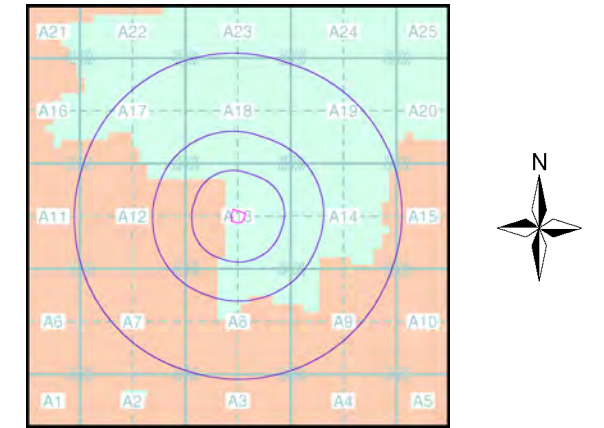
MLW Mean Low Water

MHW Mean High Water

Suitability
See the suitability map below

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

EA/NRW Suitability Map - Slice A



Order Details

Order Number: 115805868_1_1

Customer Ref: 60441574/M001.003

National Grid Reference: 473530, 171510

Slice: A

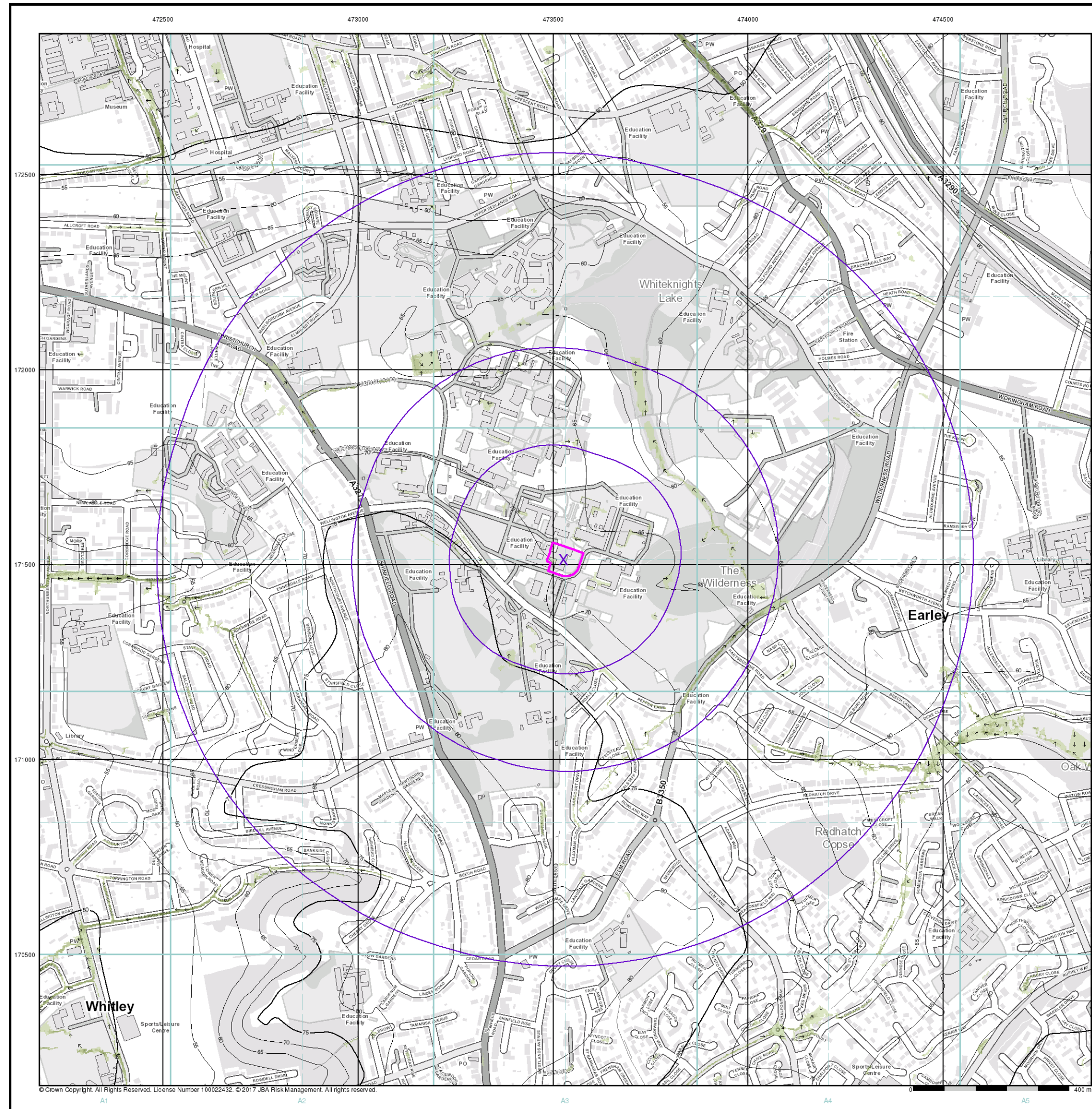
Site Area (Ha): 0.56

Search Buffer (m): 1000

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EA/NRW Surface Water 30 Year Return Velocity and Flow Direction Map (1:10,000)

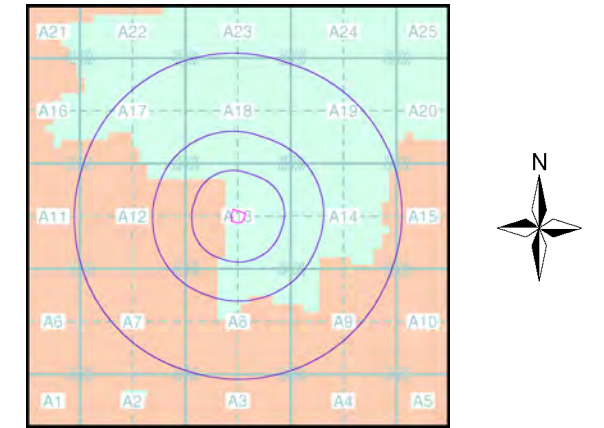
General
Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Velocity and Direction
0.00 - 0.25m/s
0.25 - 0.50m/s
0.50 - 1.00m/s
1.00 - 2.00m/s
> 2.00m/s
Flow Direction at maximum velocity

Contours (height in metres)
Standard Contour
Master Contour
Spot Height *167.8
MLW Mean Low Water
MHW Mean High Water

Suitability
See the suitability map below
National to county
County to town
Town to street
Street to parcels of land
Property

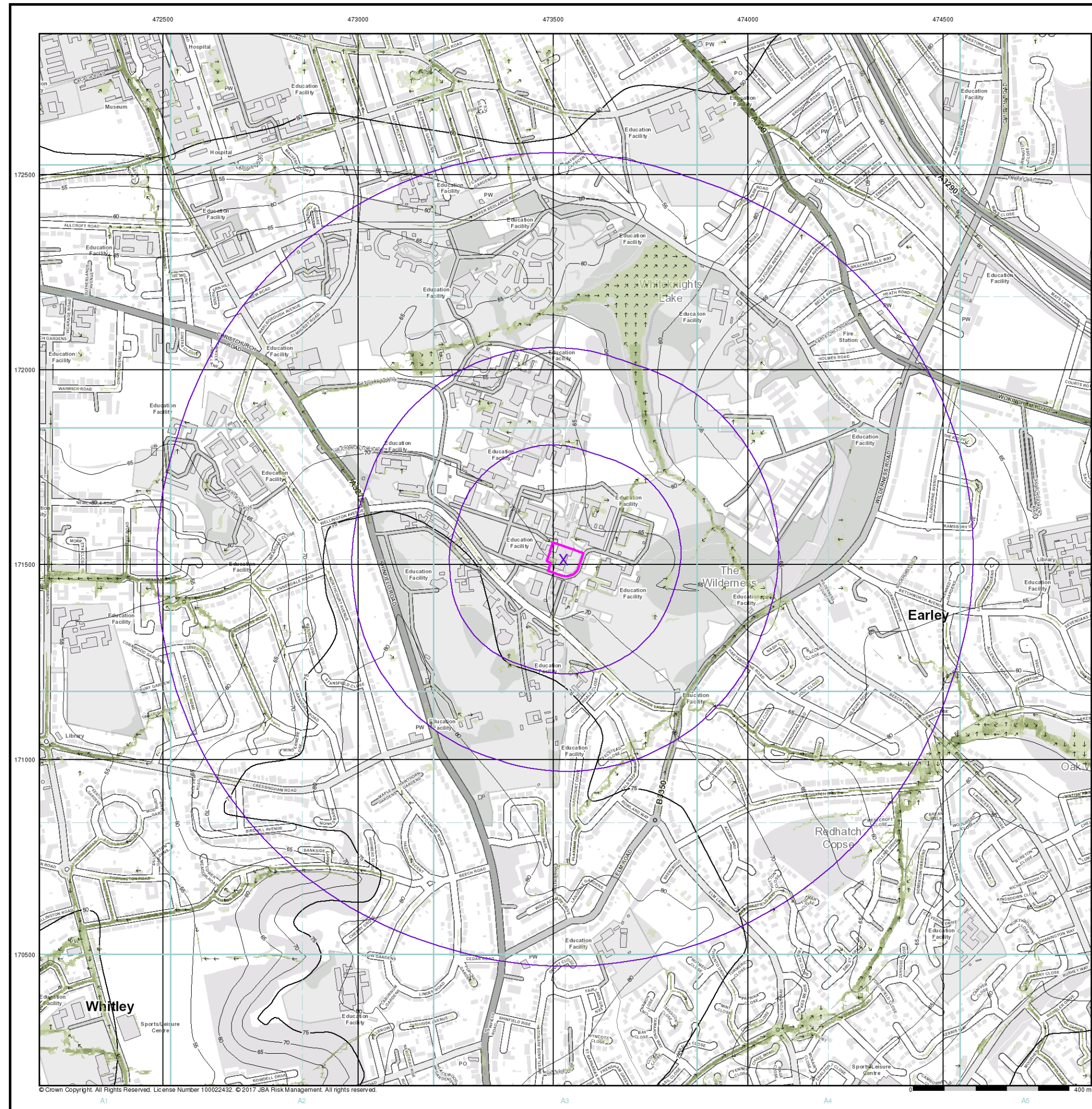
EA/NRW Suitability Map - Slice A



Order Details
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
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EA/NRW Surface Water 100 Year Return Velocity and Flow Direction Map (1:10,000)

General

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

Surface Water Velocity and Direction

- 0.00 - 0.25m/s
- 0.25 - 0.50m/s
- 0.50 - 1.00m/s
- 1.00 - 2.00m/s
- > 2.00m/s

Flow Direction at maximum velocity

Contours (height in metres)

Standard Contour

Master Contour

Spot Height

MLW Mean Low Water

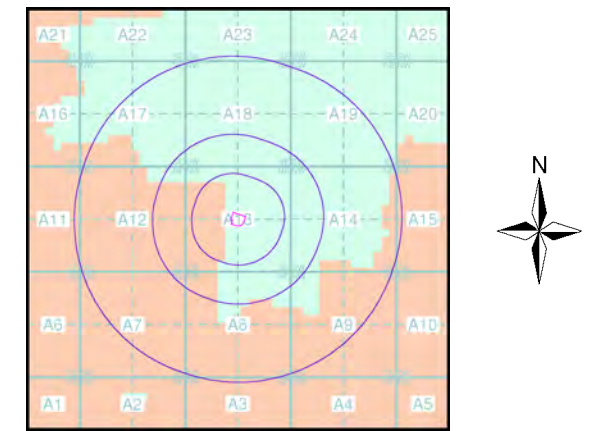
MHW Mean High Water

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



Order Details

Order Number: 115805868_1_1

Customer Ref: 60441574/M001.003

National Grid Reference: 473530, 171510

Slice: A

Site Area (Ha): 0.56

Search Buffer (m): 1000

Site Details

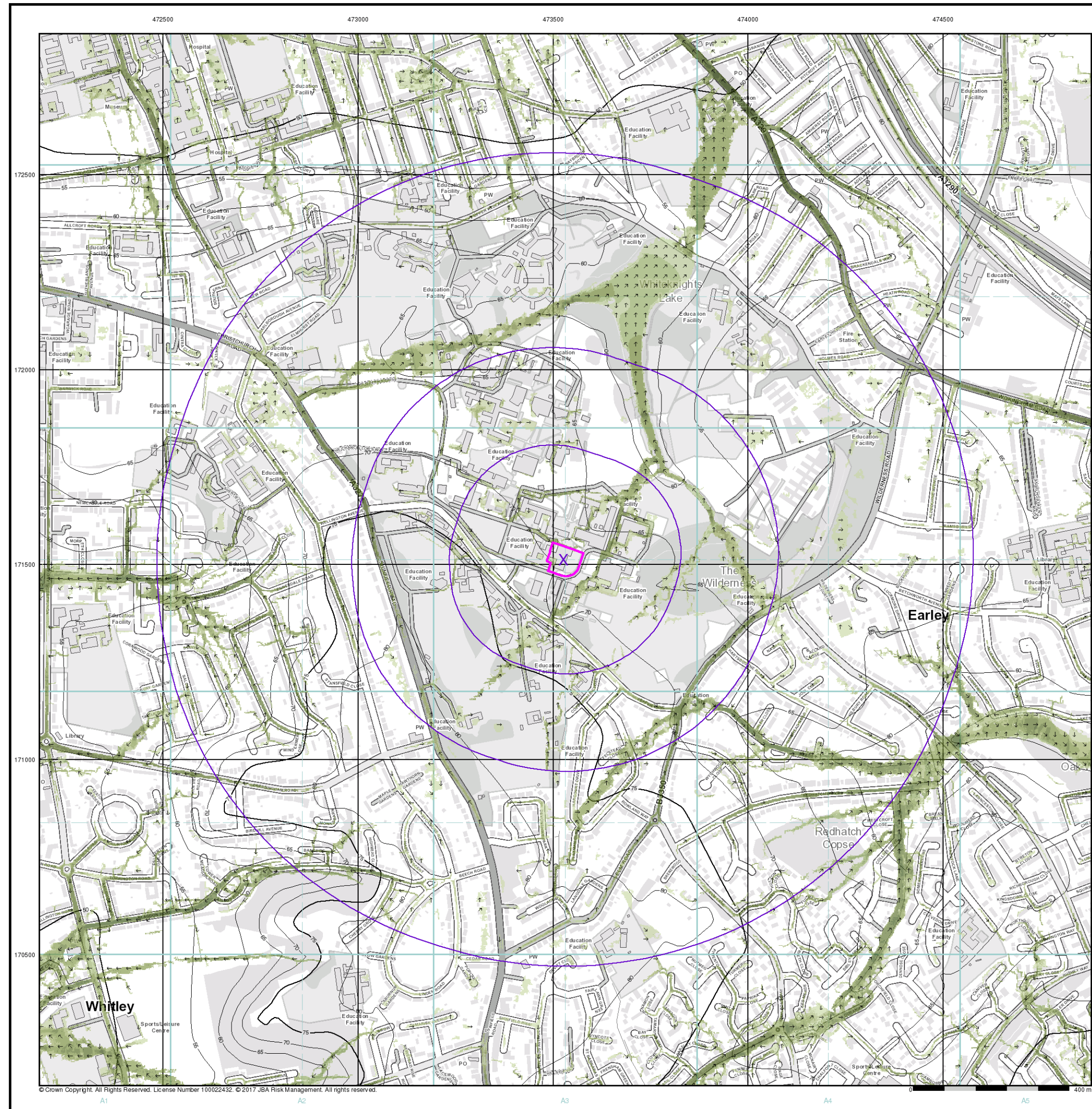
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EA/NRW Surface Water 1000 Year Return Velocity and Flow Direction Map (1:10,000)

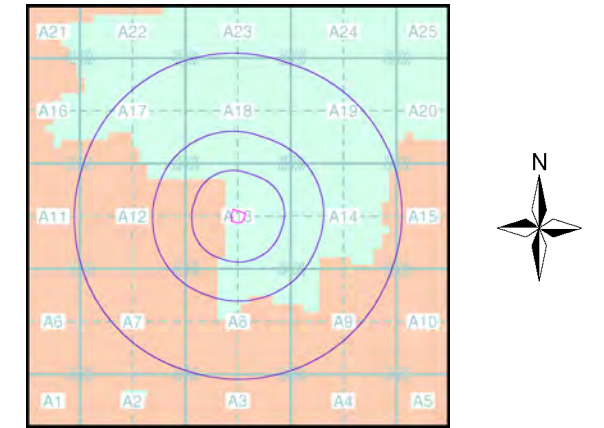
General
Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Velocity and Direction
0.00 - 0.25m/s
0.25 - 0.50m/s
0.50 - 1.00m/s
1.00 - 2.00m/s
> 2.00m/s
Flow Direction at maximum velocity

Contours (height in metres)
Standard Contour
Master Contour
Spot Height *167.8
MLW Mean Low Water
MHW Mean High Water

Suitability
See the suitability map below
National to county
County to town
Town to street
Street to parcels of land
Property

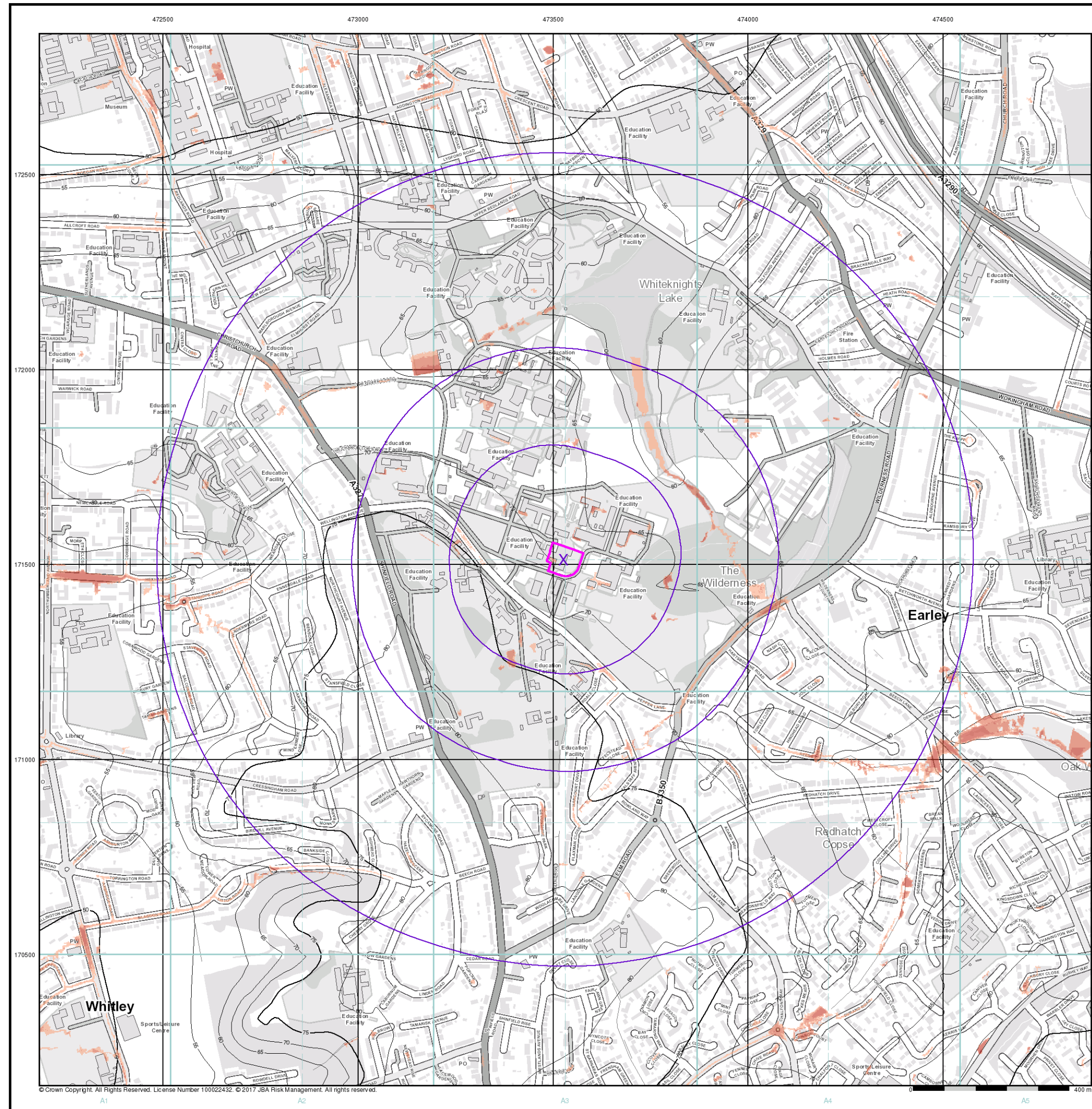
EA/NRW Suitability Map - Slice A



Order Details
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

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EA/NRW Surface Water 30 Year Return Hazard Rating Map (1:10,000)

General

Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Hazard Rating

Low (0.5 – 0.75)
Moderate (0.75 – 1.25)
Significant (1.25 – 2.0)
Extreme (>2.0)

Contours (height in metres)

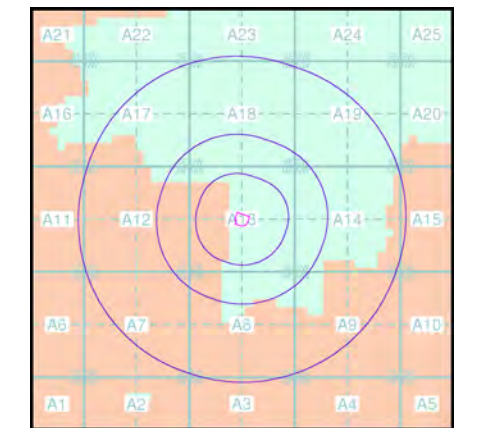
Standard Contour
Master Contour
Spot Height
MLW Mean Low Water
MHW Mean High Water
167.8

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

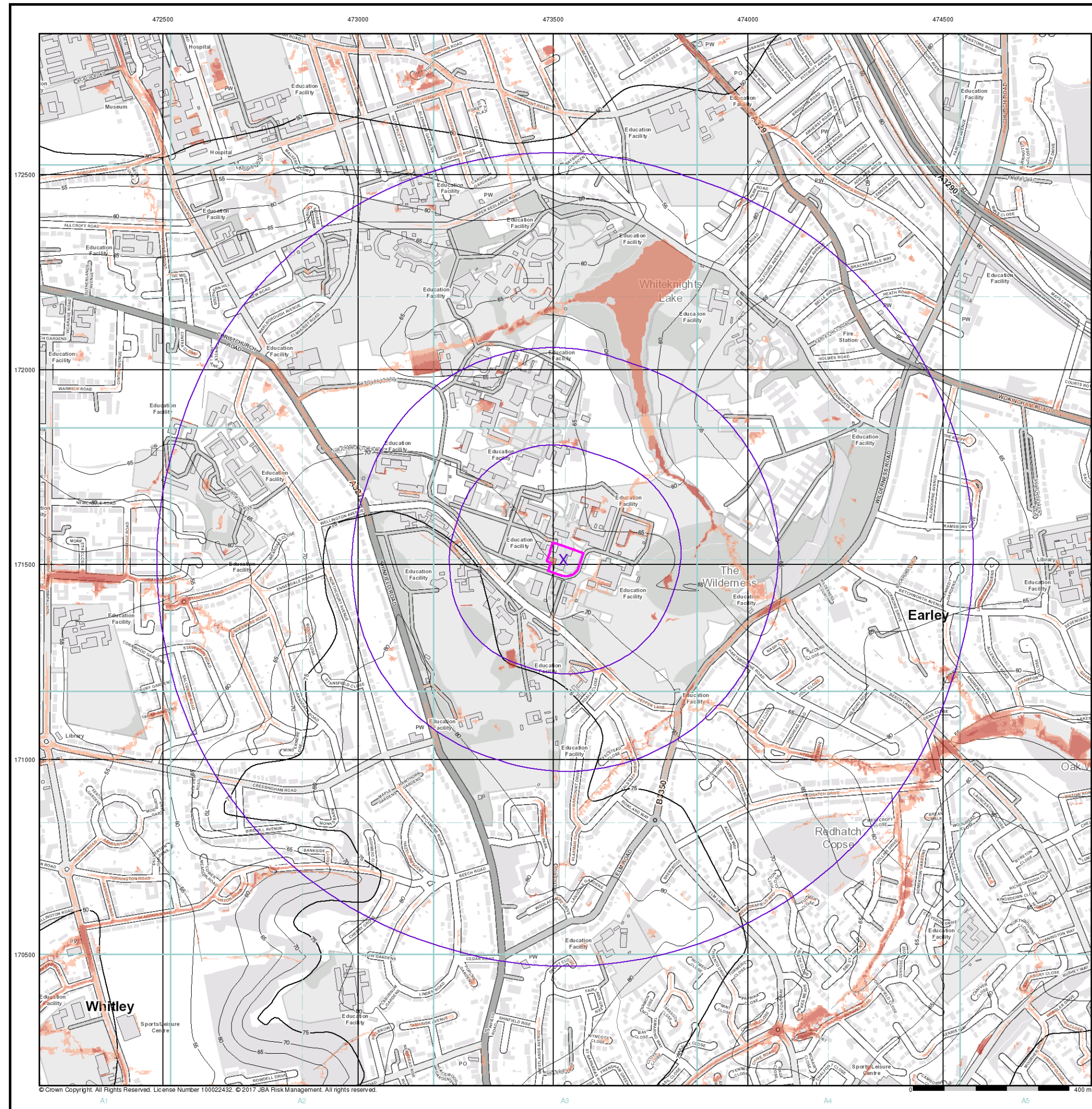


Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

Life Sciences Building, University of Reading, Shinfield Road, READING, RG6 6UR



EA/NRW Surface Water 100 Year Return Hazard Rating Map (1:10,000)

General
Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Hazard Rating

- Low (0.5 – 0.75)
- Moderate (0.75 – 1.25)
- Significant (1.25 – 2.0)
- Extreme (>2.0)

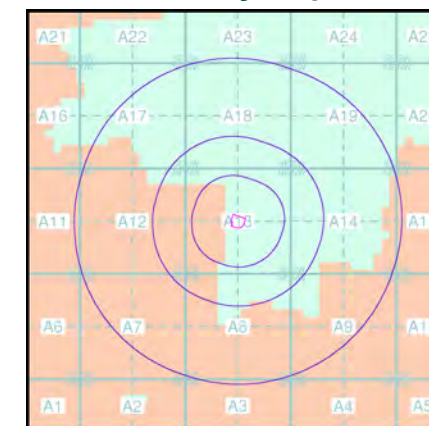
Contours (height in metres)

- Standard Contour — 105 — MLW — Mean Low Water
Master Contour — 100 — MHW — Mean High Water
Spot Height *167.8

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

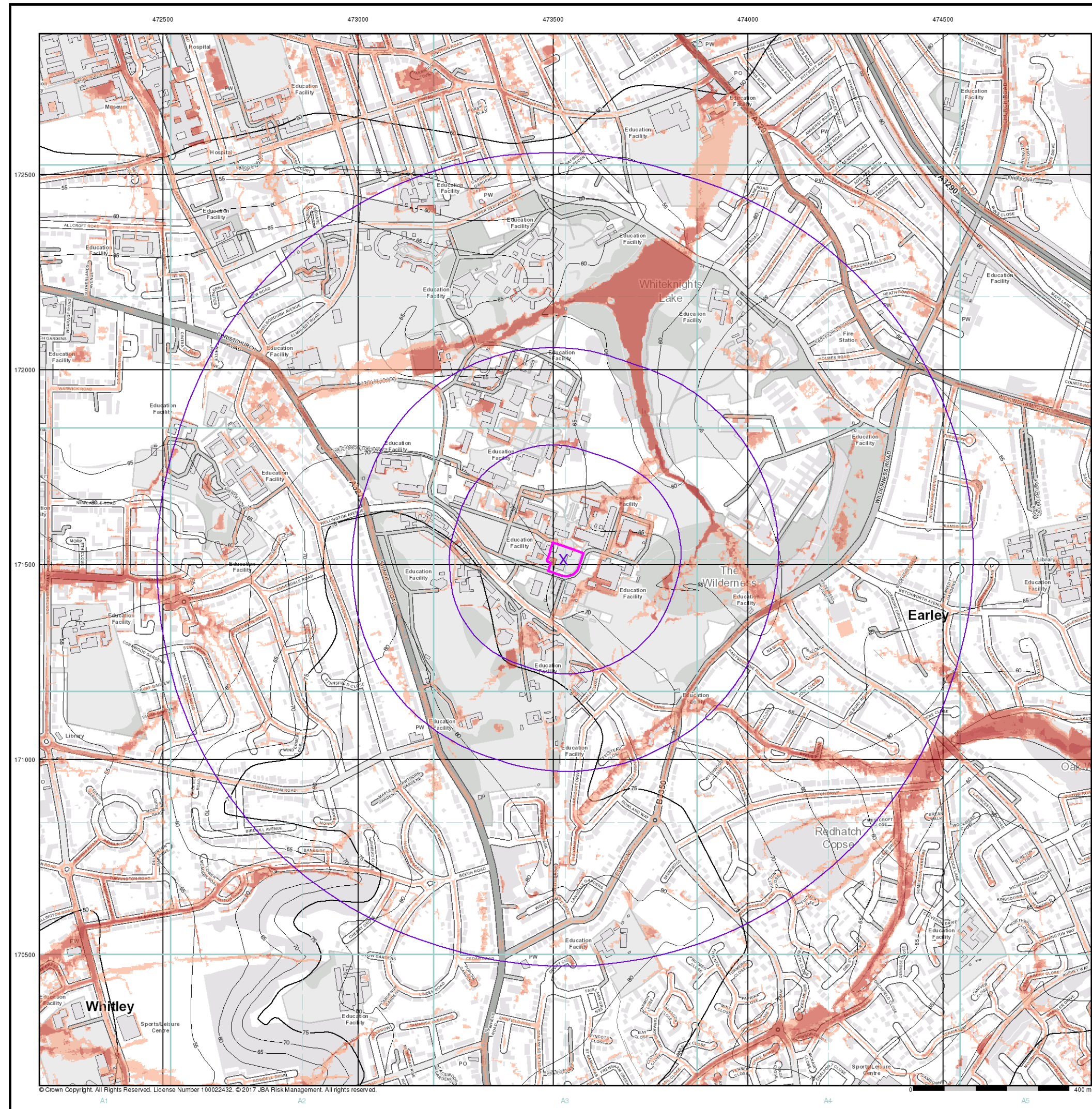


Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

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EA/NRW Surface Water 1000 Year Return Hazard Rating Map (1:10,000)

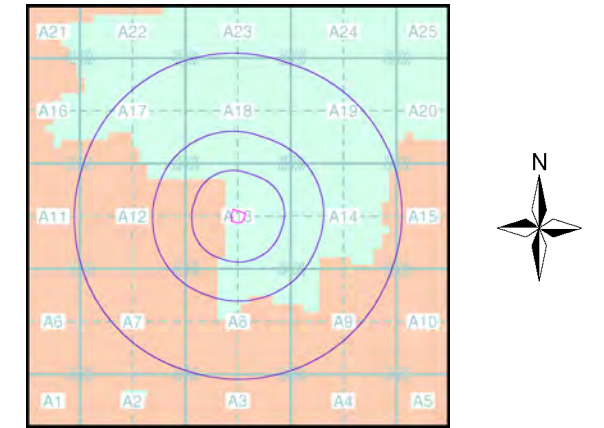
General
Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Hazard Rating
Low (0.5 – 0.75)
Moderate (0.75 – 1.25)
Significant (1.25 – 2.0)
Extreme (>2.0)

Contours (height in metres)
Standard Contour
Master Contour
Spot Height
MLW Mean Low Water
MHW Mean High Water
167.8

Suitability
See the suitability map below
National to county
County to town
Town to street
Street to parcels of land
Property

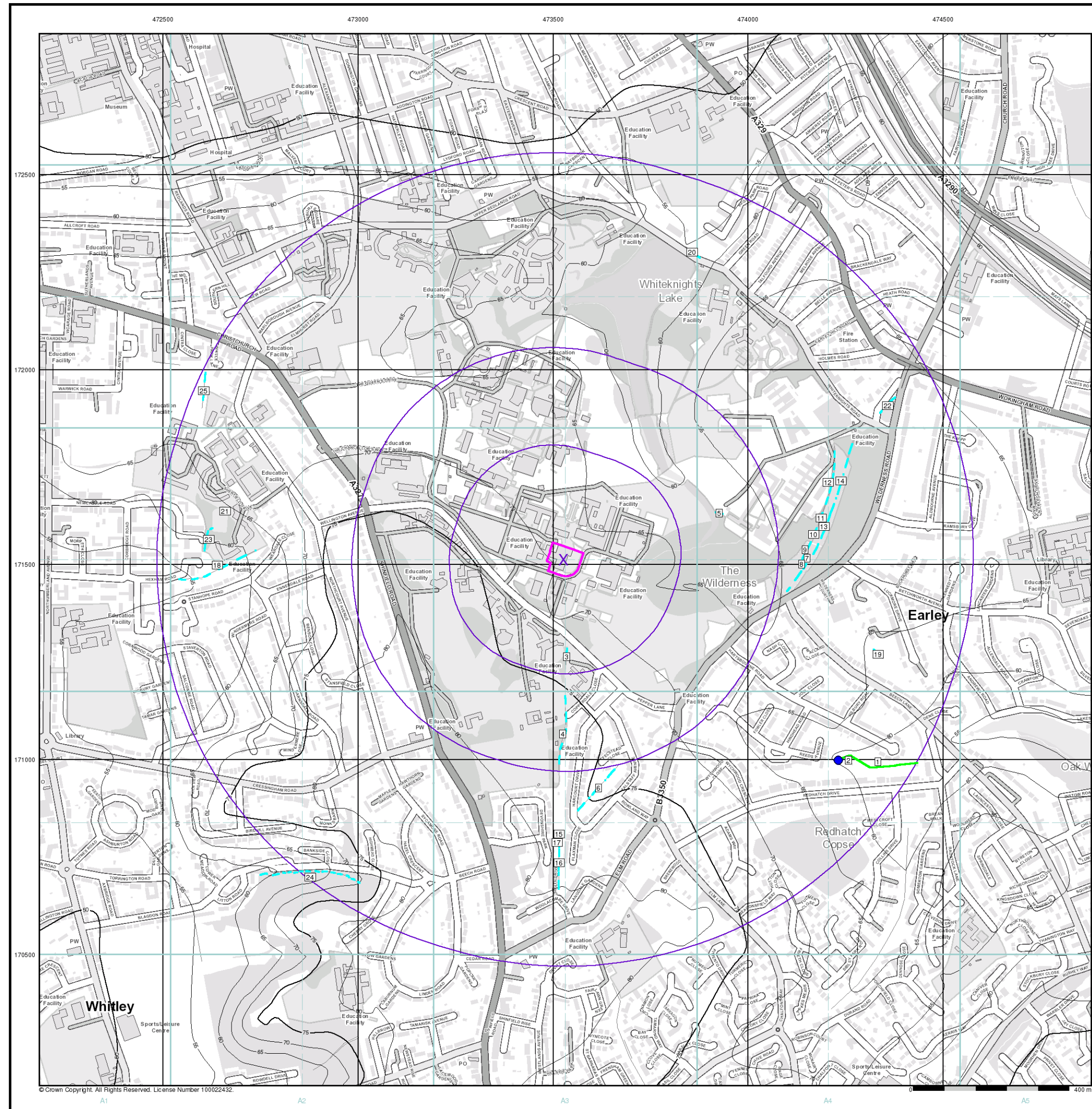
EA/NRW Suitability Map - Slice A



Order Details
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details
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Detailed River Network Map (1:10,000)

General

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

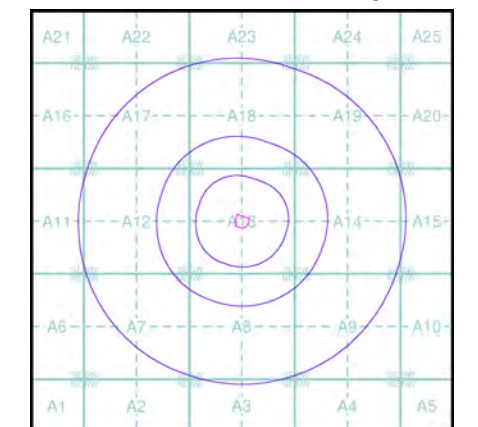
Detailed River Network Data

- | | |
|--------------------------|---|
| Primary River | Extended Culvert (greater than 50m) |
| Secondary River | Underground River (inferred) |
| Tertiary River | Underground River (local knowledge) |
| Canal | Downstream of High Water Mark |
| Canal Tunnel | Downstream of Seaward Extension |
| Undefined River | Not assigned River feature |
| Lake/Reservoir | |
| Source | Not assigned River feature |
| Junction | Pseudo Node (general) |
| Sink | Pseudo Node (High Water Mark) |
| Non-interactive Node | Pseudo Node (OS MasterMap polygon boundary) |
| Offline Drainage Feature | |

Contours (height in metres)

- Standard Contour: 105, 100, 95
- Master Contour: 105, 100, 95
- Spot Height: 167.3
- MLW: Mean Low Water
- MHW: Mean High Water

Detailed River Network Map - Slice A



Order Details

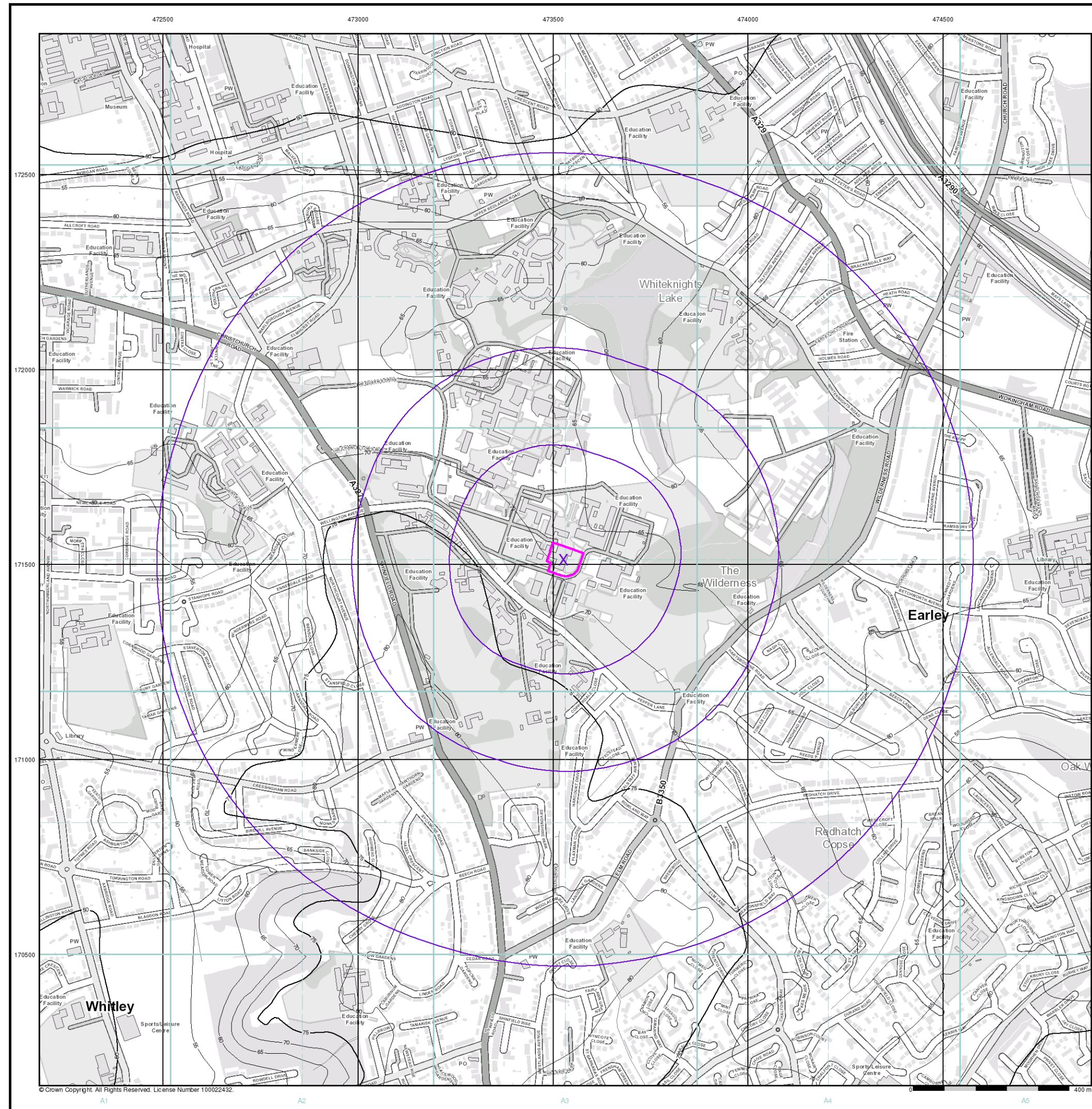
Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

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EA/NRW Historic Flood Map (1:10,000)

General

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

Historic Flood Events Data

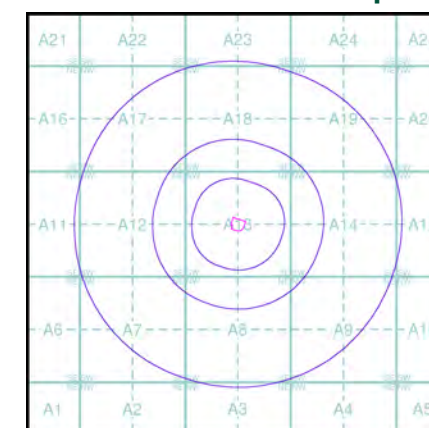
- | | |
|--|---------------------------------------|
| Channel Capacity Exceeded (no raised defences) | Obstruction/Blockage - Culvert |
| Groundwater/High Water Table | Obstruction/Blockage - Debris Screen |
| Local Drainage/Surface Water | Operational Failure/Breach of Defence |
| Mechanical Failure | Other |
| Obstruction/Blockage - Bridge | Overtopping of Defences |
| Obstruction/Blockage - Channel | Unknown |

- Historical Flood Liabilities

Contours (height in metres)

- Standard Contour 105
- Master Contour 100
- Spot Height 167.8
- MLW Mean Low Water
- MHW Mean High Water

EA/NRW Historic Flood Map - Slice A



Order Details

Order Number: 115805868_1_1
Customer Ref: 60441574/M001.003
National Grid Reference: 473530, 171510
Slice: A
Site Area (Ha): 0.56
Search Buffer (m): 1000

Site Details

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Appendix B - GEL 2016 Site Investigation Report



UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

INTERPRETATIVE REPORT ON
GROUND INVESTIGATION

Prepared for KNOWLES & SON (OXFORD) LTD

Report Ref: 31710

Geotechnical Engineering Ltd
Centurion House, Olympus Park
Quedgeley, Gloucester. GL2 4NF

01452 527743
www.geoeng.co.uk





UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

INTERPRETATIVE REPORT ON GROUND INVESTIGATION

Prepared for KNOWLES & SON (OXFORD) LTD

Report Ref: 31710

PROJECT: Proposed development

CONSULTANT: AECOM

VOLUME - VERSION	STATUS	ORIGINATOR	CHECKER	APPROVED	DATE
1 of 1 – A	DRAFT	JI	CT/NP	NP	05/05/16
1 of 1 – B	FINAL	JI	NP	NP	24/05/16
ORIGINATOR			APPROVER		
					
Jonathan Ind BSc (Hons) MSc FGS Geotechnical Consultant			N Parry BEng MSc CEng MICE MCIHT SiLC Director		

The report is not to be used for contractual or engineering purposes unless this sheet is signed and the report designated "Final".

The report has been prepared for the sole use and reliance by Knowles & Son (Oxford) Ltd. GEL accepts no liability as a result of the use or reliance of this report by any other parties.



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APPENDIX G	GEOTECHNICAL PLOTS
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1. INTRODUCTION

It is proposed to replace the existing Engineering Building at the University of Reading with a new purpose-built facility. A new electricity substation is also proposed adjacent to the existing JJ Thomson Building, to the northwest of the Engineering Building. Geotechnical Engineering Limited (GEL) was instructed by Knowles & Son (Oxford) Ltd, acting on behalf of the University of Reading, to carry out an investigation to determine the ground conditions and provide recommendations for foundation design. Contamination testing of soil and water was also undertaken, however this report does not include a full geoenvironmental assessment of the site.

The scope of work and terms and conditions of appointment were defined in correspondence by GEL, reference T23030 dated 2nd February 2016 and subsequent email communication. The investigation was carried out in accordance with the specification provided by the Consultant, being broadly in accordance with the guidance of BS10175:2011+A1:2013 and BS5930:2015.

This report describes the investigation, presents the findings and comments accordingly. The comments given in this report and the opinions expressed assume that ground conditions do not vary beyond the range revealed by this investigation. There may however, be conditions at or adjacent to the site, which have not been disclosed by the investigation and which, therefore, have not been considered in this report. Accordingly, a careful watch should be maintained during any future groundworks and the recommendations of this report reviewed as necessary.

The recommendations given in this report should not be used for any other schemes on or adjacent to this site without further reference to GEL.



2. SITE SETTING

2.1 Site Location and Description

The site is situated at the University of Reading Whiteknights Campus and may be located by its National Grid co-ordinates SU 7352, 7151 or the post code RG6 6UR.

The existing building was roughly T-shaped in plan, comprising a four-storey brick structure at the northern end with a single-storey element extending to the south. The ground level fell gradually from southwest to northeast, up to around 2.5m. The building was bound by a tarmac-surfaced car park to the east with the entrance at its southern end. The area to the north and south was mainly surfaced with grass with pedestrian pathways and a number of semi-mature/mature trees. A block-paved pathway was located west of the building. The building was bound by various buried services which are highlighted on Figure 2. Photographs are included in Appendix A.

The site of the proposed substation was located adjacent to a tarmac-surfaced access road, south of the existing JJ Thomson Building. The ground level was level and flat, occupying an area of grassed landscaping. A concrete pathway was situated at the northern end, linking to access road to a single-storey brick store with a flat roof. The area to the south was occupied by a skip and two steel storage containers, with a tree positioned beyond.

2.2 Regional Geology

British Geological Survey (BGS) England and Wales (Sheet No. 268 Reading, 1:50,000, published 2000) and the BGS online geology (1:50,000) indicate the site to be underlain by Head deposits, comprising “variably sandy and silty clay with sporadic pebbles”. The Boyn Hill Gravel Member (“sand and gravel”) is shown to the north, east and west of the site and is also likely to be present beneath the Head deposits. The superficial deposits overly the London Clay



Formation, which generally comprises “clay, variably silty, with beds of sand and silt and flint pebble seams; variably glauconitic and shelly”.

BGS boreholes located to the north of the existing library (National Grid co-ordinates SU 73539, 71567) recorded the following ground sequence:

- “Topsoil” to a depth of 0.38m below ground level (bgl);
- “Firm, brown and mottled brown and grey, sandy CLAY with some fine and medium gravel” to 1.68m bgl (Head deposits);
- “Dense to very dense, brown, clayey SAND and GRAVEL” to 4.27m bgl (Boyn Hill Gravel Member);
- “Stiff, brown , silty clay” to 4.57m bgl (London Clay Formation);
- “Stiff, fissured, grey, silty clay” to 6.10m bgl (London Clay Formation).

2.3 Regional Hydrogeology

The Environment Agency’s Groundwater Protection Policy (EA website, 2015) designates that superficial deposits as a Secondary (Undifferentiated) aquifer, meaning that they potentially contain “permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases form an important source of base flow to rivers”. The underlying bedrock (London Clay Formation) is classified as unproductive due to low permeability.

The EA website confirms the site to be located approximately 140m southwest of an Inner Zone (Zone 1) Source Protection Zone (SPZ), which is defined as “the 50 day travel time from any point below the water table to the source”.



2.4 Regional Hydrology

There are no surface water features on the site; the nearest relates to Whiteknights Lake, which is located approximately 300m east of the Engineering Building. The River Kennet is situated about 2.2km west of the site.

The EA website indicates the site does not lie within 250m of an Environment Agency fluvial floodplain. The nearest is approximately 1.5km to the west, associated with the River Kennet.

2.5 Radon

The Building Research Establishment (BRE) indicates that no radon protective measures are necessary (BR 211, 2007). It is advised that the local Building Control body is contacted to determine their minimum requirements in respect of radon protection.

3. PROPOSED WORKS

It is proposed to replace the existing Engineering Building at the University of Reading with a new purpose built facility. A new electricity substation is also proposed adjacent to the JJ Thomson Building, to the northwest of the Engineering Building. Exact details of the scheme and foundations loads were unknown at the time of preparing this report. A copy of the scheme drawing, included as part of the Consultants specification, is presented in Appendix B.



4. GROUND INVESTIGATION

4.1 Fieldwork

The fieldwork was carried out in general accordance with BS5930:2015 during the period 31st March to 12th April 2016 and comprised the following:

Existing Engineering Building

- Four cable percussion boreholes.
- In-situ SPT testing and undisturbed sampling (UT100/U100).
- Installation of ground gas and ground water observation wells in each borehole. Post fieldwork monitoring on two occasions.
- Two machine excavated trial pits.
- A single soakaway test in accordance with BRE 365 (2007).
- Three hand dug trial pits to establish existing foundation details.
- Two in-situ Dynamic Cone Penetrometer tests to establish CBR values.

Existing JJ Thomson building

- A single machine excavated trial pit.

The exploratory hole locations were selected by the Consultant and set out by this Company, within the limitations of access, and are shown on Figures 2 and 3. The ground level and co-ordinates at each exploratory hole were established by this Company using GPS techniques.



Boreholes

The boreholes, referenced BH01 to BH04 (Appendix C), were formed using a light cable tool (shell and auger) rig utilising 150mm tools and casing. Initially, an inspection pit was hand excavated at each borehole location to a depth of 1.20m to check for buried services. The boreholes were then advanced using a clay cutter and bailer with the occasional use of a heavy chisel to assist boring.

Representative disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars. Undisturbed samples of 100mm nominal diameter were taken in suitable cohesive soils using an open drive sampler (U100) or a thin walled, open drive sampler (UT100). Samples were wax sealed on site to prevent moisture loss.

Standard penetration tests (SPT) were carried out in general accordance with BS EN ISO 22476-3:2005+A1:2011. A split barrel or a solid cone was used depending upon the materials encountered and the split barrel samples retained in airtight jars. The SPT N value was taken as the number of blows to penetrate the 300mm test drive following a 150mm seating drive. Where low penetration was recorded the seating drive was terminated at 25 blows and the test drive completed after a further 50 blows. Detailed SPT results, together with the energy ratio (E_r), are presented in Appendix C and summarised as uncorrected N values on the borehole logs.

Boreholes were monitored for groundwater ingress as boring proceeded. Water levels were also recorded at the start and finish of each day's work and on completion of the borehole and are presented on the relevant log.

On completion gas/water monitoring standpipes were installed in each borehole. Each installation consisted of a 50mm ID HDPE slotted tube set in a filter response zone of non-calcareous pea gravel. The installation was sealed above and below with a bentonite plug and



accessed via a valve assembly. The installations were protected at the surface by a lockable stopcock cover set in concrete. Installation details are given on the relevant borehole log.

Following completion of the fieldwork, the installations in BH01 to BH04 were monitored on two occasions for gas flow and then tested for methane, carbon dioxide, oxygen, hydrogen sulphide and carbon monoxide using a Gas Data GFM 435 gas analyser. A MiniRAE 2000 PID was used to monitor for Volatile Organic Compounds (VOC's). Atmospheric readings for the three days prior to the monitoring visit were recorded from Weather Underground (www.wunderground.com). The readings are presented in Appendix D together with water level readings.

Trial Pits

The trial pits, referenced TP02 and TP03 (Appendix C), were formed by a wheeled excavator with a 0.60m wide backactor bucket. TP01 was not excavated due to existing trees.

The ground surface at TP02 consisted of hardstanding which required breaking out prior to excavation.

Representative disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars.

Hand vane tests were carried out in suitable cohesive material. The results are presented on the trial pit logs and tabulated in Appendix C.

A soakaway test was carried out in trial pit TP02 in general accordance with BRE 365 (2007). The excavation sides were squared using the excavator bucket and the dimensions recorded within the test section. The trial pit was partially filled with clean water using a dedicated



bowser with a 75mm diameter outlet and the fall in level recorded against time. The test was repeated three times. The results are presented in Appendix C.

Photographs of the trial pit profile and spoil heap were taken and are presented separately.

On completion all trial pits were backfilled with arisings compacted in suitable layers by the excavator bucket. The ground surface at TP02 was reinstated with tarmacadam, whilst the ground surface at TP03 was left slightly proud to accommodate the future inevitable settlement of the backfill.

Foundation Inspection Pits

Three inspection pits, referenced IP01 to IP03 (Appendix C), were hand excavated to uncover the existing foundation bases to the existing building.

Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars.

All inspection pits were backfilled with arisings and the surface reinstated.

Foundation sketches and photographs are presented with the inspection pit logs in Appendix C.

Dynamic Cone Penetrometer Tests

Dynamic Cone Penetrometer tests (DCP), referenced DCP01 and DCP02 (Appendix C), were carried out using a CNS Farnell A2465 dynamic cone penetrometer. Probe depths were measured with respect to ground level and the number of blows for the penetration of the



probe was recorded. Equivalent CBR values have been calculated and presented with the results in Appendix C.

Samples for chemical analyses were dispatched daily to ALcontrol, Hawarden, under a Chain of Custody. The remaining samples were brought to this Company's laboratory for testing and storage.

4.2 Logging

The logging of soils was carried out by an Engineering Geologist in general accordance with BS5930:2015. A key to the exploratory hole logs is presented in Appendix B.

Detailed descriptions of the samples are given in the borehole logs, Appendix C, along with details of sampling, in situ testing, groundwater ingress and relevant comments on drilling techniques.

The trial pits and foundation inspection pits were logged in situ to a depth of approximately 1.20m and thereafter from the surface. Detailed descriptions are given in the trial pit logs, Appendix C, along with details of sampling and in situ testing, groundwater ingress and relevant comments on stability.

4.3 Laboratory Testing

A schedule of laboratory tests was prepared by this Company, the following tests being carried out in accordance with BS1377:1990, unless stated otherwise. The number in brackets refers to the test number given in that standard. The results are presented in Appendix E.

The natural water content was determined on sixteen selected samples in accordance with BS EN ISO 17892-1:2014.



Liquid limit, plastic limit and plasticity index tests [Part 2:4.3, 5.3 and 5.4] were carried out on sixteen selected samples. Atterberg line plots have also been presented.

Particle size distributions were determined for five samples by wet sieving [Part 2:9.2]. The fine fractions of two of these samples were further analysed by sedimentation using the pipette method [Part 2:9.4]. The results are presented as grading curves.

The California Bearing Ratio (CBR) test [Part 4:7] was carried out on a single recompacted sample. The results are presented as graphs of force against penetration.

The one-dimensional consolidation properties [Part 5:3] were determined in the oedometer on four 63.5mm diameter by 19mm thick specimens prepared from U100/UT100 samples. The results are presented in tabular form and also as graphs of void ratio versus log (effective pressure).

Unconsolidated undrained triaxial compression tests were carried out under a single cell pressure on fifteen specimens prepared from full diameter U100/UT100 samples [Part 7:8]. A cell pressure equal to the approximate overburden pressure at sample depth was used. Fully saturated, $\phi_u = 0$, conditions were assumed and the undrained cohesion, c_u was taken as half the deviator stress at failure.

Consolidated undrained multistage triaxial compression tests with pore-water pressure measurements [Part 8:4, 5, 6, 7 and Head (1986)] were carried out on two full diameter specimens prepared from U100/UT100 samples.

Hand vane tests were carried out on fifteen undisturbed U100/UT100 samples.



The BRE SD1 (2005) reduced suite; water soluble sulphate, total sulphate and total sulphur, together with pH were determined for ten samples by ALcontrol Laboratories, Hawarden, using in-house methods.

4.4 Chemical Testing

Selected soil samples were despatched to ALcontrol Laboratories under full chain of custody documentation and tested for a suite of contamination as detailed below. The laboratory holds UKAS ISO17025 and MCERTS accreditation for most of the analyses undertaken.

- Arsenic, cadmium, total chromium, lead, mercury, selenium, boron (water soluble), copper, nickel, zinc, speciated polyaromatic hydrocarbons, speciated petroleum hydrocarbons, BTEX, MTBE, speciated phenols, total cyanide, sulphide (acid soluble), sulphate (water soluble) and pH.

Nine soil samples were also screened for asbestos fibres.

The potential risk to groundwater resources was determined by analysis of four groundwater samples taken from standpipes in BH01 to BH04, which were tested for the above suite of contamination together with hardness.

Chemical test results are presented in Appendix F.



5. DISCUSSION AND CONCLUSIONS

5.1 Ground Conditions

The ground conditions revealed by the investigation confirm the strata indicated by the geological records, proving Head deposits over the Boyn Hill Gravel Member. The superficial deposits were underlain by the London Clay Formation. A variable thickness of Made Ground was present above these materials.

Made Ground

Made Ground was recorded to depths of between 0.30m and 1.90m below ground level (bgl) [69.00m and 66.20m OD], with a greater thickness in BH02 and TP03. Below 0.10m of tarmacadam (BH03 and IP02) or block paving (BH04), sub-base comprised very gravelly sand or sandy gravel to a depth of 0.50m bgl, which was further underlain in BH03 by 0.10m of concrete. Within soft landscaping, topsoil comprised dark brown, slightly gravelly, clayey sand or soft/firm, slightly sandy, gravelly clay (including flint and brick). These materials were underlain by very soft, light brown, slightly gravelly, sandy clay (BH02) or dark greenish brown, slightly clayey, gravelly sand, locally with cobbles of brick (TP02, IP01 and IP02). Similar granular material was observed in BH03 to a depth of 1.10m bgl, which may also represent Made Ground. In TP03, the topsoil was underlain by soft, light brown, sandy clay overlying light grey, silty sand. The gravel in these materials comprised flint, brick and concrete.

Head Deposits

With the exception of BH02, the Made Ground was underlain by material which is considered to represent Head deposits. The material comprised soft to firm/firm, locally firm to stiff/stiff, light brown/orangish brown, sandy, locally slightly gravelly clay, where the



gravel was flint. The foundations inspection pits, IP01 to IP03, and TP03 were completed within this material.

Boyn Hill Gravel Member

The Boyn Hill Gravel Member was encountered below depths of between 2.10m and 3.25m bgl [66.40m and 65.85m OD] in BH01 to BH04 and TP02. The material was generally granular in nature, generally comprising light brown slightly clayey, typically very gravelly sand or sandy/very sandy gravel. Towards the base of these deposits, BH01 to BH03 proved beds of stiff/very stiff, slightly sandy/sandy, locally slightly gravelly (flint) clay, between 0.30m and 0.80m thick. The thickness of these deposits ranged between 2.70m and 3.55m, extending to depths of 4.70m and 6.30m bgl [63.40m to 62.30m OD]. TP02 was completed within the granular material at a depth of 2.70m bgl.

London Clay Formation

Underlying the superficial deposits, the London Clay Formation comprised stiff, dark brownish grey, silty clay with rare shell fragments. With increasing depth, the material became locally dark grey in colour with sand sized selenite crystals, gravel sized pockets of fine sand and mica crystals. A very stiff consistency was recorded below depths of around 10.40m to 12.95m bgl. All boreholes were completed at a depth of 18.00m bgl [51.50m to 50.10m OD].

Groundwater

Groundwater was encountered in BH03, within the Boyn Hill Gravel Member, at a depth of 3.50m bgl [65.10m OD], rising to 3.10m bgl [65.50m OD] after a 20 minute monitoring period. Perched water was also encountered in TP02 at the interface of the Made Ground



and underlying Head deposits at a depth of 1.10m bgl [67.40m OD]. The remaining holes remained dry during the short time they remained open.

Post fieldwork monitoring of the observation wells in BH01 to BH04 recorded at depths of between 3.22m and 3.91m bgl (65.62m and 64.28m OD).

5.2 Existing Foundations

Inspection pits, referenced IP01 to IP03 were excavated by hand to establish foundation details of the existing engineering building.

IP01 revealed a concrete foundation, extending 0.30m from the face of the wall, bearing at a depth of 0.90m bgl upon firm to stiff, slightly sandy slightly gravelly clay, which is considered to represent Head deposits.

In IP02, a concrete foundation was uncovered, extending 0.95m from the face of the wall, bearing at a depth of 1.15m bgl upon soft to firm, slightly sandy clay (Head deposits).

A concrete ground beam (?) was revealed in IP03, underlain at a depth of 0.40m bgl by firm to stiff, slightly gravelly, sandy clay (Head deposits).

Sketches are presented with the trial pit logs in Appendix C. Photographs are included in Appendix A.



5.3 Geotechnical Appraisal

Made Ground

No laboratory testing was carried out on the Made Ground.

A single SPT test was carried out within the cohesive Made Ground in BH01, inferring a very soft consistency after the application of a 5kPa correlation factor (Stroud, 1974).

Head Deposits

Index tests indicate the material is typically of intermediate plasticity and possesses a medium volume change potential in response to changes in moisture content (NHBC, 2014).

A high plasticity was indicated for the material from BH04 at 3.15m bgl.

SPT N values of between 11 and 16 were obtained for the Head deposits, indicating a firm/stiff consistency after the application of a 5kPa correlation factor (Stroud, 1974). Hand vane readings of 61kPa and 126kPa infer the clay to firm/stiff.

Consolidation tests carried on samples of the Head deposits from BH01 at 2.80m bgl, BH03 at 2.30m bgl and BH04 at 2.80m bgl provided coefficient of compressibility (m_v) values of between 0.098 and 0.290m²/MN for the pressure range 100kPa to 200kPa (i.e. low to medium compressibility).

CBR values of 4.8% and 7.4% were obtained for the cohesive Head deposits from a recompacted laboratory test on material from BH01 at 0.50m bgl.



A consolidated undrained triaxial test carried out on a sample of the Head Deposits in BH04 at 2.90m bgl provided an angle of shearing resistance (ϕ') of 26.6° and an effective cohesion (c') of 10.1kPa.

Boyn Hill Gravel Member

Index tests indicate the cohesive soils are of high plasticity and possesses a medium volume change potential in response to changes in moisture content (NHBC, 2014).

Particle size distribution tests indicate the granular soils to comprise:

- 1-11% fines (clay/silt), 46-56% sand and 36-52% gravel or
- 9% fines, 72% sand and 19% gravel.

Typically, SPT N values (13 to 46) indicate the granular deposits to be of medium dense/dense relative density. A further N value of 8 infers the basal deposits in BH04 to be loose. Further tests were partially carried out within the underlying London Clay Formation, suggesting a medium dense/dense relative density (N values of 20 to 36).

London Clay Formation

Index tests indicate the London Clay is of high plasticity. Based upon the plasticity indices, this material is considered to be of medium and high volume change potential in response to changes in moisture content (NHBC, 2014).

SPT N values of between 13 and 48 infer the London Clay to be typically stiff, becoming very stiff with increasing depth, after the application of a 5kPa correlation factor (Stroud, 1974).



Triaxial tests yielded undrained cohesion of between 94kPa and 242kPa, indicating the upper weathered part of the London Clay to be stiff, becoming very stiff with increasing depth. Hand vane readings suggest the material to be at least stiff.

A consolidation test carried on a sample of the London Clay from BH04 at 6.5m bgl provided a coefficient of compressibility (m_v) value of $0.096\text{m}^2/\text{MN}$ for the pressure range 200kPa to 400kPa (i.e. low compressibility).

A consolidated undrained triaxial test carried out on a sample of the London Clay in BH03 at 7.15m bgl provided an angle of shearing resistance (ϕ') of 25° and an effective cohesion (c') of 2.6kPa.

5.4 Foundation Considerations

Details of the scheme including foundation loads were unknown at the time of preparing this report. As such, the following comments are of a general nature and should be reviewed when appropriate information becomes available.

The exploratory holes proved a variable thickness of Made Ground, up to 1.90m thick, which is considered an unsuitable bearing stratum. Due to the changeable bearing characteristics and localised absence of the Head deposits, it is generally recommended that foundations bear within underlying natural materials, although it may be locally utilised to support lightly loaded structures.

The Boyn Hill Gravel Member, as encountered between depths of between 2.10m and 3.25m bgl [66.40m and 65.85m OD] would offered an allowable bearing capacity of at least 200kPa, however the depth of excavation through Made Ground and localised groundwater ingress may pose problems for construction and health and safety.



Given the above, it is considered that the most suitable solution is likely to be piles, extending into the London Clay Formation.

Given the potential problems with noise/vibrations during pile driving within proximity to existing buildings and services, continuous flight auger (cfa) or bored piles are likely to be considered the preferred option.

Temporary casing will be required to maintain hole stability within the Made Ground and superficial deposits.

Piles will need to be designed to resist tensional forces that may be caused by rehydration of the clay soils within proximity to existing trees/vegetation and should therefore be designed as tension piles and/or sleeved to accommodate heave.

It will be important that the concrete is poured as soon as the excavation is completed to avoid softening and the potential for groundwater ingress into the base of the shaft.

Based on the undrained shear strength plot in Appendix G, preliminary allowable working loads have been calculated for a single bored cast in-situ pile of given diameter, as presented in Table 5.1 below. The toe depth given is based on piles being installed from an assumed formation level of 69m OD to a level of 53m OD, providing a minimum of 9.3m penetration into the London Clay. An adhesion factor (α) of 0.45, bearing capacity factor (N_c) of 9 and a combined factor of safety of 2.5 have been applied. Skin friction associated with the Made Ground, Head deposits and Boyn Hill Gravel Member has been ignored. An average undrained cohesion of 130kPa has been assumed over the shaft and an undrained shear strength of 180kPa at the pile toe.



Pile length (m)	Allowable Working Load (kN)					
	Pile Diameter					
	300mm	450mm	600mm	750mm	900mm	1200mm
16	250	410	595	800	1030	1555

Table 5.1: Preliminary Pile Working Loads

Once more detail is available with respect to the proposed scheme and loadings, it is recommended that specialist piling contractors should be consulted to advise further on the most suitable pile type, installation method and to provide final design working loads on their chosen system.

Given the presence of shrinkable soils at shallow depth and the potential for shrinkage/heave within the influence zone of existing trees, it is recommended that the ground floor slab is constructed as fully suspended.

5.5 Excavations

Excavations should be within the scope of conventional backhoe excavators. Recourse to hydraulic breakers may be required to break out existing obstructions.

Excavations through the Made Ground are likely to be unstable, even in the short term. If potentially unstable excavations or any excavations deeper than 1.00m are to be entered then the sides should be battered back and/or shoring methods and equipment should be utilised in accordance with relevant Health and Safety legislation.

All excavations should be closely inspected and any loose or soft spots should be removed and replaced with suitably compacted granular material. In order to prevent formation



softening and deterioration it is recommended that all foundations be cast as soon as possible after the excavation or a concrete blinding is placed to protect the formation.

5.6 Buried Concrete

In accordance with the BRE Special Digest 1 (2005) the site is not regarded as brownfield, however the ground is considered to contain sulfides.

The chemical analyses recorded in the investigation fall within the Design Sulfate Class DS-1 for the superficial deposits, based upon the water soluble and groundwater sulphate values. Taking into account mobile groundwater conditions and with alkaline pH values, an ACEC site classification of AC-1 is proposed.

For piled foundations extending into the London Clay Formation, a Design Sulfate Class DS-1 and ACEC site classification of AC-1 is also recommended since the material should not be significantly disturbed.

The total sulphur results indicate that the London Clay Formation possesses a high sulphide content. Any excavated clay should not be reused on site where it could come into contact with, or influence, any buried concrete as it is likely to become sulphate rich upon oxidation.

5.7 Pavement Design

Dynamic Cone Penetrometer (DCP) tests, referenced DCP01 and DCP02, were carried out along the route of a proposed access road. The results suggest a California Bearing Ratio (CBR) value of at least 5% for the Head deposits in DCP01 (with comparison to the ground profile in BH01). Below a depth of around 1.1m bgl, an increase in CBR value was recorded with increasing depth (>16%). Index testing on samples of the near surface Head deposits



(BH01 at 0.50m bgl) suggest the near surface clays should yield a CBR value of approximately 3-4% as per Table 5.1 of the Highways Agency publication IAN 73/06 (2009), based on a plasticity index of 30%. CBR values of 4.8% and 7.4% were obtained for the cohesive Head deposits from a recompacted laboratory test on material from BH01 at 0.50m bgl. A conservative CBR value of 3% is therefore suggested for the Head deposits.

Within the existing car park, DCP02 initially recorded CBR values of at least 32% (probable Made Ground), decreasing below around 0.75m bgl, where CBR values of at least 11% are indicated.

For Made Ground, unless it is removed or suitably proof-rolled/compacted prior to road construction, a CBR value of 2% is recommended, unless in-situ CBR test are carried out closer to the time of construction.

On the basis of classification testing and using TRRL and published data (Croney et al, 1967), the near Head deposits are not considered to be susceptible to frost heave.

5.8 Soakaway Design

Soakaway testing in TP02 recorded negligible infiltration during the test period. Soakaway drainage would therefore not be expected to form a viable solution and alternative forms of drainage should be sought (i.e. drainage to storm water sewers).

5.9 Contamination Considerations

5.9.1 Basis of Assessment - Soils

The concentration of contamination present at a site must be assessed in relation to a recognised system of defining whether a site presents a significant possibility of significant



harm to human health. In the UK, the Department of the Environment Food and Rural Affairs (DEFRA) and the Environment Agency (EA) prepared a method for deriving generic and site-specific assessment criteria to establish actual or potential risk to human health. This comprised the Contaminated Land Exposure Assessment (CLEA) methodology, and the associated DEFRA/EA Soil Guideline Value (SGV) reports.

Further guidance was produced by DEFRA in “Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance (2012)” supporting the use of Generic Assessment Criteria (GACs) as screening tools in generic quantitative human health risk assessment to help assessors decide when land can be excluded from the need for further inspection and assessment, or when further work may be warranted. They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health but they should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist. Furthermore the Category 4 Screening Levels (C4SLs) derived by DEFRA in 2014 will generally be used in place of SGVs and other guidance. In the absence of a suitable C4SL or SGV, risk assessors are advised to identify and select appropriate generic assessment criteria in accordance with established good practice.

The CLEA computer model has been used for this assessment to derive S4ULs and similarly EIC/AGS/CL:AIRE (2010) and Soil Screening Values (SSVs), in lieu of any other available guidance. The basis for assessment of soils is discussed in full in Appendix H.

5.9.2 Basis of Assessment - Water

In the absence of any National Standards relating to groundwater it is recommended by the Environment Agency to compare the results with the general water quality guidelines from the UK, European Union and World Health Organisation. These are published in Appendix A of the publication “Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the Environmental Protection Act 1990” (2002). New



values published in accordance with the Water Framework Directive (2015) may also be relevant in assessment of groundwater.

5.9.3 Basis of Assessment - Ground Gases

Approved Document Part C2 of the Building Regulations (DoE) recommends a tiered risk assessment approach in respect of “methane and other gases” (used to define hazardous soil gases which originate either from waste deposited in landfill sites or are generated naturally). Approved Document C does not include radon (which is dealt with separately) but does include volatile organic compounds (VOC’s). The methodology for the semi-quantitative risk assessment is defined in BS 8485:2015, which provides a framework in line with CLR 11 (2004). For gases not covered by BS8485:2015, a risk assessment basis is considered appropriate with standards taken from occupational exposure limits or other accepted data. Reference should also be made to CIRIA Report C665 (Wilson et al, 2007).

For the determination of the acceptability of volatile vapours (VOCs) in soils, values derived from Soil Gas Acceptance Criteria for the Protection of Indoor Air Quality for a commercial end-use, documented in the New Zealand Guidelines (1999) shall be used. A “trigger” value of 100ppm was used for the determination of acceptability of soils based on the New Zealand Guidelines.

5.9.4 Comparison of Results - Soil

Potential contamination at the site has been compared with the Generic Assessment Criteria (GAC) screening values for a commercial end use. The screening values are defined by C4SLs or SGVs, LQM/CIEH S4ULs (2014), EIC/AGS/CL:AIRE values (2010) and ATRISK SSVs (2011), calculated using the CLEA (2009) computer model. An assumed Soil Organic Matter of 6% SOM (defined by Environment Agency) was used for the SGVs and C4SLs, whilst a worst case, conservative Soil Organic Matter of 1% SOM was used for the S4ULs (where



applicable), EIC/AGS/CL:AIRE and SSVs (defined by Atkins), as closest to conditions on site [measured SOM of between 0.44% and 1.71%].

General Contaminants

When compared to the published GACs for a commercial end use, no exceedances of general contaminants were recorded. As such, these soils are considered unlikely to present a significant possibility of significant harm to human health with respect to the general contaminants in Table 5.2 below.

Contaminant	Concentration ranges with exceedances	GACs (mg/kg)
Arsenic	Range: 7.0 – 18.3mg/kg	640 [•] [°] [#]
Boron	Range: <1.00 – 1.05mg/kg	240,000 [•]
Cadmium	Range: <0.02 – 1.92mg/kg	190 [•] , 410 [°] , 230 [#]
Chromium	Range: 12 – 21.5mg/kg	8,600 [•]
Copper	Range: 4.01 – 12.7mg/kg	68,000 [•]
Cyanide	All less than 1mg/kg	34 [*]
Lead	Range: 11.2 – 36mg/kg	2,300 [°]
Mercury (Methyl)	All less than 0.14mg/kg	410 [#] , 320 [•]
Nickel	Range: 7.39 – 18.1mg/kg	980 [•] , 1,800 [#]
Phenol	All less than 0.18mg/kg	3,200 [#]
Selenium	All less than 1mg/kg	12,000 [•] , 13,000 [#]
Zinc	Range: 17.8 – 139mg/kg	730,000 [•]

[•]GACs derived from Land Quality Management (LQM)/CIEH S4ULs (2014) for commercial end use (6% SOM)

[#]SGVs (2009) for commercial end use (6% SOM)

[°]C4SLs for commercial end use (6% SOM)

^{*}ATRISK (2011) Soil Screening Values (SSVs) for commercial end use (1% SOM)

Exceedances marked in **bold**

Table 5.2: GAC for General Contaminants



Polyaromatic Hydrocarbons (PAHs)

No exceedances of PAHs were recorded above the published GACs for a commercial end use, as shown in Table 5.3 below. On this basis, these soils are considered unlikely to present a significant possibility of significant harm to human health with respect to PAHs.

Contaminant	Concentration ranges with exceedances	GACs (mg/kg)
Acenaphthene	Range: <0.008 – 0.0191mg/kg	84,000 [57] ^{sol}
Acenaphthylene	All less than 0.0433mg/kg	83,000 [86.1] ^{sol}
Anthracene	Range: <0.016 – 0.114mg/kg	520,000
Benzo(a)anthracene	Range: <0.014 – 0.597mg/kg	170
Benzo(a)pyrene	Range: 0.015 – 0.660mg/kg	35, 77 [°]
Benzo(b)fluoranthene	Range: 0.015 – 0.964mg/kg	44
Benzo(ghi)perylene	Range: 0.024 – 0.472mg/kg	3,900
Benzo(k)fluoranthene	Range: <0.014 – 0.297mg/kg	1,200
Chrysene	Range: <0.010 – 0.565mg/kg	350
Dibenzo(ah)anthracene	Range: <0.023 – 0.110mg/kg	3.5
Fluoranthene	Range: 0.017 – 0.979mg/kg	23,000
Fluorene	Range: <0.010 – 0.020mg/kg	63,000 [30.9] ^{sol}
Indeno(123-cd)pyrene	Range: <0.018 – 0.416mg/kg	500
Naphthalene	Range: <0.009 – 0.0116mg/kg	190 [76.4] ^{sol}
Phenanthrene	Range: <0.015 – 0.289mg/kg	22,000
Pyrene	Range: <0.015 – 0.828mg/kg	54,000

GACs derived from Land Quality Management (LQM)/CIEH S4ULs (2014) for commercial end use (1% SOM)

[°]C4SL for commercial land use (1% SOM)

Figure in square brackets [] refer to where GAC presented exceeds the solubility or vapour saturation limit

Exceedances marked in **bold**

Table 5.3: GAC for Polyaromatic Hydrocarbons

Total Petroleum Hydrocarbons (TPHs), BTEX and MTBE

When compared to the published GACs for a commercial end use, no exceedances of TPHs, BTEX or MTBE were recorded, therefore, these soils are considered unlikely to present a



significant possibility of significant harm to human health. The results are shown in Table 5.4 below.

Contaminant	Concentration ranges with exceedances	GACs (mg/kg)
TPH Aliphatic >C ₅ to C ₆	Range: 0.01 – 0.0104mg/kg	3,200 [340] ^{sol}
TPH Aliphatic >C ₆ to C ₈	Range: 0.01 – 0.0253mg/kg	7,800 [144] ^{sol}
TPH Aliphatic >C ₈ to C ₁₀	Range: 0.01 – 5.02mg/kg	2,000 [78] ^{sol}
TPH Aliphatic >C ₁₀ to C ₁₂	Range: 0.01 – 6.68mg/kg	9,700 [48] ^{sol}
TPH Aliphatic >C ₁₂ to C ₁₆	Range: <0.10 – 15.8mg/kg	59,000 [24] ^{sol}
TPH Aliphatic >C ₁₆ to C ₂₁	Range: <0.10 – 39.6mg/kg	1,600,000
TPH Aliphatic >C ₂₁ to C ₃₅	Range: 21.9 – 105mg/kg	1,600,000
TPH Aliphatic >C ₃₅ to C ₄₄	Range: <0.10 – 90mg/kg	1,600,000
TPH Aromatic >C ₅ to C ₇	All less than 0.01mg/kg	26,000 [1,220] ^{sol}
TPH Aromatic >C ₇ to C ₈	All less than 0.01mg/kg	56,000 [869] ^{sol}
TPH Aromatic >C ₈ to C ₁₀	Range: 0.01 – 3.35mg/kg	3,500 [613] ^{vap}
TPH Aromatic >C ₁₀ to C ₁₂	Range: 0.01 – 4.45mg/kg	16,000 [364] ^{sol}
TPH Aromatic >C ₁₂ to C ₁₆	Range: <0.10 – 3.55mg/kg	36,000 [169] ^{sol}
TPH Aromatic >C ₁₆ to C ₂₁	Range: <0.10 – 24.9mg/kg	28,000
TPH Aromatic >C ₂₁ to C ₃₅	Range: 2.57 – 76.7mg/kg	28,000
TPH Aromatic >C ₃₅ to C ₄₄	Range: 0.976 – 127mg/kg	28,000
Benzene	All less than 0.01mg/kg	27, 95 [#] , 98 [°]
Toluene	Range: 0.002 – 0.00234mg/kg	56,000, 4,400 [#]
Ethylbenzene	All less than 0.003mg/kg	5,700, 2,800 [#]
m,p-Xylene	All less than 0.006mg/kg	5,900, 3,200 (p-xylene) [#]
o-Xylene	All less than 0.003mg/kg	6,600, 2,600 [#]
Methyl-tertiary-butyl-ether (MTBE)	All less than 0.005mg/kg	7,900 [*]

GACs derived from Land Quality Management (LQM)/CIEH S4ULs (2014) for a commercial end use (1% SOM)

Figure in square brackets [] refer to where GAC presented exceeds the solubility or vapour saturation limit

[#]SGVs (2009) for commercial end-use (6% SOM)

[°]C4SL for commercial land use (1% SOM)

^{*}GAC derived from EIC/AGS/CL:AIRE GAC for commercial end use (1% SOM)

Table 5.4: GAC for Total Petroleum Hydrocarbons, BTEX and MTBE



Asbestos

Asbestos fibres were not detected in the nine samples of Made Ground tested.

5.9.5 Comparison of Results - Water

The potential risk to groundwater resources was determined by analysis of four water samples obtained from the monitoring standpipes in BH01 to BH04, taken following completion of the fieldwork on 18th April 2016.

The Water Quality Standards (WQS) employed as Tier 1 Water Environment screening criteria are given in Table 5.5 below. The more conservative values of the UK Drinking Water Standards (UK DWS) and Environmental Quality Standards (EA EQS) (Freshwater) have been selected as the primary Tier 1 Screening Values.

The results in Table 5.5 above fall below the published WQS with the exception of the following:

- Selenium in BH04 (26.5µg/l), above the UK DWS (10µg/l) and WFD (7.5µg/l).
- Sulphide in BH04 (1,300 µg/l), above the EA EQS (250µg/l).
- Polyaromatic hydrocarbons in all standpipes (7.89 – 687µg/l), above the UK DWS (0.1µg/l).
- Total petroleum hydrocarbons in all standpipes (977 - 2790µg/l), above the UK DWS (10µg/l).

The results are discussed further in Section 6.2.



Contaminant	Concentrations ranges with exceedances	EA EQS (µg/l)	UK DWS (µg/l)	WFD* (µg/l)
Arsenic	Range: 0.369 – 1.18µg/l	50	10	7.5
Boron	Range: 15.7 – 30.3µg/l	2,000	1,000	750
Cadmium	Range: <0.1 – 0.209µg/l	5	5	3.75
Chromium	Range: 2.76 – 4.66µg/l	250*	50	37.5
Copper	Range: 0.9 – 1.96µg/l	28**	2,000	1,500
Cyanide (total)	All less than 50µg/l	-	50	-
Lead	Range: 0.05 – 0.158µg/l	250*	10	7.5
Mercury	All less than 0.01µg/l	1	1	0.75
Nickel	Range: 4.35 – 30.6µg/l	200**	50	15
Selenium	Range: 1.53 – 26.5µg/l BH04 above the UK DWS	-	10	7.5
Sulphate	Range: 27,500– 99,400µg/l	400,000	250,000	188,000
Sulphide	Range: <100 – 1,300µg/l BH04 above the EA EQS	250		-
Zinc	Range: 2.7 – 14.6µg/l	500*	5,000	-
Phenols	All less than 1µg/l	300	0.5	
Polyaromatic hydrocarbons***	Range: 7.89 – 687µg/l All above the UK DWS	-	0.1	-
Benzo(a)pyrene	Range: 2.17 – 244µg/l All above the UK DWS	-	0.01	0.0075
TPH (total)▲	Range: 977 - 2790µg/l All above the UK DWS	-	10	-
Benzene	All less than 7µg/l	30	1	-
Toluene	All less than 4µg/l	50	-	-
Xylene	All less than 11µg/l	30	-	

* For freshwater, suitable for coarse fish; hardness band CaCO₃ >250mg/l;

** For freshwater, suitable for all fish life; hardness band CaCO₃ >250mg/l;

*** UK DWS for total PAHs relates to the sum of the individual concentrations of benzo(k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene and benzo(b)fluoranthene.

▲ Drinking Water Guidance. 1989 Water quality Regulations (superseded).

•WFD – Water Framework Directive drinking water protected areas

Table 5.5: Inorganic and Organic Tier 1 Water Environment Screening Criteria



5.9.6 Comparison of Results - Ground Gases

The observation wells in BH01 to BH04 were monitored on two occasions following completion of the fieldwork to assist in ground gas risk assessment and provide recommendations for gas protective measures, if required. The results are presented in Appendix B and summarised in Table 5.6 below. A preliminary assessment of the results is provided in Section 6.2.

Borehole	Response Zone/Strata (m bgl)	Evidence of Contamination	No. of Monitoring Visits	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Flow (l/hr)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Volatile Organic Compounds (ppm)	Water Level (m bgl)	Atmospheric Pressure (Mb)
BH01	1.00 – 6.20/ HD & BHG	No	2	0.0- 0.1	2.8- 4.1	9.9-13.0	0.0	0-1	0	1.7-1.8	3.50- 3.91	1003- 1017
BH02	1.00-4.30/ MG, HD & BHG	No	2	0.0	2.1- 5.1	11.2- 17.9	0.0	0-1	0	0.2-1.4	3.22- 3.85	1003- 1010
BH03	1.00 – 6.30/ HD & BHG	No	2	0.0- 0.1	0.2- 5.2	14.0- 19.8	0.0	0-1	0	0.5-0.9	3.25- 3.52	1004- 1019
BH04	1.00 – 6.20/ HD & BHG	No	2	0.0	1.1- 3.0	15.5- 18.8	0.0	0-1	0	0.6-1.7	3.83- 3.91	1003- 1016

Notes: MG – Made Ground; HD – Head deposits; BHG – Boyn Hill Gravel Member

Table 5.6: Summary of Gas Monitoring Data



6. CONTAMINATION RISK ASSESSMENT AND RECOMMENDATIONS

6.1 Qualitative Risk Assessment

6.1.1 General

The assessment of potential sources of contamination were limited to a site walkover and the findings of the ground investigation. Further assessment should be considered, in accordance with the DEFRA and Environment Agency publication CLR 11 (2004), including a Phase 1 desk study of the site to suitably establish the environmental setting.

Notwithstanding the above, chemical analysis of soils fell below the published GACs for a commercial end use. Asbestos fibres were not detected in the samples of Made Ground tested, although this does not prove the absence of asbestos at the site.

Chemical analysis of groundwater in BH01 to BH04 identified exceedances of selenium, sulphide, polycyclic aromatic hydrocarbons and total petroleum hydrocarbons in groundwater beneath the site.

The concentrations of ground gases (based on methane and carbon dioxide) and vapours observed in BH01 to BH04 during post fieldwork monitoring at the site are discussed in Section 6.2 below.



6.1.1 Receptors and Pathways

Human Health

The results of the chemical analysis and asbestos screening indicate the site presents a **LOW** risk to the human health of end-users of the site based on a commercial end use.

Direct human contact could occur during demolition and construction activities proposed for the site, however the potential risk would be deemed to be **LOW** if precautionary measures discussed in Section 7.5 below are adhered to.

Buried Services

Potential receptors would also include buried services (particularly water pipes); further comment is made in Section 6.3.

Controlled Waters

The superficial deposits are designated as a Secondary (Undifferentiated) aquifer, whilst the underlying bedrock (London Clay Formation) is classified as unproductive due to low permeability. The site is located approximately 140m southwest of an Inner Zone (Zone 1) SPZ.

There are no surface water features on the site; the nearest relates to Whiteknights Lake, which is located approximately 300m east of the Engineering Building. The River Kennet is situated about 2.2km west of the site.



The proposed scheme indicates that the majority of the site will be covered by the new building or hardstanding, which will serve to limit potential contamination into the underlying Secondary (Undifferentiated) Aquifer.

Whilst chemical analysis of groundwater in BH01 to BH04 was generally recorded below the WQS, exceedances of selenium, sulphide, polyaromatic hydrocarbons and total petroleum hydrocarbons, above the WQS, indicate that further assessment will be required.

Given the above, the risk to controlled waters is therefore considered to be **LOW to MEDIUM**.

6.2 Gas Protection Measures

The risk posed by gassing sites can be determined from a semi-quantitative assessment of the risk, as proposed by Wilson and Card (1999), following development of the system as detailed in BS8485:2015. The method uses both gas concentrations and borehole flow rates to define a characteristic situation (CS) for a site based on the limiting borehole gas volume-flow or “Gas Screening Value” (GSV) for methane and carbon dioxide. The GSV (litres of gas per hour) can be calculated from the borehole flow rate (litres per hour) and gas concentration (%). The calculation is carried out for both methane and carbon dioxide and the worst case GSV value is generally adopted for comparison with the Classification Situation.

The ground gas observation wells installed in BH01 to BH04 were monitored on two occasions following completion of the fieldwork. The results indicate a maximum concentration of carbon dioxide (CO₂) at 5.2%, up to 0.1% methane and 1ppm carbon monoxide. Hydrogen sulphide was not measured above the limits of detection. Oxygen concentrations varied between 9.9% and 19.8%. No gas flow was detected during the two visits. Given the recorded concentrations of carbon dioxide, it is recommended that at least



two further gas monitoring visits (four in total) are carried out in to provide more robust data for the site. Once the final gas data has been received, the detailed design of protective measures (if any) should be carried out in accordance with BS8485:2015. This design will depend on the type and use of the proposed building.

Based on the maximum recorded concentration of volatile organic compounds to date (up to 1.8ppm), vapour protection measures would not be considered necessary for development at the site.

The BRE indicates radon protective measures are not required in new developments at this site, however it is recommended that the local Building Control body is contacted to establish their minimum requirements for the area.

6.3 Further Work/Remedial Work

Based on the outline scheme, pre-construction remedial action is not considered necessary to protect the human health of future end-users of the site. Further assessment is however recommended to assess the potential risk to controlled waters, which is likely to include a Phase 1 desk study of the site to establish the environmental setting.

Whilst the results to date indicate that ground gas protection measures are not likely to be required, it is recommended that a further two monitoring visits are carried out (four in total) are carried out to provide more robust data for the site.

The concentrations of organic and inorganic contaminants may have an effect on the choice of materials used for underground services. Particularly at risk are drinking water supplies as any deterioration may have a direct effect on water quality and human health. It is therefore recommended that the specification for underground water supply pipes is



agreed with the Water Supply Company where potentially exposed to elevated contaminants.

6.4 Waste Disposal

No assessment has been made within this report with regard to the classification of material for potential offsite disposal. In order to classify materials as non-hazardous and within the Waste Acceptance Criteria (WAC), further testing may be required prior to the dispatch of waste to landfill. We can assist if necessary, with testing usually taking two weeks at the laboratory. Landfill sites may require pre-treatment of waste prior to disposal. Registration of the site may also be required before materials are dispatched. It is recommended that a suitably competent and licensed waste broker be contacted for advice/guidance on how to proceed and to provide a suitable waste classification of the material.

6.5 General Groundworks

Where construction workers are likely to come into contact with potentially contaminated materials during any redevelopment of the site it will be necessary to ensure that a strict personal hygiene regime is observed. Accordingly, skin contact with and possible ingestion of contaminated materials must be avoided. Adequate washing, toilet and first aid facilities should be provided. Construction workers coming into contact with potentially contaminated materials should wear protective clothing including gloves, overalls, boots and eye protection.

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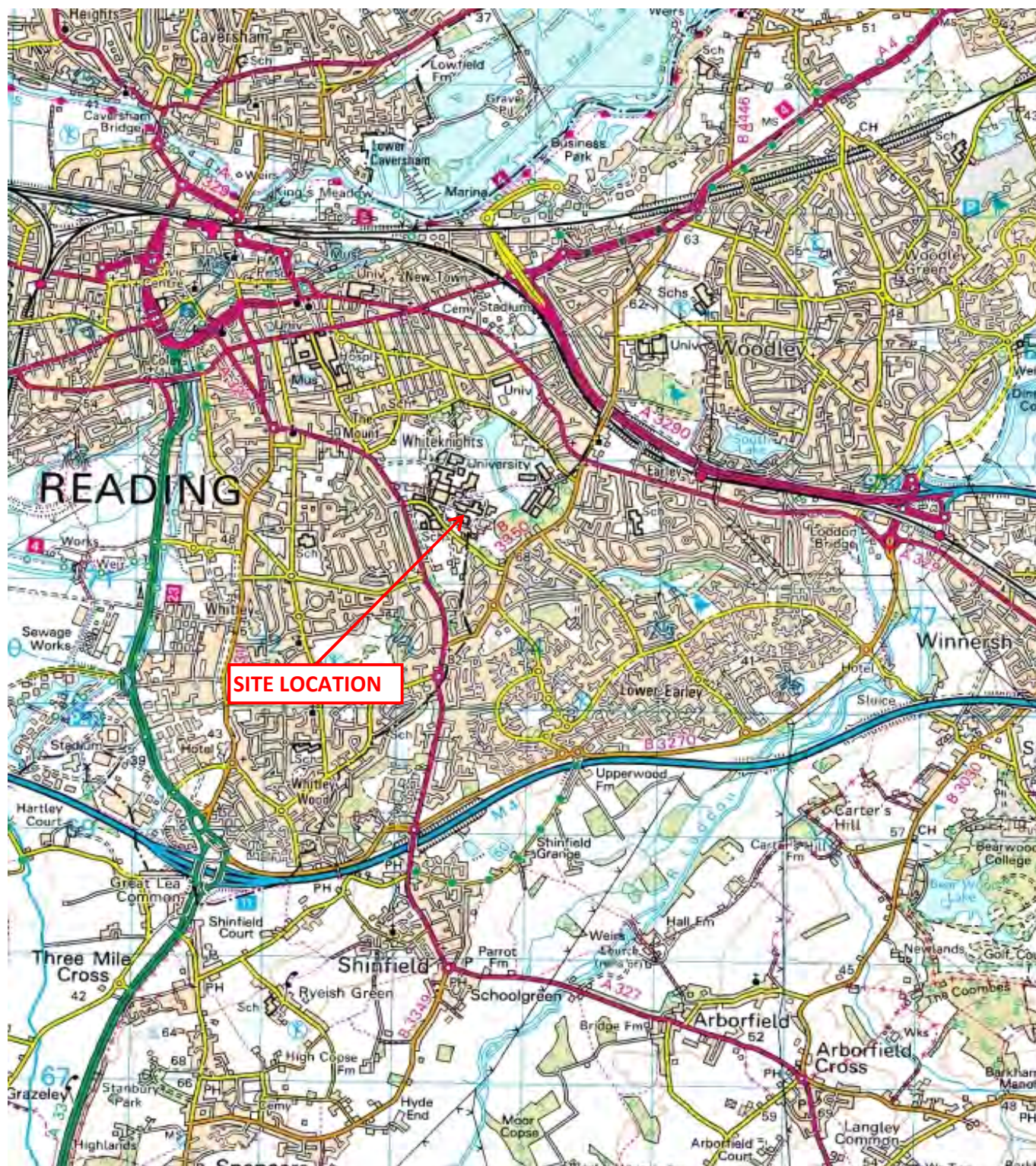
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LOCATION PLAN



CLIENT KNOWLES & SON (OXFORD) LTD
SITE UNIVERSITY OF READING - HEALTH & LIFE SCIENCES BUILDING
SCALE Approximately 1:50,000

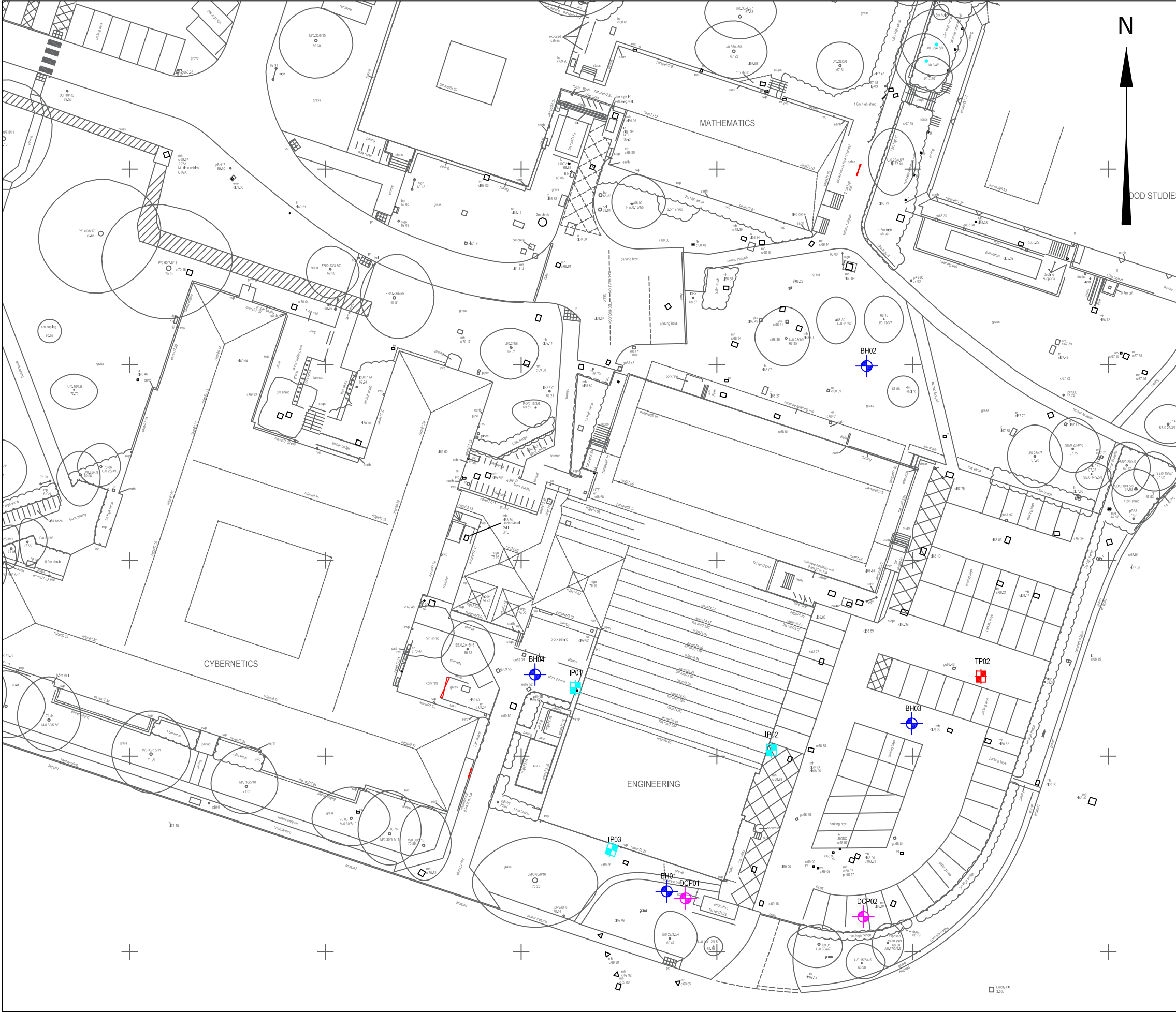
Reproduced from the 2012, 1:50,000 Ordnance Survey Map (Sheet 175 Reading & Windsor) with the permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationary Office, Crown Copyright. Geotechnical Engineering Limited, Gloucester. AL100002447.

CONTRACT

31710

FIGURE

1



Key.



Borehole Location



DCP Location



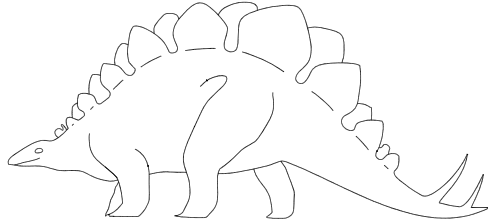
Trial Pit Location



Inspection Pit Location

Notes:

Drawing supplied by client.



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Client:

KNOWLES & SON (OXFORD) LTD

Engineer:

AECOM

Site: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

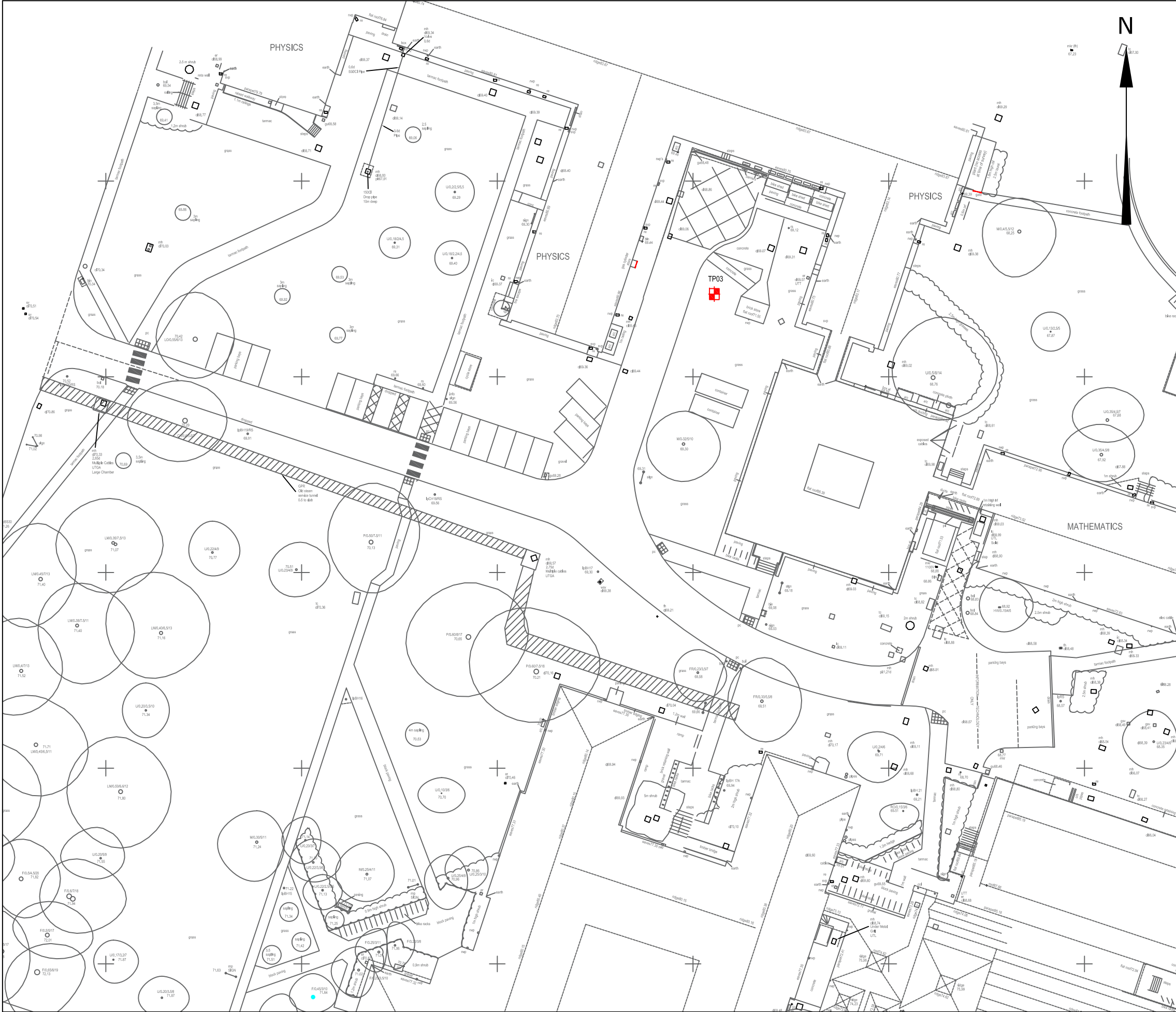
Title:

Exploratory Hole Location Plan

Drawn By:	GJS	Checked By:	JJ	Paper Size:	A3
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Scale:	1:500	Date:	April 2016
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Contract:	31710	Figure:	02
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Key.

- Borehole Location
- DCP Location
- Trial Pit Location
- Inspection Pit Location

Notes:

Drawing supplied by client.

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Engineer:		
AECOM		
Site: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING		
Title: Exploratory Hole Location Plan		
Drawn By:	GJS	Checked By: JI
Scale: 1:500		Date: April 2016
Contract: 31710	Figure: 03	



APPENDIX A

PHOTOGRAPHS



View of the entrance into Car Park 12, to the south of the existing Engineering Building



View across Car Park 12, looking northwest towards the Engineering Building



View looking west along the southern elevation of the Engineering Building



View looking west along the southern elevation of the Engineering Building



View looking west along the northern elevation of the Engineering Building



View looking southeast towards Car Park 12 from the northeast corner of the Engineering Building



Site of the proposed substation, adjacent to the JJ Thomson Building



Trial pit: TP02 profile



Trial pit: TP02 profile



Trial pit: TP02 profile



Trial pit: TP02 spoil



Trial pit: TP02 spoil



Trial pit: TP02 reinstatement



Trial pit: TP03 profile



Trial pit: TP03 profile



Trial pit: TP03 profile



Trial pit: TP03 spoil



Trial pit: TP03 reinstatement



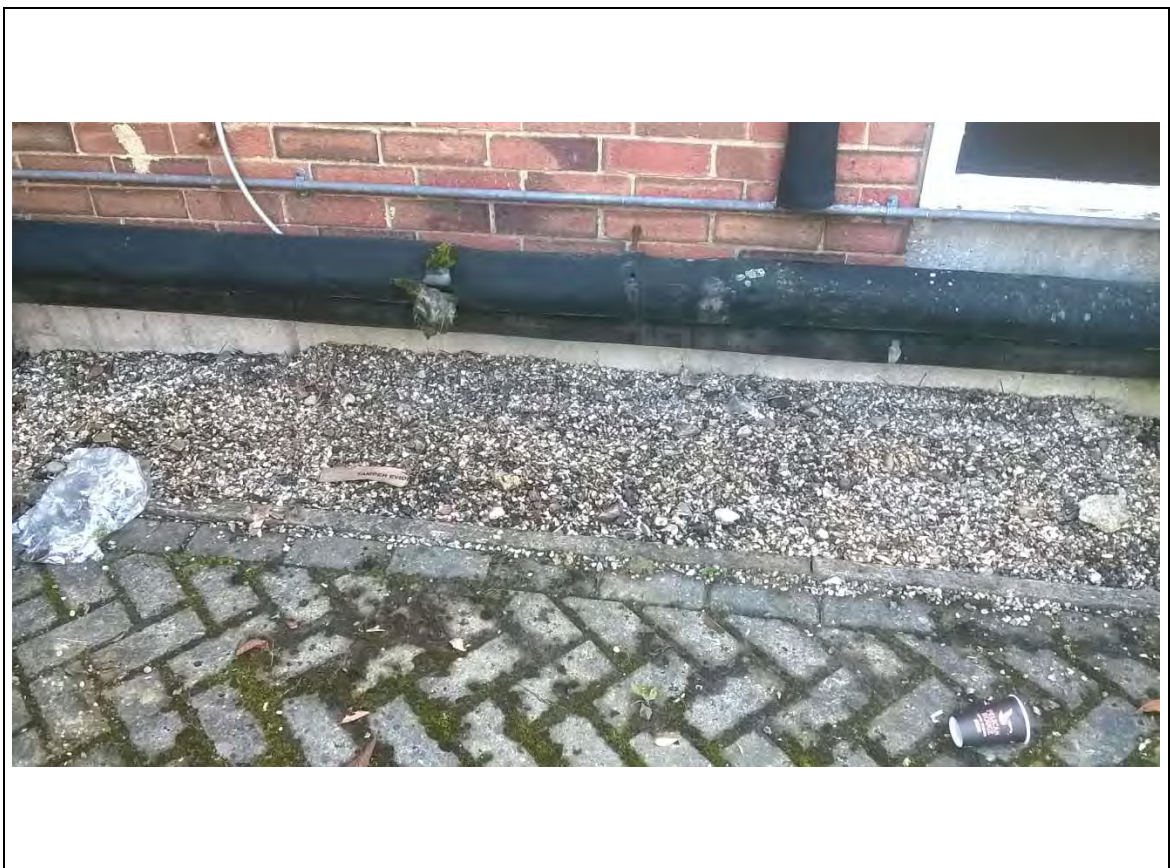
Inspection pit: IP01



Inspection pit: IP01



Inspection pit: IP01 spoil



Inspection pit: IP01 reinstatement



Inspection pit: IP02 profile



Inspection pit: IP02 profile



Inspection pit: IP02 spoil



Inspection pit: IP02 reinstatement



Inspection pit: IP03 profile



Inspection pit: IP03 profile



Inspection pit: IP03 spoil

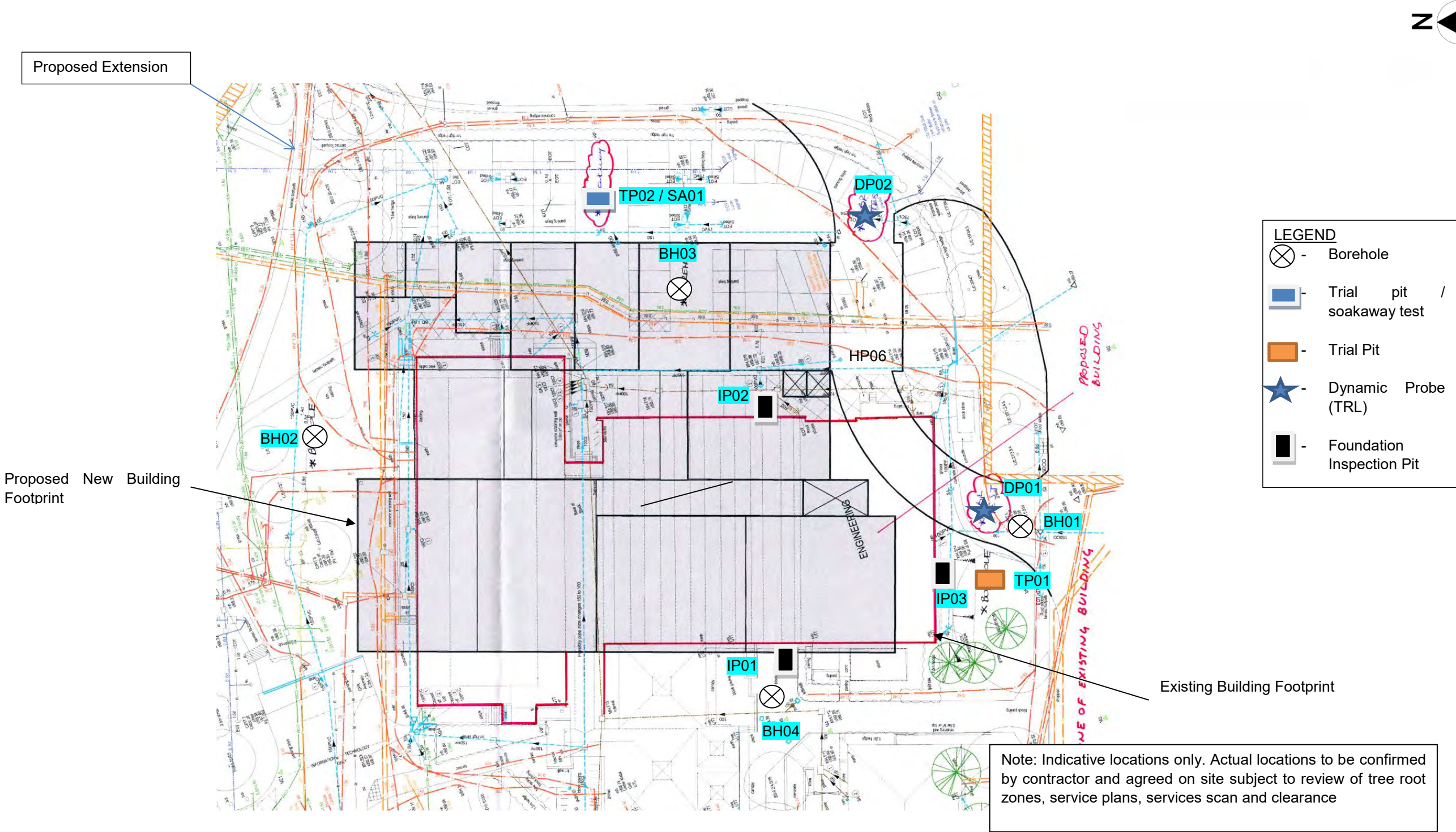


Inspection pit: IP03 reinstatement



APPENDIX B

OUTLINE SCHEME





APPENDIX C

FIELDWORK DATA

KEY TO EXPLORATORY HOLE LOGS



Sample type

D	Small disturbed	U	Undisturbed	X/L	Dynamic	D*/ES	Environmental - soil	Cs	Core subsample (prepared)
B	Bulk disturbed	UT	Undisturbed thin wall	C	Core	EW	Environmental - water	Xs/Ls	Dynamic subsample (prepared)
LB	Large bulk disturbed	P	Piston	W	Water				

Test type

S SPT - Split spoon sampler followed by uncorrected SPT 'N' Value

C SPT - Solid cone followed by uncorrected SPT 'N' Value

(*250 - Where full test drive not completed, linearly extrapolated 'N' value reported, ** - Denotes no effective penetration)

H Hand vane - direct reading in kPa - not corrected for BS1377 (1990). Re* denotes refusal

M Mackintosh probe - number of blows to achieve 100mm penetration

PP Pocket penetrometer - direct reading in kg/sq.cm

Vo Headspace vapour reading, uncorrected peak values in ppm, using a PID (calibrated with Isobutylene, using a 10.6eV bulb)

Sample/core range/l_f

| Dynamic sample

█ Undisturbed sample - open drive including thin wall. Symbol length reflects recovery

x x = Total Core Recovery (TCR) as percentage of core run

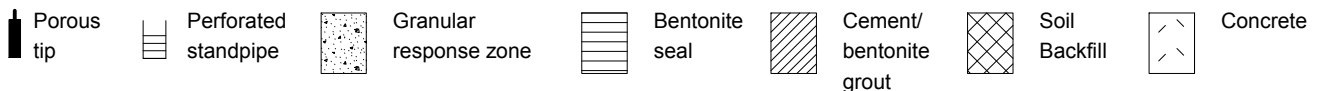
y y = Solid Core Recovery (SCR) as percentage of core run. Assessment of core is based on full diameter.

z z = Rock Quality Designation (RQD). The amount of solid core greater than 100mm expressed as percentage of core run.

Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment.

l_f - fracture spacing - the modal fracture spacing (mm) over the indicated length of core. Where spacing varies significantly, the minimum, mode and maximum values are given. NI = non-intact core NA = not applicable

Instrumentation



Stratum boundaries

----- Estimated boundary -.-.-.-.- Grading boundary

Logging

The logging of soils and rocks has been carried out in general accordance with BS 5930:2015.

Chalk is logged in general accordance with Lord et al (2002) CIRIA C574. Where possible, dynamic samples in chalk have been logged in accordance with CIRIA C574; descriptions and gradings (if presented) should be treated with caution given the potential for sample disturbance.

For rocks the term fracture has been used to identify a mechanical break within the core. Where possible incipient and drilling induced fractures have been excluded from the assessment of fracture state. Where doubt exists, a note has been made in the descriptions. All fractures are considered to be continuous unless otherwise reported.

Made Ground is readily identifiable when, within the material make up, man made constituents are evident. Where Made Ground appears to be reworked natural material the differentiation between in situ natural deposits and Made Ground is much more difficult to ascertain. The interpretation of Made Ground within the logs should therefore be treated with caution.

The descriptors "topsoil" and "tarmacadam" are used as generic terms and do not imply conformation to any particular standard or composition.

Rootlets are defined as being less than 2mm in diameter, roots are defined as in excess of 2mm diameter.

General Comments

The process of drilling and sampling will inevitably lead to disturbance, mixing or loss of material in some soil and rocks.

Indicated water levels are those recorded during the process of drilling or excavating exploratory holes and may not represent standing water levels.

All depths are measured along the axis of the borehole and are related to ground level at the point of entry. All inclinations are measured normal to the axis of the core.

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH01

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 2

Start Date 5 April 2016

Easting 473518.6

Scale 1 : 50

End Date 6 April 2016

Northing 171482.7 Ground level 69.50mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
05/04/16 0800hrs	1B	0.20 - 0.40					Grass over soft to firm dark brown slightly sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse flint. (MADE GROUND)	0.50	69.00	
	1ES	0.20 - 0.40								
	2B	0.50 - 0.70					Firm light brown mottled dark orangish brown slightly sandy gravelly CLAY. Gravel is subangular to rounded fine and medium flint. (HEAD DEPOSITS)	0.90	68.60	
	2ES	0.50 - 0.70								
	3B	1.00 - 1.20								
	4D	1.20 - 1.65	1.20	S 13			Firm light brown mottled dark orangish brown slightly gravelly sandy CLAY. Gravel is subangular and rounded fine and medium flint. (HEAD DEPOSITS)			
	5B	2.00 - 2.20								
		2.20 - 2.65	2.20	C 12				2.40	67.10	
	6B	2.30 - 2.50								
	7D	2.80					Firm light orangish brown mottled light grey slightly gravelly sandy CLAY. Gravel is subangular to rounded fine and medium flint. (HEAD DEPOSITS)			
	8U	2.80 - 3.25	2.80					3.25	66.25	
	9D	3.25 - 3.70	3.20	S 16			Medium dense light brown slightly clayey medium and coarse SAND. (BOYN HILL GRAVEL MEMBER)			
								4.00	65.50	
	10B	4.00 - 4.45	4.00	C 24			Medium dense light brown very sandy subangular and subrounded fine to coarse flint GRAVEL. (BOYN HILL GRAVEL MEMBER)			
		4.00 - 4.20						5.00	64.50	
	11B	5.00 - 5.45	5.00	C 42			Very stiff light brown slightly sandy CLAY. (BOYN HILL GRAVEL MEMBER)			
		5.00 - 5.20						5.80	63.70	
	12B	5.80 - 6.00								
		6.00 - 6.45	6.00	C 36			Dense light brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine and medium flint. (BOYN HILL GRAVEL MEMBER)	6.20	63.30	
	13B	6.20 - 6.40								
	14D	6.50								
	15U	6.50 - 6.85	6.50				Stiff dark brownish grey silty CLAY with rare shell fragments (up to 5mm). (LONDON CLAY FORMATION)			
	16D	6.85								
	17D	6.85 - 7.30	6.50	S 24						
	18D	7.50					7.50m: Burrow.			
							Continued Next Page	{8.00}		

EQUIPMENT: Light cable percussive (shell and auger) rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-18.00m.

CASING: 150mm diam to 7.00m.

BACKFILL: On completion, borehole backfilled with arisings 18.00-8.00m and bentonite pellets 8.00-6.20m. A slotted standpipe (50mm) was installed to 6.20m, granular response zone 6.20-1.00m, bentonite seal 1.00-0.20m, concrete and stopcock cover 0.20- 0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

CONTRACT
31710CHECKED
JL

BOREHOLE LOG



BH01

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 2 of 2

Start Date 5 April 2016

Easting 473518.6

Scale 1 : 50

End Date 6 April 2016

Northing 171482.7 Ground level 69.50mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
05/04/16 1600hrs Dry	19U	8.00 - 8.45	7.00					9.00	60.50	
	20D	8.45								
	21D	8.45 - 8.90	7.00	S 22						
	22D	9.00					Stiff to very stiff dark grey silty CLAY with frequent fine sand sized selenite. (LONDON CLAY FORMATION)			
	23U	9.50 - 9.95	7.00							
	24D	9.95								
	25D	9.95 - 10.40	7.00	S 27						
	26D	10.50								
	27U	11.00 - 11.45	7.00							
	28D	11.45								
06/04/16 0800hrs Dry	29D	11.45 - 11.90	7.00	S 28				15.00	54.50	
	30D	12.00					12.00m: Rare shell fragments (up to 2mm).			
	31U	12.50 - 12.95	7.00							
	32D	12.95					12.95m: Rare mica crystals (up to 5mm).			
	33D	12.95 - 13.40	7.00	S 34			12.95 - 15.00m: Very stiff.			
	34D	13.50								
	35U	14.00 - 14.40	7.00							
	36D	14.40					14.40m: Frequent mica crystals (up to 5mm).			
	37D	14.40 - 14.85	7.00	S 33						
	38D	15.00					Very stiff dark grey silty CLAY with frequent fine and medium gravel sized pockets of light grey fine sand. (LONDON CLAY FORMATION)			
06/04/16 1400hrs Dry	39U	15.50 - 15.95	7.00					18.00	51.50	
	40D	15.95					15.95m: Rare shell fragments (up to 10mm).			
	41D	15.95 - 16.40	7.00	S 48						
	42D	16.50								
	43U	17.00 - 17.45	7.00							
	44D	17.45								
	45D	17.45 - 17.90	7.00	S 39						
Borehole completed at 18.00m.								{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks Groundwater not encountered.										
								CONTRACT 31710		CHECKED JJ



BH02

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 2

Start Date 11 April 2016

Easting 473544.1

Scale 1 : 50

End Date 12 April 2016

Northing 171549.8

Ground level 68.10mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range		instru -ment	description	depth (m)	reduced level (m)	legend	
11/04/16 0800hrs	1B	0.20 - 0.30					✓	Grass over dark brown mottled light brown slightly gravelly clayey medium and coarse SAND. Gravel is angular and subangular fine and medium brick and flint. (MADE GROUND)				
	1ES	0.20 - 0.30										
	2B	0.50 - 0.70										
	2ES	0.50 - 0.70										
	3B	1.00 - 1.20						Very soft light brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine and medium concrete and flint. (MADE GROUND) 1.00m: Subangular concrete cobble.	1.00	67.10		
	3ES	1.00 - 1.20	1.20	C 2								
		1.20 - 1.65										
	4B	2.00 - 2.20						Medium dense light brown slightly clayey very gravelly fine to coarse SAND. Gravel is subangular and subrounded fine to coarse flint. (BOYN HILL GRAVEL MEMBER)	1.90	66.20		
	4ES	2.00 - 2.20	2.20	C 13								
		2.20 - 2.65										
	5B	3.00 - 3.20						Medium dense light orangish brown clayey gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint. (BOYN HILL GRAVEL MEMBER)	2.70	65.40		
		3.20 - 3.65	3.20	C 27								
6B	4.00 - 4.20						Stiff light brown slightly gravelly sandy CLAY. Gravel is subrounded and rounded fine and medium flint. (BOYN HILL GRAVEL MEMBER)	4.30	63.80			
	4.20 - 4.65	4.20	C20									
7B	4.30 - 4.50											
8D	5.00 - 5.45		4.50	S 13			Firm dark brownish grey silty CLAY with frequent fine sand sized selenite crystals. (LONDON CLAY FORMATION)	4.70	63.40			
9D	6.00											
10U	6.50 - 6.95		4.50									
11D	6.95							Stiff dark brownish grey silty CLAY with frequent fine sand sized selenite crystals. (LONDON CLAY FORMATION) 7.50m: Subangular claystone cobble.	6.95	61.15		
12D	6.95 - 7.40	4.50	S 20									
13D	7.50											
								Continued Next Page	{8.00}			

EQUIPMENT: Light cable percussive (shell and auger) rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-18.00m.

CASING: 150mm diam to 4.50m.

BACKFILL: On completion, borehole backfilled with arisings 18.00-6.30m and bentonite pellets 6.30-4.30m. A slotted standpipe (50mm) was installed to 4.30m, granular response zone 4.30-1.00m, bentonite seal 1.00-0.20m, concrete and stopcock cover 0.20- 0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
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Groundwater not encountered



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BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH02

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 2 of 2

Start Date 11 April 2016

Easting 473544.1

Scale 1 : 50

End Date 12 April 2016

Northing 171549.8 Ground level 68.10mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
11/04/16 1615hrs Dry	14U	8.00 - 8.40	4.50				Stiff to very stiff dark brownish grey silty CLAY with rare shell fragments (up to 2mm). (LONDON CLAY FORMATION)	8.40	59.70	
	15D	8.40								
	16D	8.40 - 8.85	4.50	S 29						
	17D	9.00								
	18U	9.50 - 9.90	4.50							
	19D	9.90								
	20D	9.90 - 10.35	4.50	S 30						
	21D	10.50								
	22U	11.00 - 11.40	4.50					11.40	56.70	
	23D	11.40								
12/04/16 0800hrs Dry	24D	11.40 - 11.85	4.50	S 32			Very stiff dark grey silty CLAY with frequent fine sand sized selenite crystals. (LONDON CLAY FORMATION)			
	25D	12.00								
	26U	12.50 - 12.90	4.50							
	27D	12.90								
	28D	12.90 - 13.35	4.50	S 33						
	29D	13.50						13.50	54.60	
	30U	14.00 - 14.40	4.50							
	31D	14.40								
	32D	14.40 - 14.85	4.50	S 34						
	33D	15.00								
12/04/16 1400hrs Dry	34U	15.50 - 15.95	4.50				15.95m: Frequent shell fragments (10mm).			
	34D	15.95								
	35D	15.95 - 16.40	4.50	S 37						
	36D	16.50								
	37U	17.00 - 17.45	4.50							
	38D	17.45								
	39D	17.45 - 17.90	4.50	S 41				18.00	50.10	
							Borehole completed at 18.00m.	{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks							AGS		CONTRACT	CHECKED
Groundwater not encountered.									31710	JL

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH03

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 2

Start Date 31 March 2016 Easting 473549.9

Scale 1 : 50

End Date 4 April 2016 Northing 171504.2 Ground level 68.60mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
31/03/16 1200hrs	1B	0.20 - 0.30					MADE GROUND comprising black TARMACADAM.	0.10	68.50	
	1ES	0.20 - 0.30					Light yellowish brown very gravelly medium and coarse SAND. Gravel is subangular and subrounded fine and medium flint and concrete. (MADE GROUND)	0.50	68.10	
	2B	0.60 - 0.70					MADE GROUND comprising light grey CONCRETE. (MADE GROUND)	0.60	68.00	
	2ES	0.60 - 0.70						1.10	67.50	
	3D	1.20					Dark greenish brown very clayey fine and medium SAND. (MADE GROUND?)			
	4D	1.20 - 1.65	1.20	S 11			Firm becoming stiff dark orangish brown mottled light grey sandy CLAY. (HEAD DEPOSITS)			
	3ES	1.50								
	5B	1.80								
	6UT	2.00 - 2.45	2.00							
	7D	2.40								
	8D	2.40 - 2.85	2.40	S 26				2.75	65.85	
	9B	2.80 - 3.00					Medium dense light orangish brown sandy angular to subrounded fine and medium flint GRAVEL. (BOYN HILL GRAVEL MEMBER)			
		3.00 - 3.45	3.00	C 28						
31/03/16 1600hrs 3.10m										
01/04/16 0800hrs 3.10m	10B	3.80 - 4.00						4.00	64.60	
		4.00 - 4.45	4.00	C 45						
	11B	4.80 - 5.00								
		5.00 - 5.45	5.00	C 46						
	12B	5.80 - 6.00								
		6.00 - 6.45	6.00	C 30				6.30	62.30	
	13D	6.30								
								6.60	62.00	
	14B	6.70 - 7.00					Stiff light brown mottled dark orangish brown slightly sandy CLAY. (LONDON CLAY FORMATION)			
	15UT	7.00 - 7.45	7.00				Stiff dark brownish grey silty CLAY with rare shell fragments (up to 3mm). (LONDON CLAY FORMATION)			
	16D	7.35								
	17D	7.50 - 7.95	7.00	S 21						
							Continued Next Page	{8.00}		

EQUIPMENT: Light cable percussive (shell and auger) rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-18.00m.

CASING: 150mm diam to 7.00m.

BACKFILL: On completion, borehole backfilled with bentonite pellets 18.00-6.30m. A slotted standpipe (50mm) was installed to 6.30m, granular response zone 6.30-1.00m, bentonite seal 1.00-0.20m, concrete and stopcock cover 0.20- 0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
3.50	3.50	3.10	20	


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BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH03

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 2 of 2

Start Date 31 March 2016 Easting 473549.9

Scale 1 : 50

End Date 4 April 2016 Northing 171504.2 Ground level 68.60mOD Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
	18D	8.00					8.00m: Mica crystals (up to 15mm).			
	19UT	8.50 - 8.80	7.00					8.80	59.80	
	20D	8.80								
	21D	9.00 - 9.45	7.00	S 23			Stiff becoming very stiff dark grey silty CLAY with frequent fine sand sized selenite crystals and shell fragments (up to 3mm). (LONDON CLAY FORMATION)			
	22D	9.50								
	23UT	10.00 - 10.45	7.00							
	24D	10.40								
	25D	10.40 - 10.85	7.00	S 34			10.40m: Burrow cast (5mm).			
	26D	11.00								
	27UT	11.50 - 11.95	7.00							
01/04/15 1600hrs Dry	28D	11.95								
	29D	11.95 - 12.40	7.00	S 30						
04/04/16 0800hrs 12.10m	30D	12.50								
	31U	13.00 - 13.45	7.00							
	32D	13.40								
	33D	13.50 - 13.95	7.00	S 34			Very stiff dark grey silty CLAY with frequent fine and medium gravel sized pockets of silty sand. (LONDON CLAY FORMATION)	13.50	55.10	
	34D	14.00								
	35U	14.50 - 14.95	7.00							
	36D	14.90								
	37D	14.90 - 15.35	7.00	S 37			14.90m: Rare shell fragments (up to 3mm).			
	38D	15.50								
	39U	16.00 - 16.45	7.00							
	40D	16.45								
	41D	16.45 - 16.90	7.00	S 36						
	42D	17.00								
04/04/16 1400hrs Dry	43U	17.50 - 17.95	7.00							
	44D	17.95						18.00	50.60	
							Borehole completed at 18.00m.	{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks							AGS	CONTRACT 31710	CHECKED JI	

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH04

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 2

Start Date 6 April 2016

Easting 473501.8

Scale 1 : 50

End Date 8 April 2016

Northing 171510.4 Ground level 69.45mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
06/04/16 1400hrs	1B	0.20 - 0.40					MADE GROUND comprising dark grey BLOCK PAVING.	0.10	69.35	
	1ES	0.20 - 0.40					Light greyish brown slightly clayey sandy angular to subrounded fine to coarse concrete and flint GRAVEL.	0.50	68.95	
	2B	0.50 - 0.70					(MADE GROUND)			
06/04/16 1600hrs Dry	2ES	0.50 - 0.70					Soft to firm light brown mottled dark orangish brown slightly sandy gravelly CLAY. Gravel is subangular and subrounded fine and medium flint. (HEAD DEPOSITS)	0.90	68.55	
	3B	0.90 - 1.10								
	3ES	0.90 - 1.10								
07/04/16 0800hrs Dry		1.20 - 1.65	1.20	C 16			Stiff light orangish brown slightly gravelly sandy CLAY. Gravel is subangular and subrounded fine and medium flint. (HEAD DEPOSITS)			
	4B	2.00 - 2.20								
		2.20 - 2.65	2.20	C 12						
	5B	2.40 - 2.70					Firm light orangish brown mottled light grey sandy CLAY. (HEAD DEPOSITS)	2.40	67.05	
	6U	2.70 - 3.15	2.70							
	7D	3.15								
	8D	3.15 - 3.60	3.00	S 31						
	9B	3.50 - 3.70					Dense light brown slightly clayey very gravelly medium and coarse SAND. Gravel is subangular to rounded fine to coarse flint. (BOYN HILL GRAVEL MEMBER)	3.50	65.95	
	10B	4.00 - 4.20								
		4.20 - 4.65	4.20	C 31						
	11B	4.80 - 5.00					Loose light brown very gravelly fine to coarse SAND. Gravel is subangular and subrounded fine and medium flint. (BOYN HILL GRAVEL MEMBER)	4.70	64.75	
		5.00 - 5.45	5.00	C 8						
	12B	6.00 - 6.20								
	13D	6.20								
	14U	6.50 - 6.95	6.50				Stiff dark brownish grey silty CLAY. (LONDON CLAY FORMATION)	6.20	63.25	
	15D	6.95								
	16D	6.95 - 7.40	6.50	S 22						
	17D	7.50					Stiff dark brownish grey silty CLAY with rare shell fragments (up to 2mm). (LONDON CLAY FORMATION)	7.50	61.95	
							Continued Next Page	{8.00}		

EQUIPMENT: Light cable percussive (shell and auger) rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-18.00m.

CASING: 150mm diam to 7.00m.

BACKFILL: On completion, borehole backfilled with arisings 18.00-7.50m and bentonite pellets 7.50-6.20m. A slotted standpipe (50mm) was installed to 6.20m, granular response zone 6.20-1.00m, bentonite seal 1.00-0.20m, concrete and stopcock cover 0.20- 0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

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BH04

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 2 of 2

Start Date 6 April 2016

Easting 473501.8

Scale 1 : 50

End Date 8 April 2016

Northing 171510.4 Ground level 69.45mOD

Depth 18.00 m

progress date/time	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range		instru- ment	description	depth (m)	reduced level (m)	legend
	18U	8.00 - 8.35	7.00								
	19D	8.35									
	20D	8.50 - 8.95	7.00	S 24							
	21D	9.00							9.00	60.45	
	22U	9.50 - 9.90	7.00								
	23D	9.90									
	24D	9.90 - 10.35	7.00	S 29							
	25D	10.50									
07/04/16 1615hrs Dry	26U	11.00 - 11.35	7.00								
	27D	11.35									
08/04/16 0800hrs Dry	28D	11.50 - 11.95	7.00	S 29				11.50m: Burrow.			
	29D	12.00									
	30UT	12.50 - 12.90	7.00								
	31D	12.90									
	32D	12.90 - 13.35	7.00	S 31				12.90m: Rare shell fragments (up to 2mm). 12.90 - 13.35m: Very stiff.			
	33D	13.50									
	34UT	14.00 - 14.45	7.00								
	35D	14.45									
	36D	14.45 - 14.90	7.00	S 35					14.45	55.00	
	37D	15.00									
	38UT	15.50 - 15.90	7.00								
	39D	15.90									
	40D	15.90 - 16.35	7.00	S 36							
	41D	16.50									
	42UT	17.00 - 17.40	7.00								
	43D	17.40									
08/04/16 1400hrs Dry	44D	17.40 - 17.85	7.00	S 36							
								Borehole completed at 18.00m.	18.00	51.45	
									{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks											
Groundwater not encountered.											
								AGS	CONTRACT	CHECKED	
									31710	Jl	

STANDARD PENETRATION TEST

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole no.	borehole depth (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
					blows	pen (mm)	blows	pen (mm)	pen (mm)	pen (mm)			
BH01	1.20	1.65	1.20	Dry	1 2	75 75	2 3 4 4	75 75 75 75			S	13	81
BH01	2.20	2.65	2.20	Dry	1 2	75 75	3 3 3 3	75 75 75 75			C	12	81
BH01	3.25	3.70	3.20	Dry	1 2	75 75	2 4 5 5	75 75 75 75			S	16	81
BH01	4.00	4.45	4.00	3.60	3 4	75 75	6 6 6 6	75 75 75 75			C	24	81
BH01	5.00	5.45	5.00	4.10	3 4	75 75	8 11 11 12	75 75 75 75			C	42	81
BH01	6.00	6.45	6.00	4.90	4 8	75 75	8 6 12 10	75 75 75 75			C	36	81
BH01	6.85	7.30	6.50	6.60	3 4	75 75	5 5 7 7	75 75 75 75			S	24	81
BH01	8.45	8.90	7.00	Dry	2 3	75 75	4 6 6 6	75 75 75 75			S	22	81
BH01	9.95	10.40	7.00	Dry	3 4	75 75	5 6 8 8	75 75 75 75			S	27	81
BH01	11.45	11.90	7.00	Dry	2 5	75 75	5 6 8 9	75 75 75 75			S	28	81
BH01	12.95	13.40	7.00	Dry	5 6	75 75	6 8 10 10	75 75 75 75			S	34	81
BH01	14.40	14.85	7.00	Dry	5 5	75 75	7 8 8 10	75 75 75 75			S	33	81
BH01	15.95	16.40	7.00	Dry	5 6	75 75	8 8 11 21	75 75 75 75			S	48	81
BH01	17.45	17.90	7.00	Dry	6 7	75 75	8 10 10 11	75 75 75 75			S	39	81
BH02	1.20	1.65	1.20	Dry	1 0	75 75	0 1 1 0	75 75 75 75			C	2	81
BH02	2.20	2.65	2.20	Dry	1 2	75 75	2 3 3 5	75 75 75 75			C	13	81
BH02	3.20	3.65	3.20	Dry	1 2	75 75	4 6 8 9	75 75 75 75			C	27	81
BH02	4.20	4.65	4.20	Dry	3 2	75 75	3 4 6 7	75 75 75 75			C	20	81
BH02	5.00	5.45	4.50	Dry	1 2	75 75	2 3 4 4	75 75 75 75			S	13	81
BH02	6.95	7.40	4.50	Dry	2 3	75 75	4 4 6 6	75 75 75 75			S	20	81
BH02	8.40	8.85	4.50	Dry	4 4	75 75	6 7 8 8	75 75 75 75			S	29	81
BH02	9.90	10.35	4.50	Dry	3 4	75 75	5 6 7 12	75 75 75 75			S	30	81
BH02	11.40	11.85	4.50	Dry	4 5	75 75	6 8 8 10	75 75 75 75			S	32	81
BH02	12.90	13.35	4.50	Dry	5 6	75 75	7 8 8 10	75 75 75 75			S	33	81

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, solid cone C.
4. Where full test drive not completed, linearly extrapolated N value reported.
5. <1 Denotes hammer self weight penetration (sank under own weight).
6. ** Denotes no effective penetration.

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STANDARD PENETRATION TEST

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole no.	borehole depth (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
					blows	pen (mm)	blows	pen (mm)	pen (mm)	pen (mm)			
BH02	14.40	14.85	4.50	Dry	3 5	75 75	6 8 9 11	75 75 75 75			S	34	81
BH02	15.95	16.40	4.50	Dry	5 6	75 75	8 8 10 11	75 75 75 75			S	37	81
BH02	17.45	17.90	4.50	Dry	4 5	75 75	7 11 10 13	75 75 75 75			S	41	81
BH03	1.20	1.65	1.20	Dry	1 2	75 75	2 3 2 4	75 75 75 75			S	11	81
BH03	2.40	2.85	2.40	Dry	1 3	75 75	3 4 6 13	75 75 75 75			S	26	81
BH03	3.00	3.45	3.00	Dry	2 4	75 75	9 7 6 6	75 75 75 75			C	28	81
BH03	4.00	4.45	4.00	3.10	6 6	75 75	9 11 13 12	75 75 75 75			C	45	81
BH03	5.00	5.45	5.00	3.60	4 8	75 75	9 12 15 10	75 75 75 75			C	46	81
BH03	6.00	6.45	6.00	5.30	2 5	75 75	6 7 8 9	75 75 75 75			C	30	81
BH03	7.50	7.95	7.00	6.20	3 4	75 75	4 5 6 6	75 75 75 75			S	21	81
BH03	9.00	9.45	7.00	Dry	3 4	75 75	5 5 6 7	75 75 75 75			S	23	81
BH03	10.40	10.85	7.00	Dry	4 5	75 75	7 8 8 11	75 75 75 75			S	34	81
BH03	11.95	12.40	7.00	Dry	3 4	75 75	6 7 7 10	75 75 75 75			S	30	81
BH03	13.50	13.95	7.00	Dry	5 9	75 75	7 8 9 10	75 75 75 75			S	34	81
BH03	14.90	15.35	7.00	Dry	4 5	75 75	7 9 10 11	75 75 75 75			S	37	81
BH03	16.45	16.90	7.00	Dry	4 6	75 75	7 9 10 10	75 75 75 75			S	36	81
BH04	1.20	1.65	1.20	Dry	2 2	75 75	4 4 4 4	75 75 75 75			C	16	81
BH04	2.20	2.65	2.20	Dry	1 2	75 75	3 3 3 3	75 75 75 75			C	12	81
BH04	3.15	3.60	3.00	Dry	1 4	75 75	4 8 9 10	75 75 75 75			S	31	81
BH04	4.20	4.65	4.20	4.00	3 4	75 75	6 8 8 9	75 75 75 75			C	31	81
BH04	5.00	5.45	5.00	4.60	3 2	75 75	2 2 2 2	75 75 75 75			C	8	81
BH04	6.95	7.40	6.50	Dry	2 3	75 75	4 6 5 7	75 75 75 75			S	22	81
BH04	8.50	8.95	7.00	Dry	3 4	75 75	4 6 7 7	75 75 75 75			S	24	81
BH04	9.90	10.35	7.00	Dry	4 4	75 75	6 7 7 9	75 75 75 75			S	29	81

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, solid cone C.
4. Where full test drive not completed, linearly extrapolated N value reported.
5. <1 Denotes hammer self weight penetration (sank under own weight).
6. ** Denotes no effective penetration.

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borehole no.	borehole depth (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
					blows	pen (mm)	blows		pen (mm)				
BH04	11.50	11.95	7.00	Dry	3 5	75 75	5 8 8 8	75 75 75 75		S	29	81	
BH04	12.90	13.35	7.00	Dry	4 4	75 75	6 7 9 9	75 75 75 75		S	31	81	
BH04	14.45	14.90	7.00	Dry	4 5	75 75	7 8 9 11	75 75 75 75		S	35	81	
BH04	15.90	16.35	7.00	Dry	5 7	75 75	7 8 10 11	75 75 75 75		S	36	81	
BH04	17.40	17.85	7.00	Dry	4 6	75 75	7 8 10 11	75 75 75 75		S	36	81	

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, solid cone C.
4. Where full test drive not completed, linearly extrapolated N value reported.
5. <1 Denotes hammer self weight penetration (sank under own weight).
6. ** Denotes no effective penetration.

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TRIAL PIT LOG



TP02

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473558.7

Scale 1 : 25

End Date 4 April 2016

Northing 171510.2 Ground level 68.50mOD

Depth 2.70 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
1.10m: seepage	1B		0.20	MADE GROUND comprising black TARMACADAM.	0.10	68.40	
	1ES		0.20	Light yellowish brown sandy subangular to rounded fine to coarse flint, brick and concrete GRAVEL. (MADE GROUND)	0.35	68.15	
				Dark greenish grey slightly clayey gravelly coarse SAND with a medium subangular brick cobble content. Gravel is angular and subangular fine to coarse brick and flint. (MADE GROUND)			
	2B		0.80				
	2ES		0.80		1.10	67.40	
				Firm to stiff light orangish brown mottled light grey sandy CLAY. (HEAD DEPOSITS)			
	3B	H 92	1.50				
			1.60				
	3ES		1.60		2.10	66.40	
	4B		2.50	Light orangish brown sandy subangular to rounded fine and medium flint GRAVEL. (BOYN HILL GRAVEL MEMBER)			
Damp	4ES		2.50		2.70	65.80	
				Trial pit completed at 2.70m.			

Notes

Trial pit excavated by JCB 3CX mechanical excavator.
Groundwater seepage encountered at 1.10m.
Trial pit sides remained stable and vertical.
Trial pit dimensions 0.70x1.50x2.70m.
On completion, the trial pit was backfilled with materials arising.

Sketch of Foundation - Not to scale. All dimensions in metres.



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EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

Geotechnical Engineering Limited
SOAKAWAY TEST



CLIENT KNOWLES & SON (OXFORD) LTD
 SITE UNIVERSITY OF READING HEALTH AND LIFE SCIENCES BUILDING TRIAL PIT **TP02**
 DATE 04/04/2016

TEST 1 LENGTH 1.50 m BREADTH 0.70 m DEPTH 2.70 m WATER LEVEL Dry m FILL LEVEL 1.68 m V_{p75-25} 0.536 m³ a_{p50} 3.294 m² t_{p75-25} min soil infiltration rate, f ms⁻¹ Insufficient water take to calculate infiltration rate	Time (minutes)
TEST 2 LENGTH m BREADTH m DEPTH m WATER LEVEL m FILL LEVEL m V_{p75-25} m³ a_{p50} m² t_{p75-25} min soil infiltration rate, f ms⁻¹	Time (minutes)
TEST 3 LENGTH m BREADTH m DEPTH m WATER LEVEL m FILL LEVEL m V_{p75-25} m³ a_{p50} m² t_{p75-25} min soil infiltration rate, f ms⁻¹	Time (minutes)
Remarks Test carried out in accordance with BRE 365 (2007).	
CONTRACT CHECKED 31710 JI	

TRIAL PIT LOG



TP03

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473477.7

Scale 1 : 25

End Date 4 April 2016

Northing 171610.6 Ground level 69.15mOD

Depth 2.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry	1B		0.20	Grass over soft dark brown slightly gravelly sandy CLAY. Gravel is subangular and subrounded fine to coarse flint. (MADE GROUND)	0.30	68.85	
	1ES		0.20				
				Soft light brown mottled dark orangish brown sandy CLAY. (MADE GROUND)	1.10	68.05	
	2B		0.70				
	2ES		0.70				
		H 28	0.80	Light grey slightly silty fine to coarse SAND. (MADE GROUND)	1.70	67.45	
	3B		1.30				
	3ES		1.30				
	4B	H 61	1.80	Firm light orangish brown mottled light grey sandy CLAY. (HEAD DEPOSITS)	2.00	67.15	
	4ES		1.80				
				Trial pit completed at 2.00m.			

Notes

Trial pit excavated by JCB 3CX mechanical excavator.
Groundwater not encountered.
Trial pit sides remained stable and vertical.
Trial pit dimensions 0.60x1.60x2.00m.
On completion, the trial pit was backfilled with materials arising.

Sketch of Foundation - Not to scale. All dimensions in metres.



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EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

Geotechnical Engineering Limited

IN-SITU HAND VANE/POCKET PENETROMETER



CLIENT KNOWLES & SON (OXFORD) LIMITED

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borehole /trial pit no.	depth (m)	hand vane peak (kPa)	average hand vane peak (kPa)	hand vane remoulded (kPa)	average hand vane remoulded (kPa)	pocket penetrometer (kg/cm ²)	average pocket penetrometer (kPa)*	remarks
TP02	1.50	100 68 108	92	49 45 52	49			
TP03	0.80	30 28 25	28	12 12 10	11			
TP03	1.80	66 57 60	61	42 40 26	36			
general remarks:								
Hand vane test results reported as undrained shear strength. *Average pocket penetrometer results reported as undrained shear strength.							CONTRACT 31710	CHECKED JI

TRIAL PIT LOG



IP01

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473506.9

Scale 1 : 25

End Date 4 April 2016

Northing 171508.7 Ground level 69.50mOD

Depth 1.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry	1B		0.20	Soft dark brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. (MADE GROUND)	0.40	69.10	
	1ES		0.20				
	2B		0.60	Dark greenish grey slightly gravelly clayey fine and medium SAND. Gravel is angular and subangular fine and medium flint. (MADE GROUND)	0.90	68.60	
	2ES		0.60				
	3B		0.90- 1.00	Firm to stiff light orangish brown mottled light brown slightly sandy slightly gravelly CLAY. Gravel subangular and subrounded fine and medium flint. (HEAD DEPOSITS)	1.00	68.50	
	3ES		0.90- 1.00				
Trial pit completed at 1.00m.							

Notes

Trial pit excavated by hand.
Groundwater was not encountered.
Trial pit sides remained stable.
On completion, the trial pit was backfilled and the surface reinstated.

Sketch of Foundation - Not to scale. All dimensions in metres.



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TRIAL PIT DETAIL

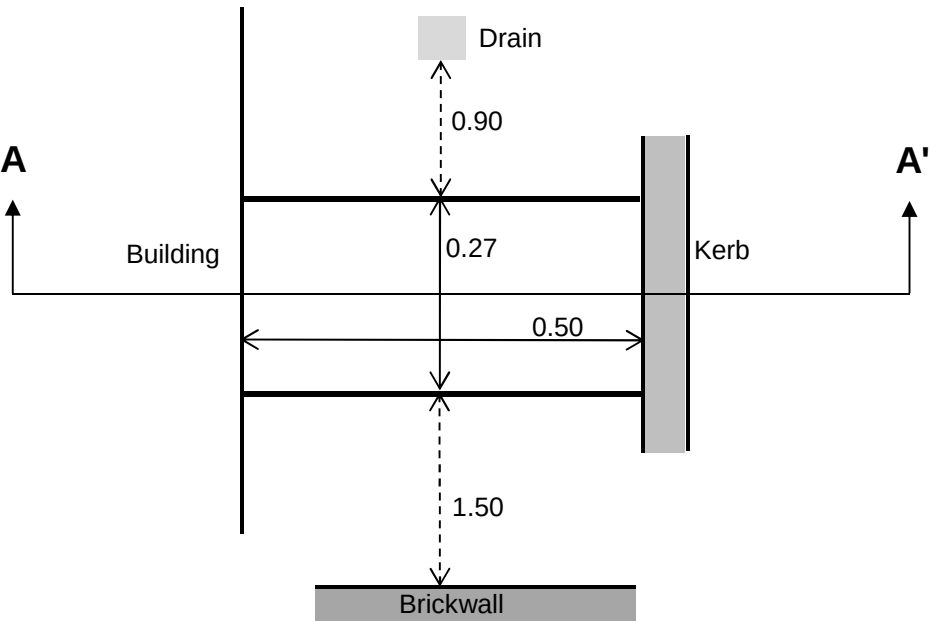
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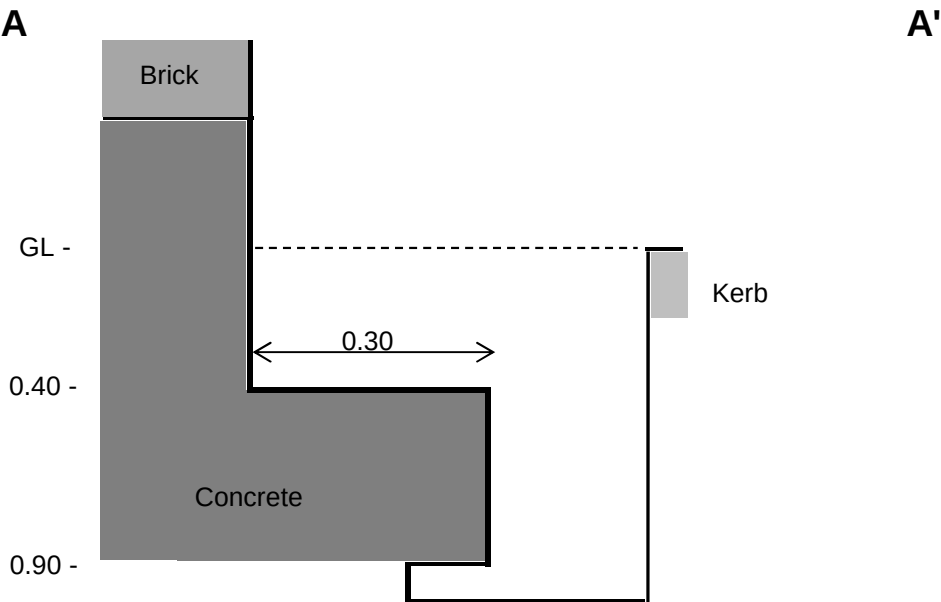


IP01

Plan View



Section A - A'



All measurements in metres.
Not to scale.

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TRIAL PIT LOG



IP02

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SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473532.0

Scale 1 : 25

End Date 4 April 2016

Northing 171500.8 Ground level 68.95mOD

Depth 1.25 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry	1B		0.20	MADE GROUND comprising black TARMACADAM.	0.10	68.85	
	1ES		0.20	Light yellowish brown sandy subangular to rounded fine to coarse flint brick and concrete GRAVEL. (MADE GROUND)	0.35	68.60	
	2B		0.50	Dark greenish grey slightly clayey gravelly coarse SAND with a medium subangular brick cobble content. Gravel is angular and subangular fine to coarse brick and flint. (MADE GROUND)	0.80	68.15	
	2ES		0.50				
				Soft to firm light brown sandy CLAY. (HEAD DEPOSITS)			
	3B		1.00				
	3ES		1.00		1.25	67.70	
				Trial pit completed at 1.25m.			

Notes

Trial pit excavated by hand.
Groundwater was not encountered.
Trial pit sides remained stable.
On completion, the trial pit was backfilled and the surface reinstated.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT

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EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

TRIAL PIT DETAIL

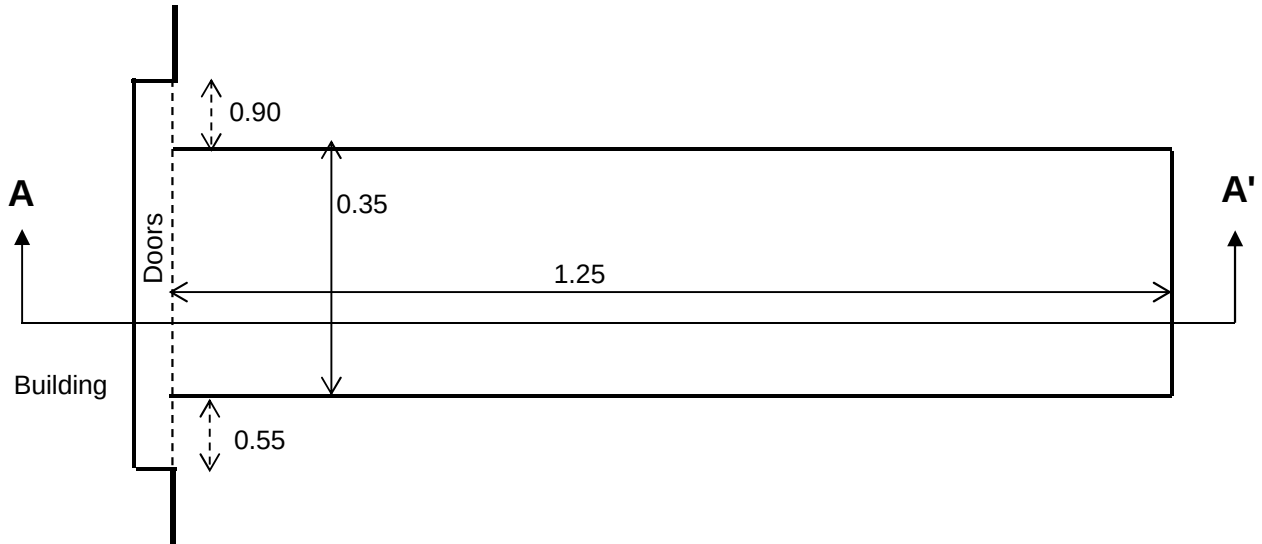
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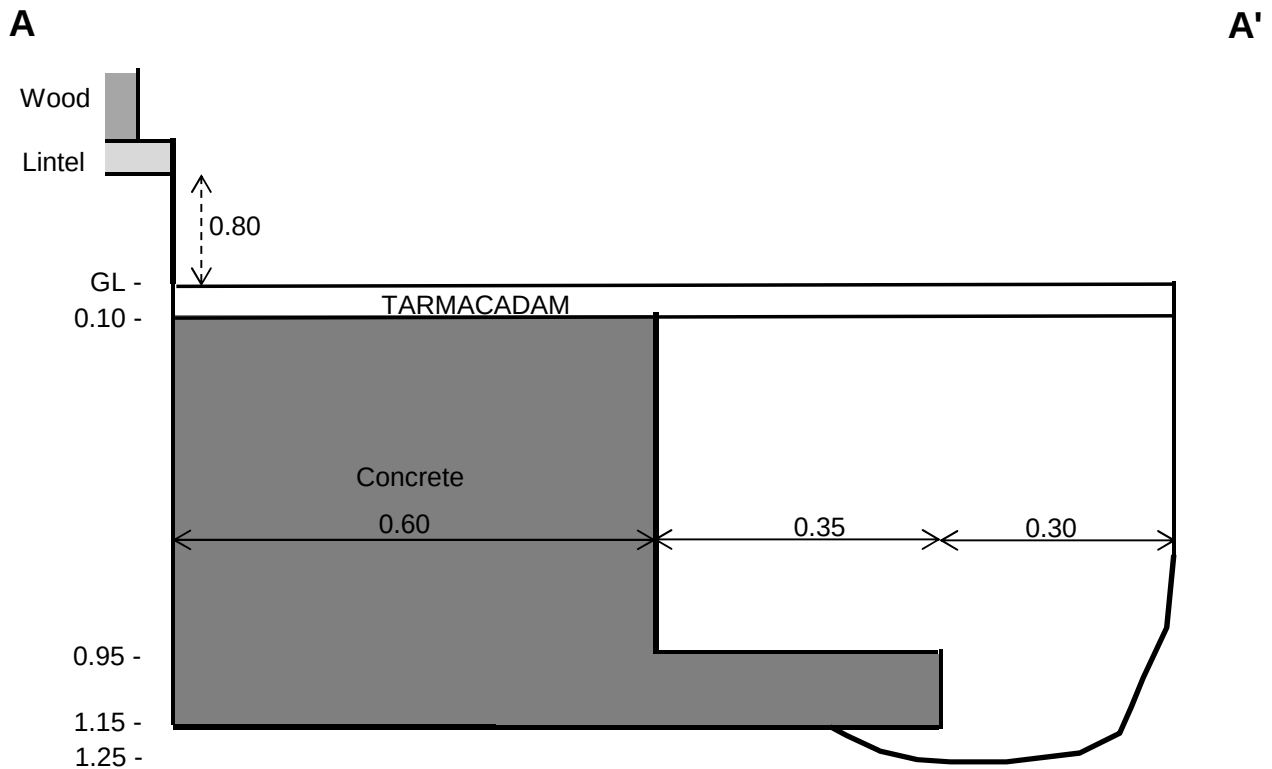


IP02

Plan View



Section A - A'



All measurements in metres.
Not to scale.

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TRIAL PIT LOG**IP03**

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SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473511.6

Scale 1 : 25

End Date 4 April 2016

Northing 171488.1 Ground level 69.55mOD

Depth 0.60 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry	1B		0.20	Grass over dark brown slightly clayey slightly gravelly fine SAND. Gravel is subangular to rounded fine and medium flint. Frequent rootlets. (MADE GROUND)	0.30	69.25	
	1ES		0.20				
	2B		0.50	Firm to stiff light orangish brown mottled light brown slightly gravelly sandy CLAY. Gravel is subangular to rounded fine and medium flint. (HEAD DEPOSITS)	0.60	68.95	
	2ES		0.50				
				Trial pit completed at 0.60m.			

Notes

Trial pit excavated by hand.
Groundwater was not encountered.
Trial pit sides remained stable.
On completion, the trial pit was backfilled and the surface reinstated.

Sketch of Foundation - Not to scale. All dimensions in metres.



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EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

TRIAL PIT DETAIL

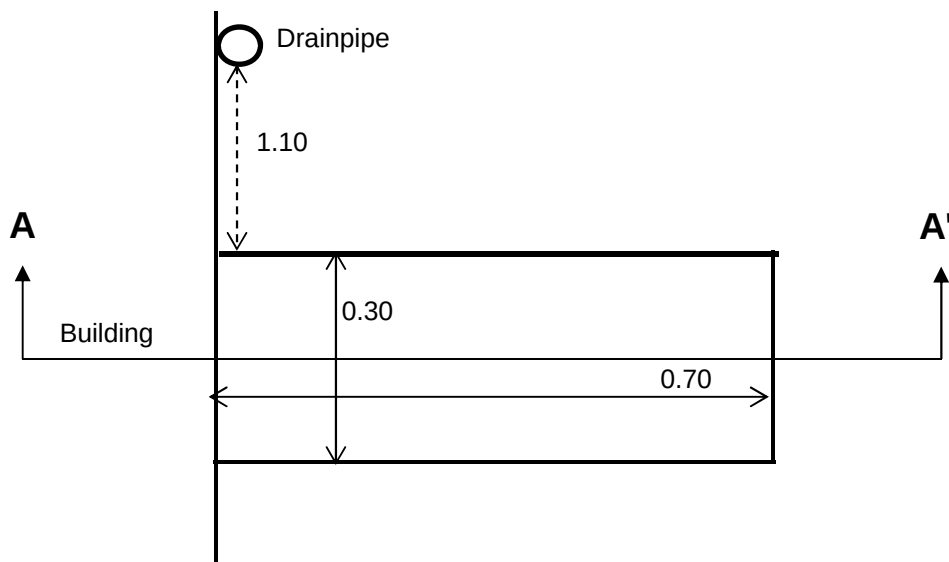
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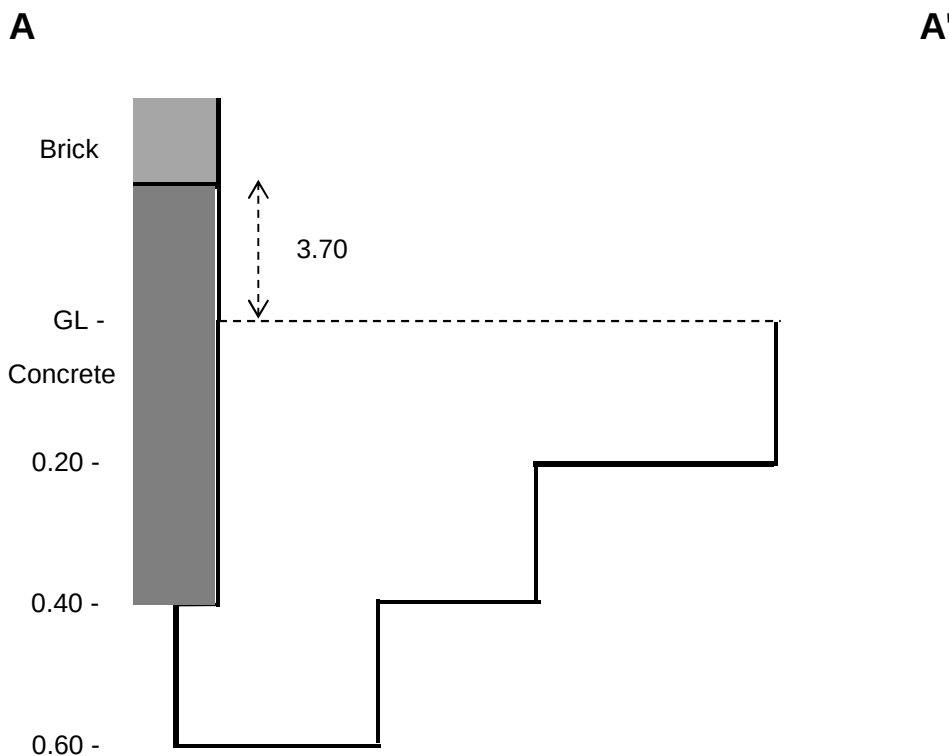


IP03

Plan View



Section A - A'



All measurements in metres.
Not to scale.

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DYNAMIC CONE PENETROMETER TESTING

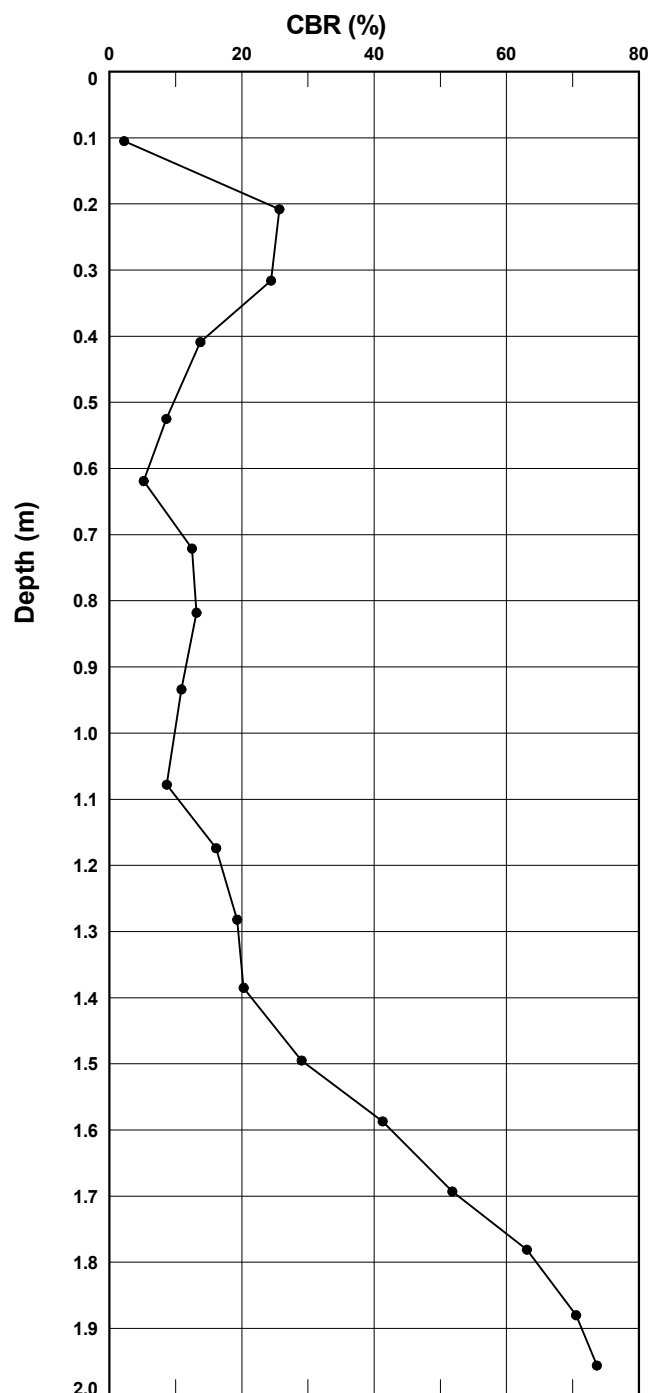


CLIENT	KNOWLES & SON (OXFORD) LIMITED
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING
DATE	31 March 2016

DCP01

Initial scale reading (mm) 0 Datum bgl (mm) 0

Easting	473521.0
Northing	171481.8
Ground level	69.35mOD

[illegible]

Remarks:

Test carried out in accordance with operating instructions for the dynamic cone penetrometer Model A2465 by CNS Farnell Ltd.
CBR correlation based on the relationship $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 * \text{Log}_{10}(\text{mm/blow})$ developed by TRL taken from The Highways Agency Interim Advice Note 73/06 - Design Guidance for Road Pavement Foundations (2009)

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DYNAMIC CONE PENETROMETER TESTING



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES

BUILDING

DATE 1 April 2016

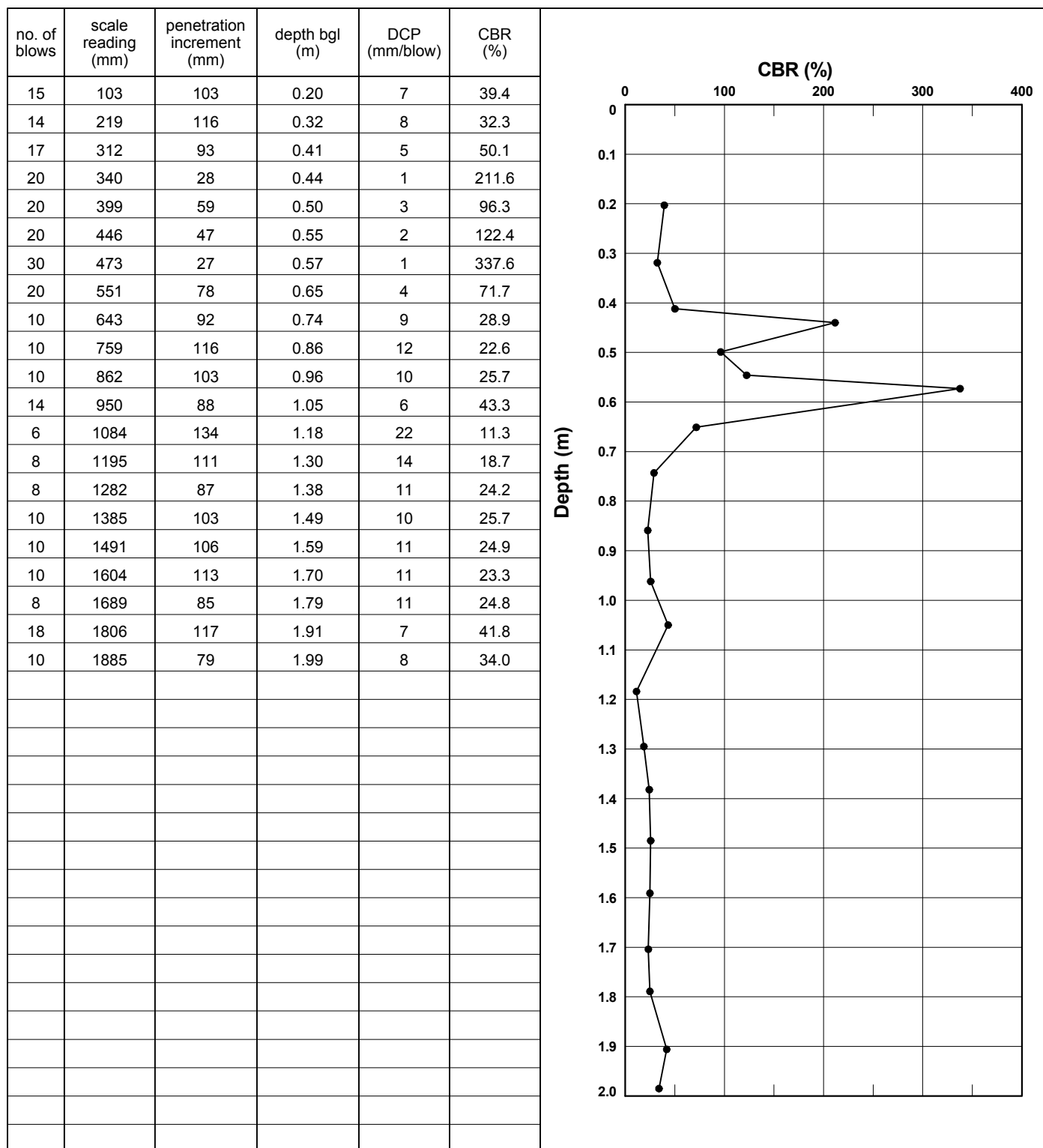
DCP02

Easting 473543.7

Northing 171479.5

Ground level 69.00mOD

Initial scale reading (mm) 0 Datum bgl (mm) 100



Remarks:

Test carried out in accordance with operating instructions for the dynamic cone penetrometer Model A2465 by

CNS Farnell Ltd.

CBR correlation based on the relationship $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 * \text{Log}_{10}(\text{mm/blow})$ developed by TRL taken from The Highways Agency Interim Advice Note 73/06 - Design Guidance for Road Pavement Foundations (2009)

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APPENDIX D

GAS MONITORING

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole / trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH01	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH01	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH01	18/04/16 09:50:00	1017	-0.52								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH01	18/04/16 09:51:00										0.0			
BH01	18/04/16 09:52:00										0.0			
BH01	18/04/16 09:53:00										0.0			
BH01	18/04/16 09:54:00										0.0			
BH01	18/04/16 09:55:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:56:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:57:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:58:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:59:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 10:00:00			3.4	0.0	13.0	0.0	0	0	1.7				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	18/04/16 10:01:00			3.3	0.0	13.0	0.0	0	0	1.7				
BH01	18/04/16 10:02:00			3.2	0.0	13.0	0.0	0	1	1.7				
BH01	18/04/16 10:03:00			3.1	0.0	13.0	0.0	0	1	1.6				
BH01	18/04/16 10:04:00			3.1	0.0	13.1	0.0	0	1	1.5				
BH01	18/04/16 10:05:00												3.91	
BH01	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH01	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	25/04/16 10:00:00	1003	0.38								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	25/04/16 10:01:00										0.0			
BH01	25/04/16 10:02:00										0.0			
BH01	25/04/16 10:03:00										0.0			
BH01	25/04/16 10:04:00										0.0			
BH01	25/04/16 10:05:00			2.8	0.1	11.2	2.0	0	0	1.8				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	25/04/16 10:06:00			2.8	0.1	11.1	2.0	0	0	1.8				
BH01	25/04/16 10:07:00			2.9	0.1	11.0	2.0	0	0	1.8				
BH01	25/04/16 10:08:00			2.9	0.1	11.0	2.0	0	0	1.8				
BH01	25/04/16 10:09:00			3.2	0.1	10.7	2.0	0	0	1.8				
BH01	25/04/16 10:10:00			3.5	0.1	10.5	2.0	0	0	1.8				
BH01	25/04/16 10:11:00			3.7	0.1	10.3	2.0	0	0	1.8				
BH01	25/04/16 10:12:00			3.9	0.1	10.1	2.0	0	0	1.8				
BH01	25/04/16 10:13:00			4.0	0.1	10.0	2.0	0	0	1.8				
BH01	25/04/16 10:14:00			4.1	0.1	9.9	2.0	0	0	1.8				
BH01	25/04/16 10:15:00												3.50	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH02	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH02	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH02	18/04/16 11:30:00	1010	-0.51								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH02	18/04/16 11:31:00										0.0			
BH02	18/04/16 11:32:00										0.0			
BH02	18/04/16 11:33:00										0.0			
BH02	18/04/16 11:34:00										0.0			
BH02	18/04/16 11:35:00			4.3	0.0	11.9	0.0	0	1	1.4				
BH02	18/04/16 11:36:00			4.3	0.0	11.8	0.0	0	0	1.4				
BH02	18/04/16 11:37:00			4.6	0.0	11.6	0.0	0	0	1.3				
BH02	18/04/16 11:38:00			4.8	0.0	11.4	0.0	0	0	1.3				
BH02	18/04/16 11:39:00			5.0	0.0	11.3	0.0	0	0	0.2				
BH02	18/04/16 11:40:00			5.1	0.0	11.2	0.0	0	0	1.1				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	18/04/16 11:41:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:42:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:43:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:44:00			5.0	0.0	11.3	0.0	0	0	1.1				
BH02	18/04/16 11:45:00												3.22	
BH02	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH02	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	25/04/16 11:00:00	1003	0.33								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	25/04/16 11:01:00										0.0			
BH02	25/04/16 11:02:00										0.0			
BH02	25/04/16 11:03:00										0.0			
BH02	25/04/16 11:04:00										0.0			
BH02	25/04/16 11:05:00			2.2	0.0	17.7	0.0	0	0	0.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	25/04/16 11:06:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:07:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:08:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:09:00			2.2	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:10:00			2.1	0.0	17.9	0.0	0	0	0.6				
BH02	25/04/16 11:11:00			2.1	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:12:00			2.1	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:13:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:14:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:15:00												3.82	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH03	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH03	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH03	18/04/16 09:00:00	1019	-0.81								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH03	18/04/16 09:01:00										0.0			
BH03	18/04/16 09:02:00										0.0			
BH03	18/04/16 09:03:00										0.0			
BH03	18/04/16 09:04:00										0.0			
BH03	18/04/16 09:05:00			0.2	0.0	19.8	0.0	0	0	0.9				
BH03	18/04/16 09:06:00			0.2	0.0	19.9	0.0	0	0	0.8				
BH03	18/04/16 09:07:00			0.3	0.0	19.7	0.0	0	0	0.8				
BH03	18/04/16 09:08:00			0.3	0.0	19.5	0.0	0	0	0.8				
BH03	18/04/16 09:09:00			0.4	0.0	19.2	1.0	0	0	0.8				
BH03	18/04/16 09:10:00			0.5	0.0	18.7	1.0	0	0	0.9				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	18/04/16 09:11:00			0.7	0.1	18.2	1.0	0	0	0.9				
BH03	18/04/16 09:12:00			0.9	0.1	17.9	1.0	0	1	0.9				
BH03	18/04/16 09:13:00			0.9	0.1	17.9	1.0	0	1	0.9				
BH03	18/04/16 09:14:00			0.9	0.1	18.0	1.0	0	1	0.9				
BH03	18/04/16 09:15:00												3.52	
BH03	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH03	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	25/04/16 10:00:00	1004									0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	25/04/16 10:01:00										0.0			
BH03	25/04/16 10:02:00										0.0			
BH03	25/04/16 10:03:00										0.0			
BH03	25/04/16 10:04:00										0.0			
BH03	25/04/16 10:05:00			3.4	0.0	16.1	0.0	0	0	0.8				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

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SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks	
BH03	25/04/16 10:06:00			3.8	0.1	15.6	1.0	0	0	0.8					
BH03	25/04/16 10:07:00			4.3	0.1	15.0	1.0	0	0	0.7					
BH03	25/04/16 10:08:00			5.0	0.1	14.2	1.0	0	0	0.6					
BH03	25/04/16 10:09:00			5.2	0.1	14.0	1.0	0	0	0.5					
BH03	25/04/16 10:10:00			5.0	0.1	14.3	1.0	0	0	0.5					
BH03	25/04/16 10:11:00			5.0	0.1	14.3	1.0	0	0	0.5					
BH03	25/04/16 10:12:00			4.7	0.1	14.6	1.0	0	0	0.5					
BH03	25/04/16 10:13:00			4.7	0.1	14.7	1.0	0	0	0.5					
BH03	25/04/16 10:14:00			4.7	0.1	14.8	1.0	0	0	0.5					
BH03	25/04/16 10:15:00												3.25		
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 31710	CHECKED JI

GAS AND GROUNDWATER LEVELS

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH04	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH04	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH04	18/04/16 10:20:00	1016	-0.29								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH04	18/04/16 10:21:00										0.0			
BH04	18/04/16 10:22:00										0.0			
BH04	18/04/16 10:23:00										0.0			
BH04	18/04/16 10:24:00										0.0			
BH04	18/04/16 10:25:00			1.3	0.0	18.4	0.0	0	1	0.7				
BH04	18/04/16 10:26:00			1.3	0.0	18.5	0.0	0	0	0.7				
BH04	18/04/16 10:27:00			1.3	0.0	18.4	0.0	0	1	0.7				
BH04	18/04/16 10:28:00			1.1	0.0	18.7	0.0	0	0	0.6				
BH04	18/04/16 10:29:00			1.1	0.0	18.8	0.0	0	0	0.6				
BH04	18/04/16 10:30:00			1.3	0.0	18.6	0.0	0	0	0.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	18/04/16 10:31:00			1.4	0.0	18.4	0.0	0	0	0.6				
BH04	18/04/16 10:32:00			1.4	0.0	18.5	0.0	0	0	0.6				
BH04	18/04/16 10:33:00			1.6	0.0	18.2	0.0	0	0	0.6				
BH04	18/04/16 10:34:00			1.7	0.0	18.1	0.0	0	0	0.6				
BH04	18/04/16 10:35:00												3.83	
BH04	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH04	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	25/04/16 10:40:00	1003	0.68								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	25/04/16 10:41:00										0.0			
BH04	25/04/16 10:42:00										0.0			
BH04	25/04/16 10:43:00										0.0			
BH04	25/04/16 10:44:00										0.0			
BH04	25/04/16 10:45:00			2.6	0.0	16.1	0.0	0	1	1.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	25/04/16 10:46:00			2.7	0.0	16.0	0.0	0	0	1.7				
BH04	25/04/16 10:47:00			2.7	0.0	15.9	0.0	0	0	1.7				
BH04	25/04/16 10:48:00			2.8	0.0	15.8	0.0	0	0	1.6				
BH04	25/04/16 10:49:00			2.9	0.0	15.7	0.0	0	0	1.6				
BH04	25/04/16 10:50:00			3.0	0.0	15.6	0.0	0	0	1.5				
BH04	25/04/16 10:51:00			3.0	0.0	15.5	0.0	0	0	1.4				
BH04	25/04/16 10:52:00			3.0	0.0	15.5	0.0	0	0	1.4				
BH04	25/04/16 10:53:00			3.0	0.0	15.6	0.0	0	0	1.4				
BH04	25/04/16 10:54:00			3.0	0.0	15.6	0.0	0	0	1.4				
BH04	25/04/16 10:55:00												3.91	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl



APPENDIX E

LABORATORY TESTING



2718

GEOTECHNICAL ENGINEERING LIMITED



For the attention of Jon Ind

Version No. 1

Page No. 1 of 29

Date of Issue 23/05/2016

TEST REPORT

PROJECT/SITE	University of Reading - Health and Life Sciences Building	Samples received	14/04/2016
GEL REPORT NUMBER	31710	Schedule received	14/04/2016
Your ref/PO:	0	Testing commenced	19/04/2016
Test report refers to	Schedule 1	Status	Final

SUMMARY OF RESULTS ATTACHED

TEST METHOD & DESCRIPTION	QUANTITY	ACCREDITED TEST
BS EN ISO 17892-1: 2014:5. Water Content	16	YES
BS1377: Part 2: 1990:4.2-4.4&5.2-5.4, Liquid & Plastic Limits	16	YES
BS1377: Part 2: 1990:9.2, Particle Size Distribution - Wet Sieve	5	YES
BS1377: Part 2: 1990:9.4, Particle Size Distribution - Pipette	2	YES
BS1377: Part 4: 1990:7, California Bearing Ratio (CBR)	1	YES
BS1377: Part 7: 1990:8&9, Undrained Triaxial Compression	15	NO
BS1377: Part 8: 1990: Effective Stress Testing	2	NO
Hand vane (non BS1377)	15	NO
BRE SD1 Reduced Suite: pH, Sulphate - water and acid soluble, sulphur (subcontracted)	10	YES

Remarks This report may not be partially reproduced without written permission from this laboratory.	Approved Signatories: S Robinson (Client Manager) C Andrew (Client Manager) W Jones (Technical Support) J Hanson (Director) N Parry (Director) 
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Doc TR01

Rev No. 14

Revision date 23/10/15

DC:JH

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LIQUID AND PLASTIC LIMITS**BS.1377 : Part 2 : 1990 : 4 and 5**

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borehole /trial pit no.	sample		specimen depth (m)	natural water content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
	no./type	depth (m)								
BH01	2B	0.50	0.50	14.4	BXE	40	47	17	30	Brown mottled reddish brown slightly sandy gravelly CLAY
BH01	3B	1.00	1.00	17.0	BXE	19	44	16	28	Reddish brown mottled light grey slightly sandy slightly gravelly CLAY
BH01	5B	2.00	2.00	21.3	BXE	26	42	15	27	Reddish brown slightly sandy slightly gravelly CLAY
BH01	7D	2.80	2.80	26.5	AXE	0	42	17	25	Brown slightly sandy CLAY
BH01	11B	5.00	5.00	29.2	BXE	6	67	28	39	Brown slightly sandy slightly gravelly CLAY
BH01	18D	7.50	7.50	25.9	AXE	0	64	23	41	Grey slightly sandy CLAY
BH02	7B	4.30	4.30	25.9	BXE	18	66	27	39	Brown slightly sandy slightly gravelly CLAY
BH02	9D	6.00	6.00	28.3	AXE	0	62	22	40	Grey slightly sandy CLAY
BH03	5B	1.80	1.80	19.3	BXE	11	42	16	26	Orangish brown mottled greyish brown slightly sandy slightly gravelly CLAY
BH03	16D	7.35	7.35	25.8	AXE	0	64	25	39	Grey slightly sandy CLAY
BH03	27UT	11.50	11.75	25.2	AXE	0	68	26	42	Dark grey slightly sandy CLAY
BH03	40D	16.45	16.45	22.2	BXE	1	56	21	35	Dark grey slightly sandy CLAY with rare shell fragments
BH04	3B	0.90	0.90	12.7	BXE	50	39	16	23	Orangish brown slightly sandy gravelly CLAY
BH04	4B	2.00	2.00	23.7	BXE	22	44	15	29	Orangish brown slightly sandy slightly gravelly CLAY
BH04	7D	3.15	3.15	25.4	AXE	0	59	23	36	Orangish brown mottled grey slightly sandy CLAY
TP03	4B	1.80	1.80	22.3	BXE	12	49	15	34	Brown and grey mottled reddish brown slightly sandy slightly gravelly CLAY

general remarks:

natural water content determined in accordance with BS EN ISO 17892 - 1 : 2014

NP denotes non-plastic

denotes sample tested is smaller than that which is recommended in accordance with BS1377 or BS EN ISO 17892

specimen preparation:

A - as received

B - washed on 0.425mm sieve

C - air dried

D - oven dried (60°C)

E - oven dried (105°C)

F - not known

test method:

X - cone penetrometer (test 4.3)

Y - one point cone penetrometer (test 4.4)

Z - Casagrande apparatus (test 4.5)

CONTRACT

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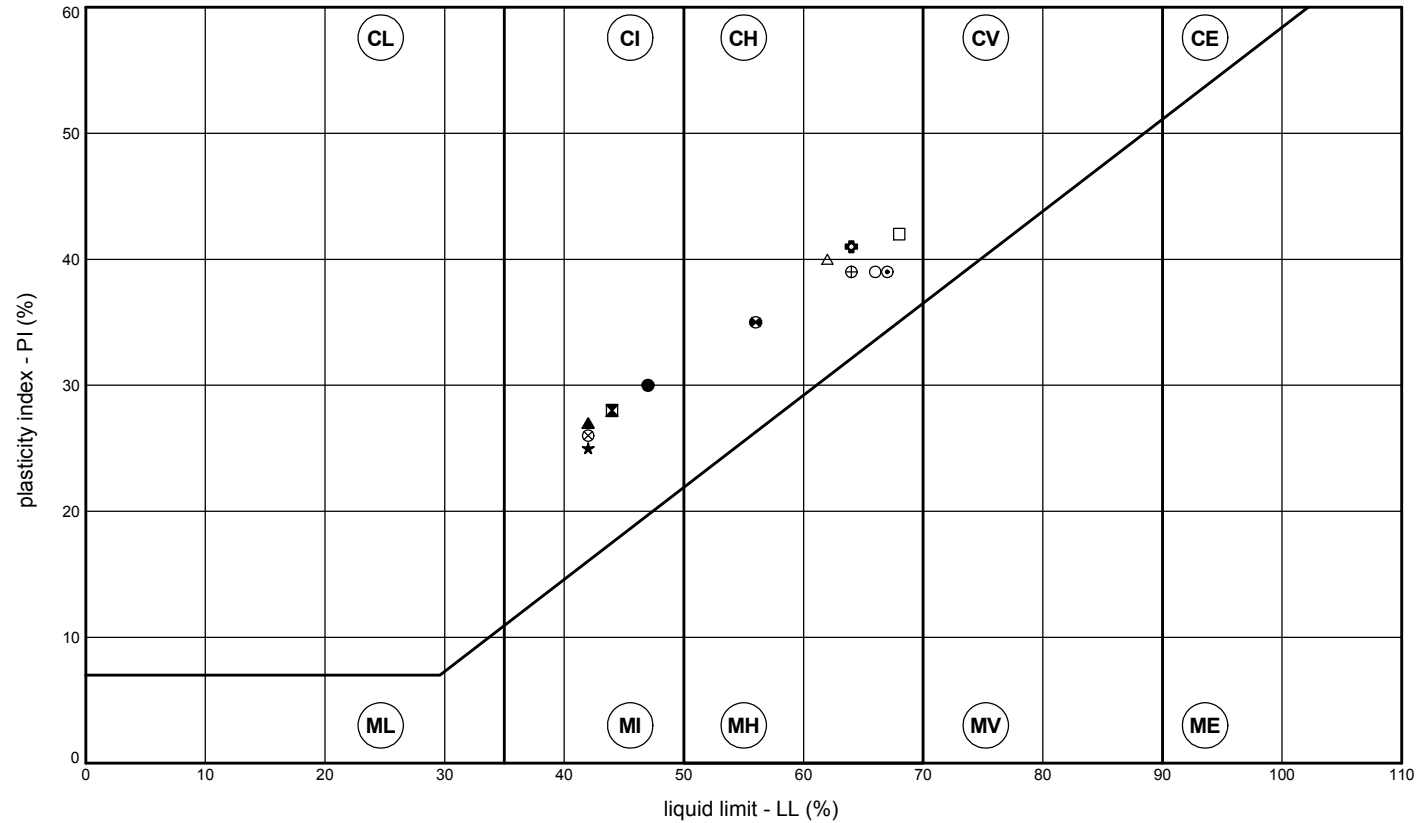
ATTERBERG LINE PLOT



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	BH/TP No.	depth (m)	LL	PL	PI	remarks
●	BH01	0.50	47	17	30	
⊠	BH01	1.00	44	16	28	
▲	BH01	2.00	42	15	27	
★	BH01	2.80	42	17	25	
⊙	BH01	5.00	67	28	39	
⊕	BH01	7.50	64	23	41	
○	BH02	4.30	66	27	39	
△	BH02	6.00	62	22	40	
⊗	BH03	1.80	42	16	26	
⊕	BH03	7.35	64	25	39	
□	BH03	11.75	68	26	42	
⊗	BH03	16.45	56	21	35	

CONTRACT	CHECKED
31710	CA

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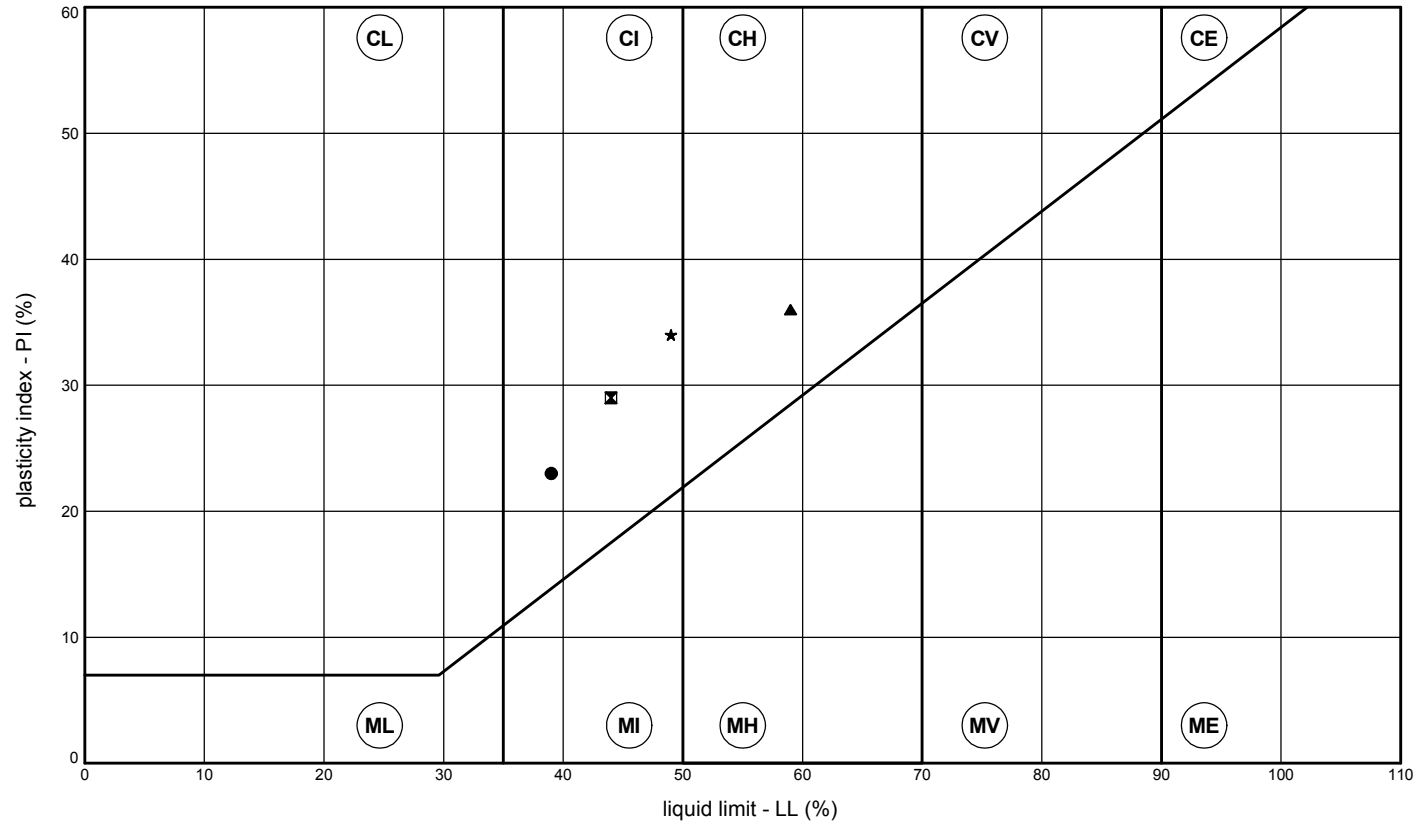
ATTERBERG LINE PLOT



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SITE UNIVERSITY OF READING - HEALTH AND LIFE

 SCIENCES BUILDING



	BH/TP No.	depth (m)	LL	PL	PI	remarks
●	BH04	0.90	39	16	23	
⊠	BH04	2.00	44	15	29	
▲	BH04	3.15	59	23	36	
★	TP03	1.80	49	15	34	

CONTRACT	CHECKED
31710	CA

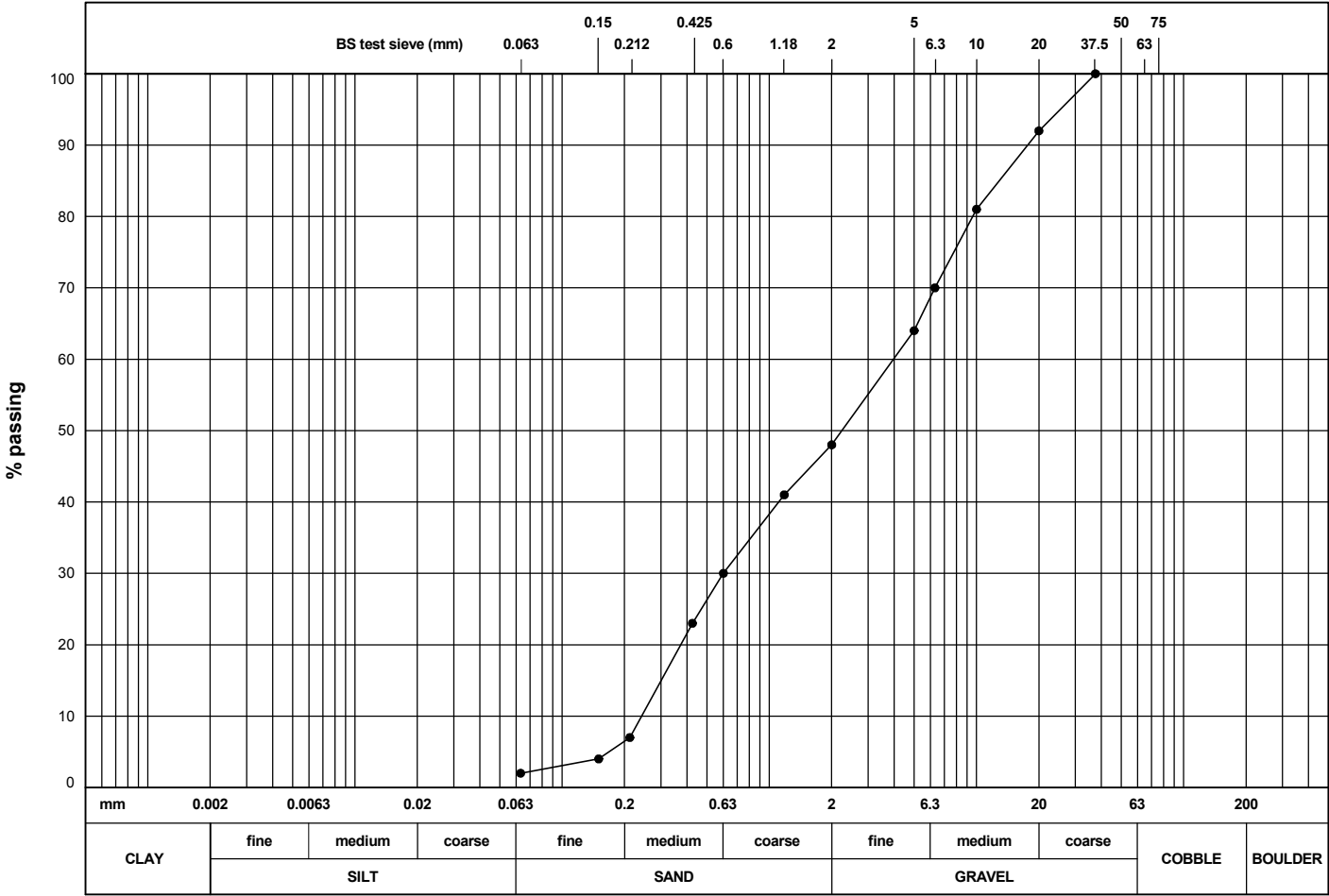
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PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH01
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	10B
DESCRIPTION	Yellowish brown slightly silty very sandy GRAVEL	SAMPLE DEPTH (m)	4.00
		SPECIMEN DEPTH (m)	4.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	64	20	
SILT	2	75		2	48	6	
SILT & CLAY	46	63		1.18	41	2	
SAND	52	50		0.6	30		
GRAVEL	0	37.5	100	0.425	23		
COBBLE & BOULDER		20	92	0.212	7		
test method(s)	9.2#	10	81	0.15	4		
test method:		6.3	70	0.063	2		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

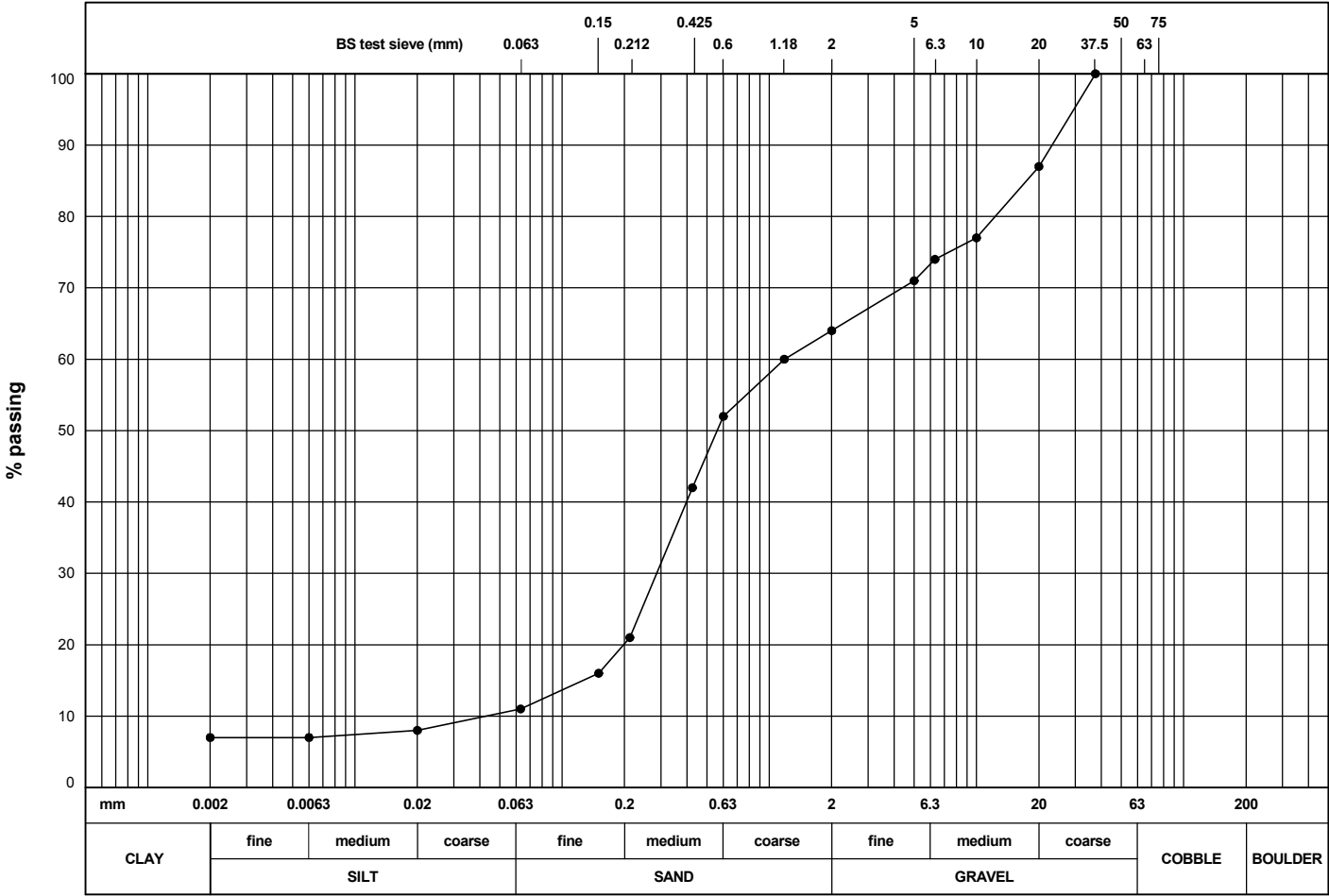
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PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH02
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	4B
DESCRIPTION	Brown clayey very gravelly SAND	SAMPLE DEPTH (m)	2.00
		SPECIMEN DEPTH (m)	2.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	7	150		5	71	20	8
SILT	4	75		2	64	6	7
SILT & CLAY	11	63		1.18	60	2	7
SAND	53	50		0.6	52		
GRAVEL	36	37.5	100	0.425	42		
COBBLE & BOULDER	0	20	87	0.212	21		
test method(s)	9.2# & 9.4	10	77	0.15	16		
test method:		6.3	74	0.063	11		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

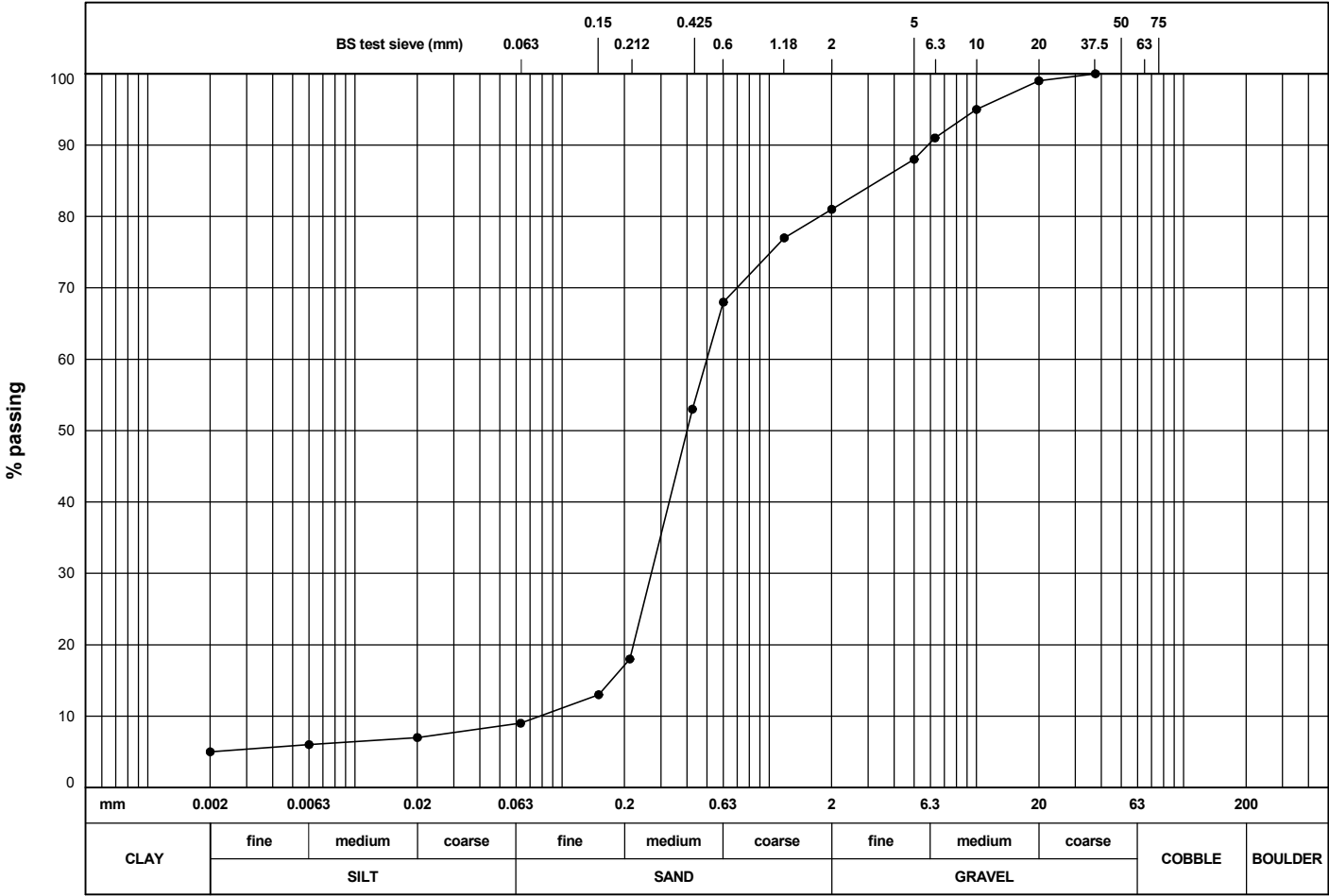
Geotechnical Engineering Limited

PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH02
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	5B
DESCRIPTION	Yellowish brown clayey gravelly SAND	SAMPLE DEPTH (m)	3.00
		SPECIMEN DEPTH (m)	3.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	5	150		5	88	20	7
SILT	4	75		2	81	6	6
SILT & CLAY	9	63		1.18	77	2	5
SAND	72	50		0.6	68		
GRAVEL	19	37.5	100	0.425	53		
COBBLE & BOULDER	0	20	99	0.212	18		
test method(s)	9.2 & 9.4	10	95	0.15	13		
test method:		6.3	91	0.063	9		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

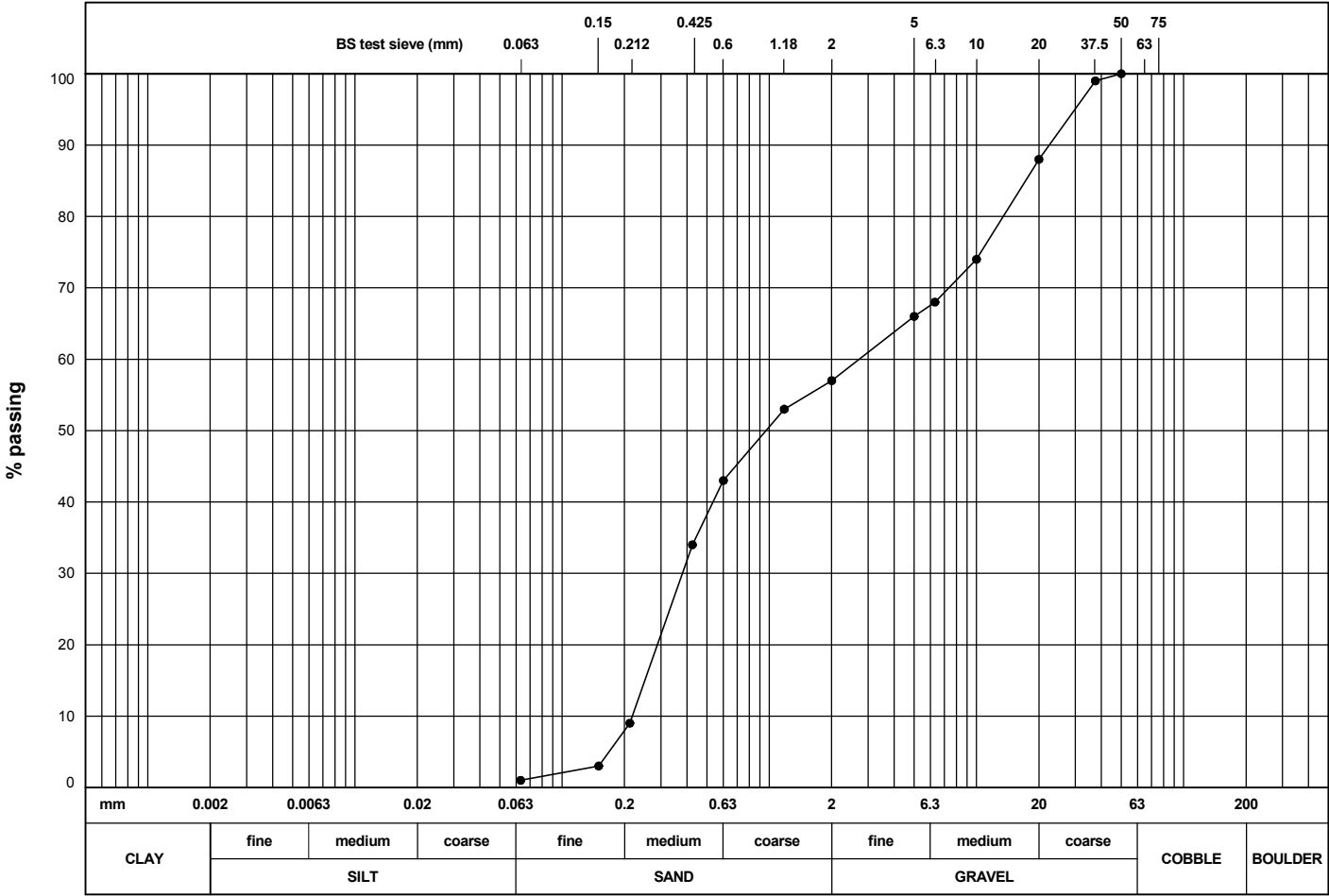
Geotechnical Engineering Limited

PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH03
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	11B
DESCRIPTION	Yellowish brown slightly clayey very gravelly SAND	SAMPLE DEPTH (m)	4.80
		SPECIMEN DEPTH (m)	4.80



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	66	20	
SILT		75		2	57	6	
SILT & CLAY	1	63		1.18	53	2	
SAND	56						
GRAVEL	43						
COBBLE & BOULDER	0						
test method(s)	9.2#	50	100	0.6	43		
		37.5	99	0.425	34		
test method:		20	88	0.212	9		
9.2 - wet sieving		10	74	0.15	3		
9.3 - dry sieving		6.3	68	0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

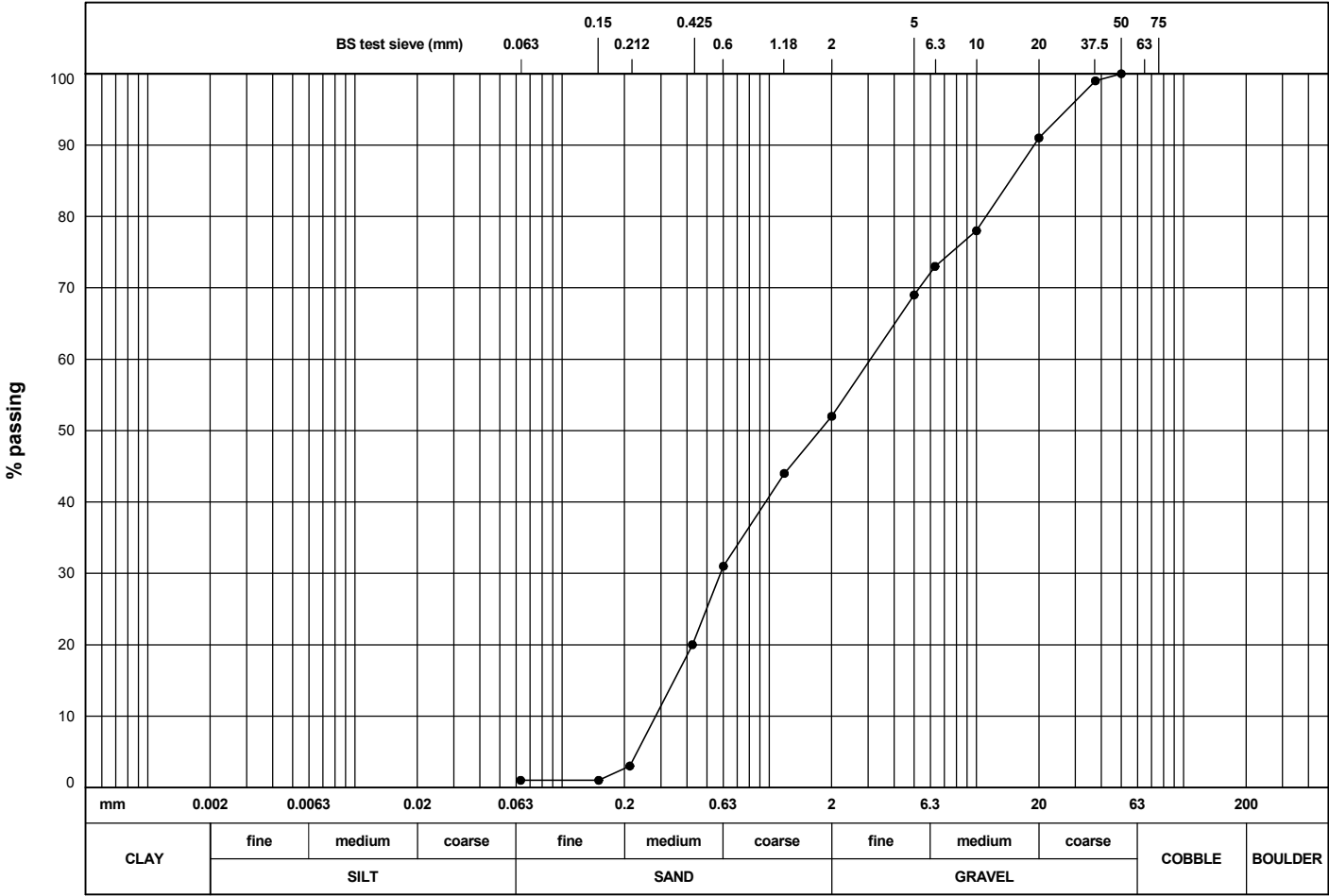
Geotechnical Engineering Limited

PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	10B
DESCRIPTION	Yellowish brown slightly silty very gravelly SAND	SAMPLE DEPTH (m)	4.00
		SPECIMEN DEPTH (m)	4.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	69	20	
SILT		75		2	52	6	
SILT & CLAY	1	63		1.18	44	2	
SAND	51						
GRAVEL	48						
COBBLE & BOULDER	0						
test method(s)	9.2#	50	100	0.6	31		
		37.5	99	0.425	20		
test method:		20	91	0.212	3		
9.2 - wet sieving		10	78	0.15	1		
9.3 - dry sieving		6.3	73	0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

CALIFORNIA BEARING RATIO**BS.1377 : Part 4 : 1990 : 7**

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH/TP No.

BH01

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES
BUILDING

SAMPLE No./TYPE

2B

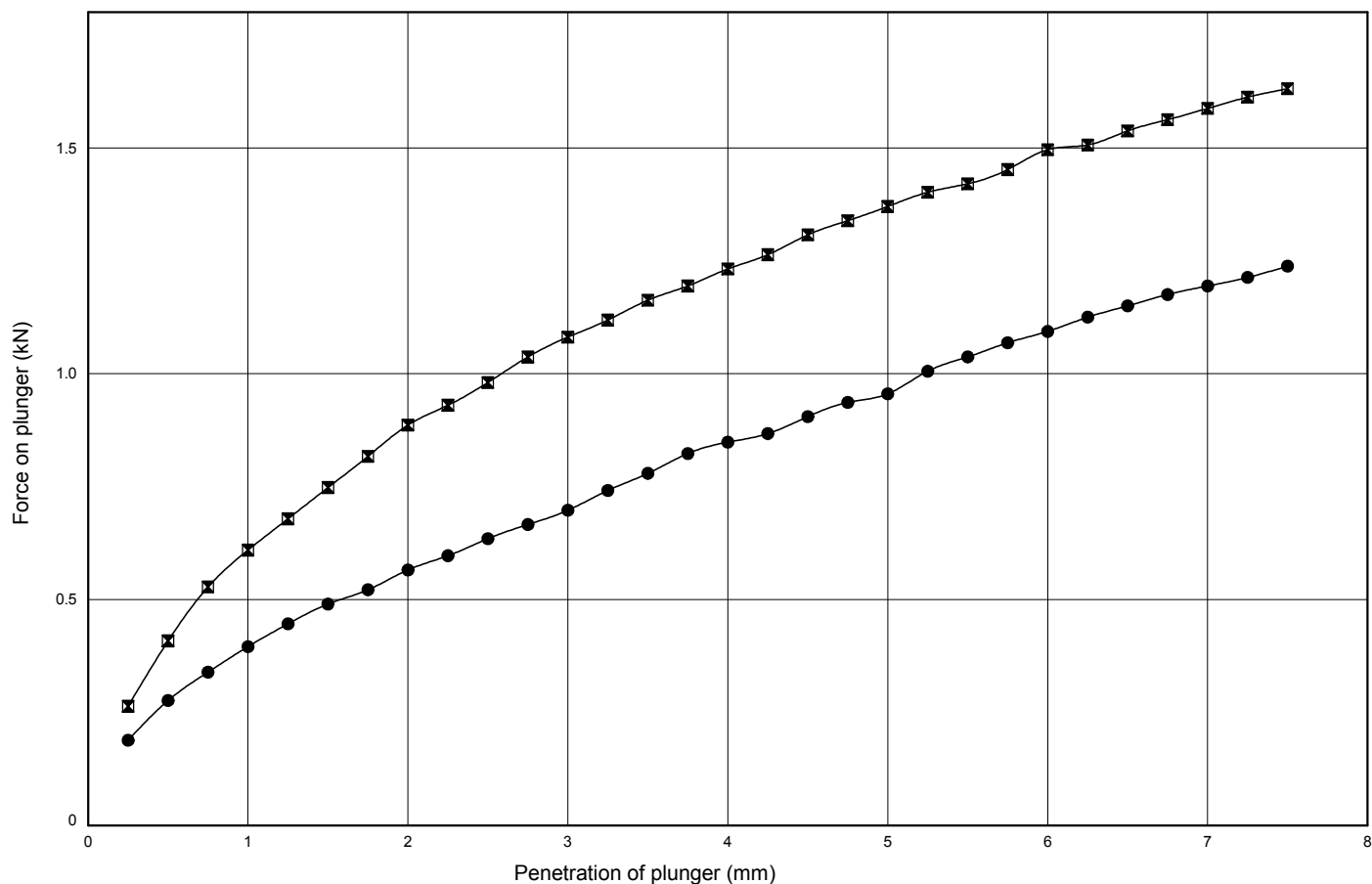
SAMPLE DEPTH (m)

0.50

DESCRIPTION Brown mottled reddish brown slightly sandy gravelly CLAY

SPECIMEN DEPTH (m)

0.50



sample preparation:		Dynamic compaction - 2.5Kg rammer	
proportion >20mm removed (%)	4.4	sample condition	Unsoaked
surcharge mass (kg)	10	amount of swell (mm)	N/A
INITIAL CONDITIONS		FINAL CONDITIONS	
moisture content (%)	12	moisture content - top (%)	16
bulk density (Mg/m ³)	2.04	moisture content - base (%)	14
dry density (Mg/m ³)	1.83		
remarks:			
● ● ● ● ● Top ■ ■ ■ ■ ■ Base		CBR value top (%)	4.8
		CBR value base (%)	7.4
		average CBR value (%)	
		CONTRACT	CHECKED
		31710	CA

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES**BS.1377 : Part 5 : 1990 : 3**

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH/TP No.

BH01

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES
BUILDING

SAMPLE No./TYPE

8U

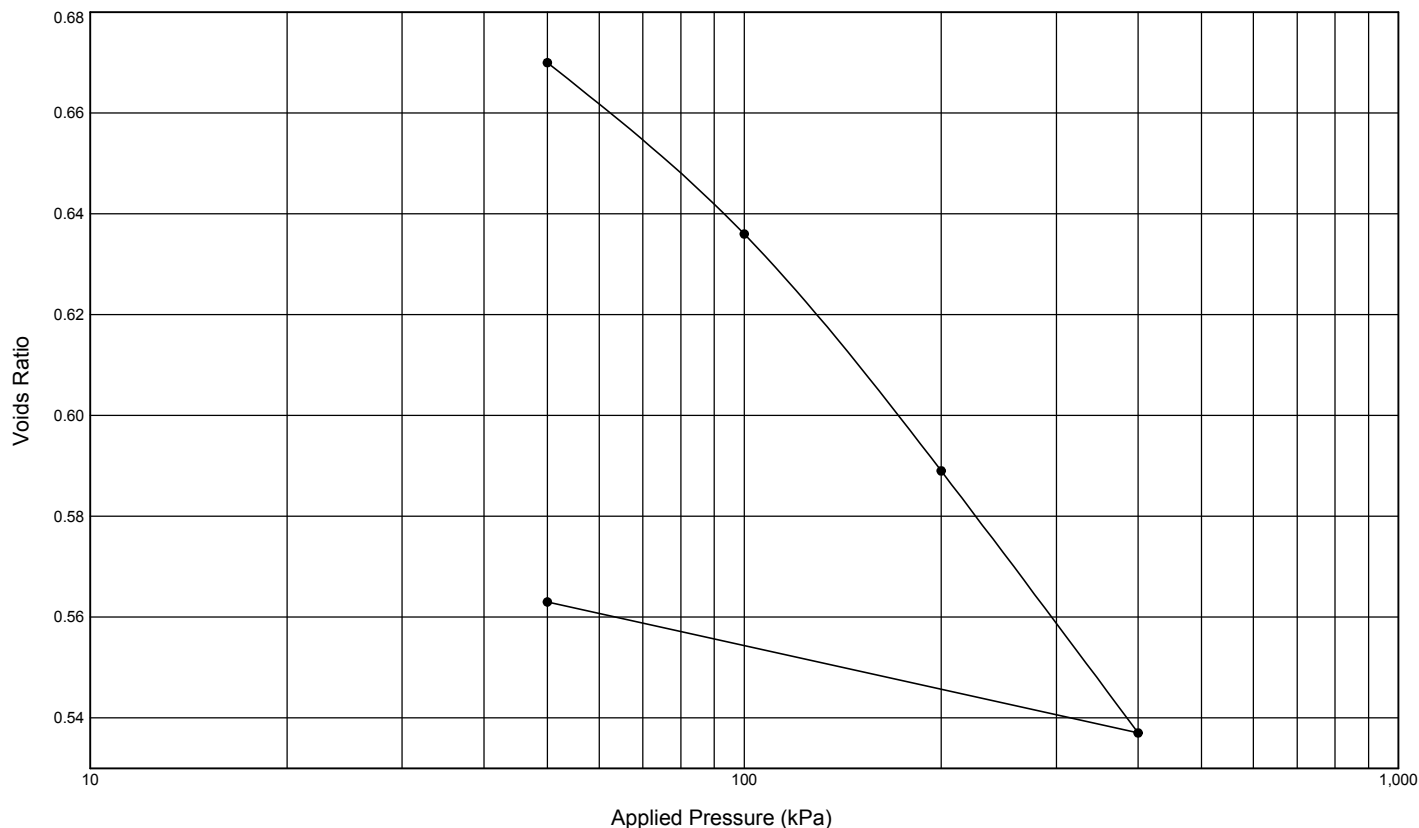
SAMPLE DEPTH (m)

2.80

DESCRIPTION Orangish brown mottled light grey slightly sandy CLAY

SPECIMEN DEPTH (m)

2.80



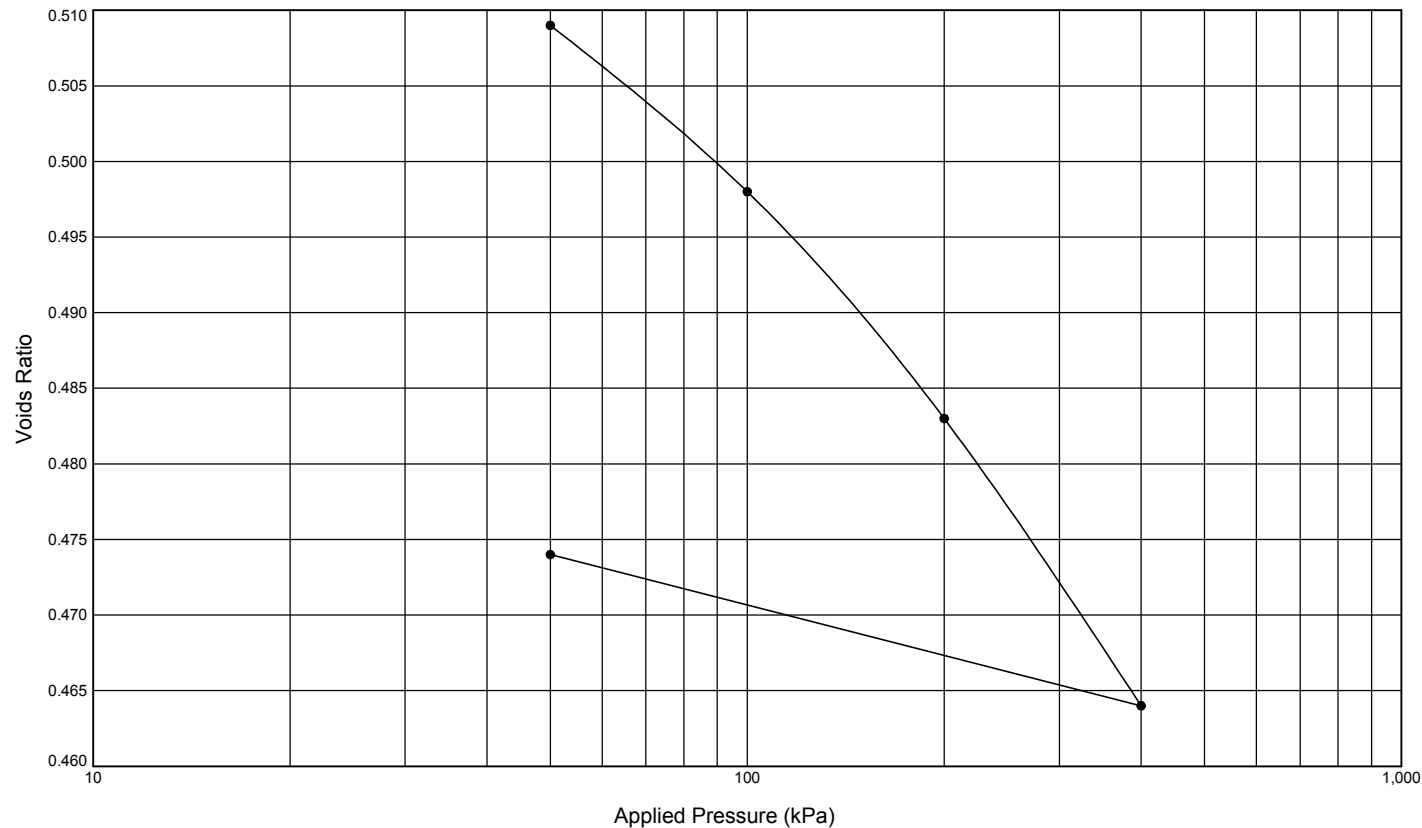
Test and sample details			Test results			
			pressure stage (kPa)	voids ratio	laboratory coefficients of compressibility (m ² /MN)	consolidation (m ² /year)
specimen diameter	(mm)	63.33				
specimen height	(mm)	18.89				
initial moisture content	(%)	26.8				
final moisture content	(%)	22.8				
initial bulk density	(Mg/m ³)	1.98	50	0.670	0.724	1.4
initial dry density	(Mg/m ³)	1.56	100	0.636	0.408	1.3
initial voids ratio		0.733	200	0.589	0.290	1.5
initial degree of saturation	(%)	99	400	0.537	0.163	1.6
particle density	(Mg/m ³)	#2.70	50	0.563	0.049	
swelling pressure	(kPa)	N/A				
P'o to P'o +100 kPa	(kPa)					
laboratory temperature	(°C)	20 ± 2				
method of time fitting		root time				
remarks: # denotes particle density has been assigned an assumed value.					CONTRACT 31710	CHECKED CA

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES



BS.1377 : Part 5 : 1990 : 3

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH03
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	6UT
		SAMPLE DEPTH (m)	2.00
DESCRIPTION	Orangish brown mottled grey sandy CLAY	SPECIMEN DEPTH (m)	2.30



Test and sample details			Test results			
			pressure stage (kPa)	voids ratio	laboratory coefficients of compressibility (m ² /MN)	consolidation (m ² /year)
specimen diameter	(mm)	63.55				
specimen height	(mm)	18.10				
initial moisture content	(%)	16.6				
final moisture content	(%)	17.4				
initial bulk density	(Mg/m ³)	2.05	50	0.509	0.335	6.8
initial dry density	(Mg/m ³)	1.76	100	0.498	0.147	3.5
initial voids ratio		0.535	200	0.483	0.098	7.8
initial degree of saturation	(%)	84	400	0.464	0.065	3.0
particle density	(Mg/m ³)	#2.70	50	0.474	0.019	
swelling pressure	(kPa)	N/A				
P'o to P'o +100 kPa	(kPa)					
laboratory temperature	(°C)	20 ± 2				
method of time fitting		root time				
remarks: # denotes particle density has been assigned an assumed value.					CONTRACT 31710	CHECKED CA

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES**BS.1377 : Part 5 : 1990 : 3**

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH/TP No.

BH04

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES
BUILDING

SAMPLE No./TYPE

6U

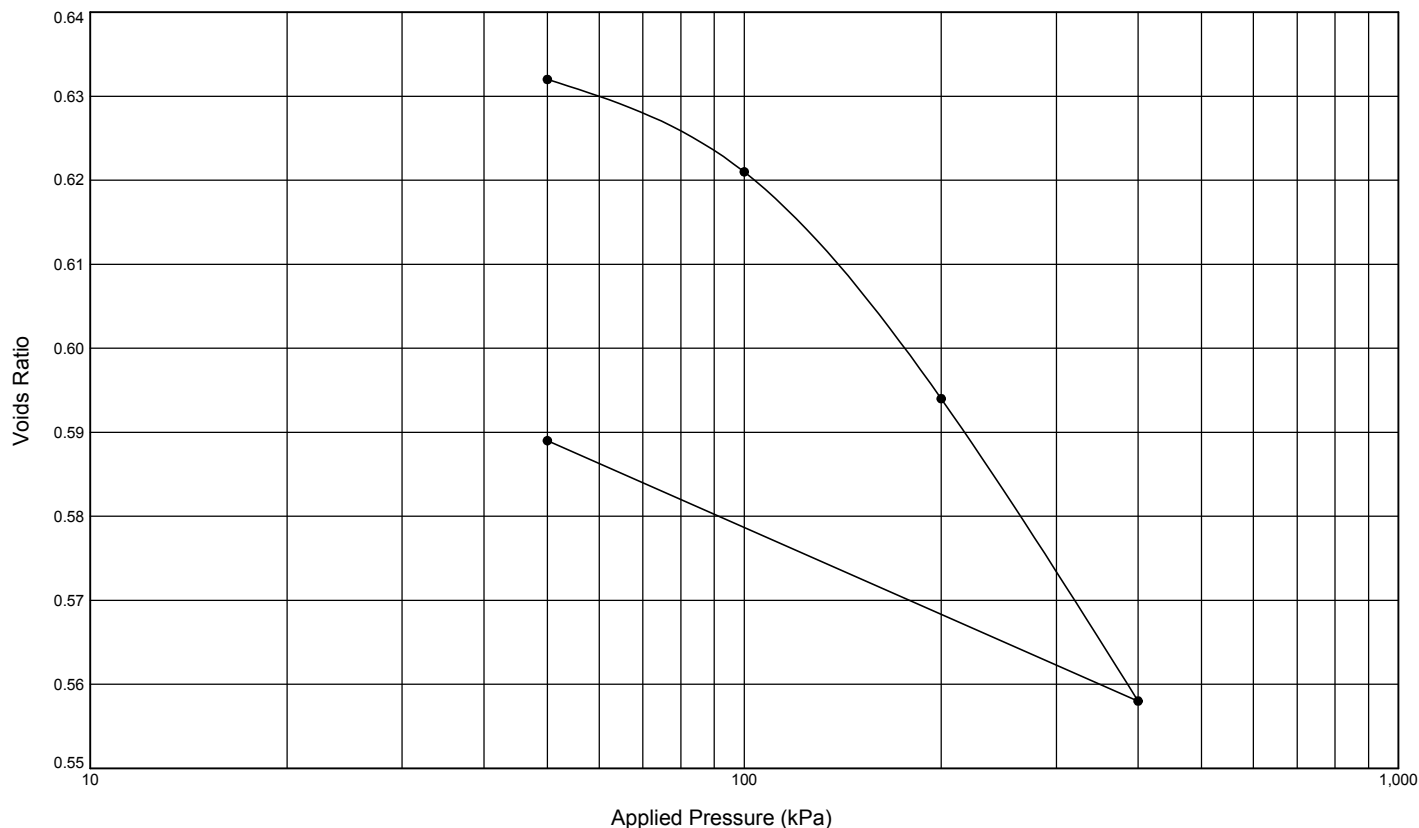
SAMPLE DEPTH (m)

2.70

DESCRIPTION Orange brown slightly sandy slightly gravelly CLAY

SPECIMEN DEPTH (m)

2.80



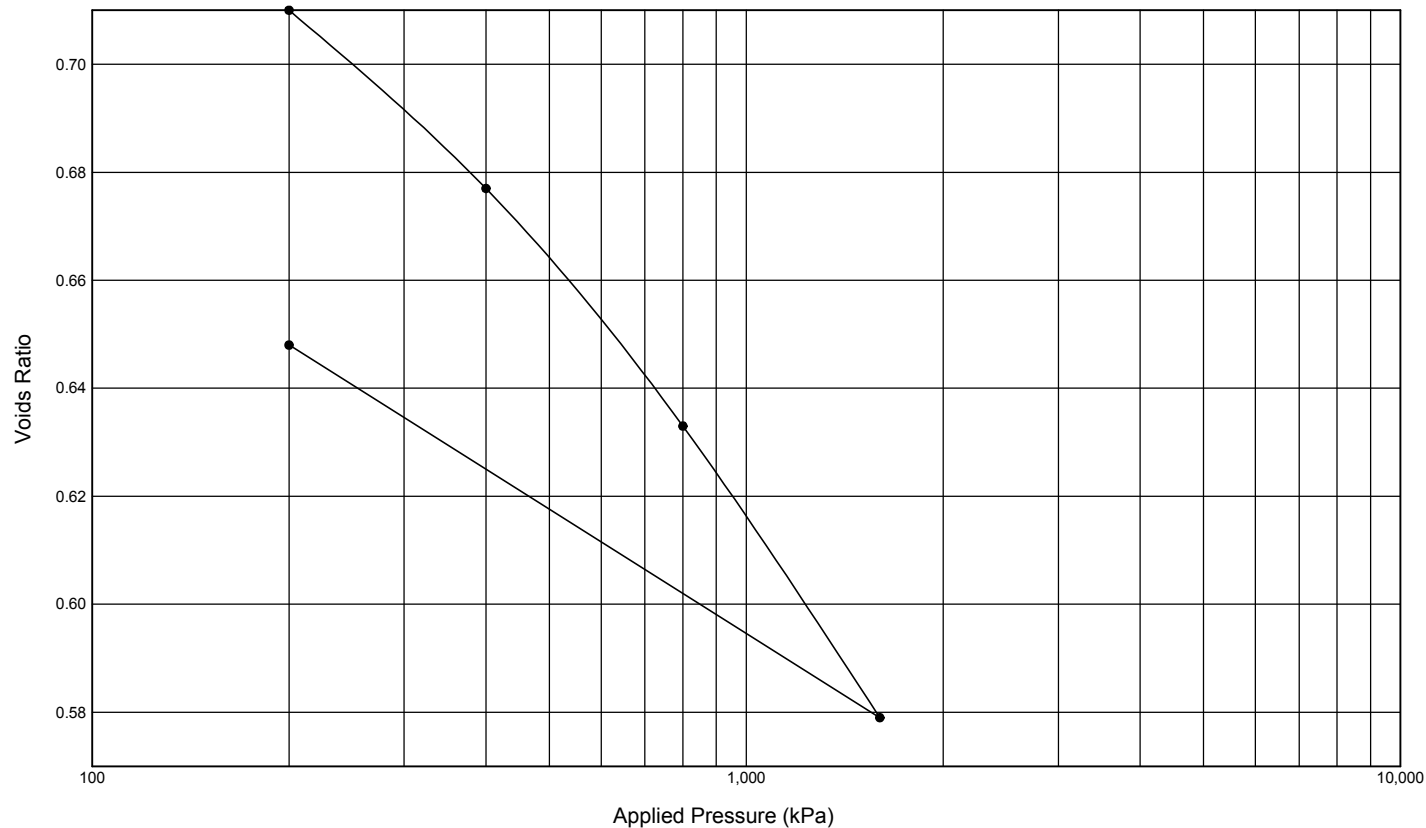
Test and sample details			Test results			
			pressure stage (kPa)	voids ratio	laboratory coefficients of compressibility (m ² /MN)	consolidation (m ² /year)
specimen diameter	(mm)	63.43				
specimen height	(mm)	19.04				
initial moisture content	(%)	24.1				
final moisture content	(%)	23.8				
initial bulk density	(Mg/m ³)	2.02	50	0.632	0.350	12
initial dry density	(Mg/m ³)	1.63	100	0.621	0.135	1.9
initial voids ratio		0.661	200	0.594	0.165	0.79
initial degree of saturation	(%)	99	400	0.558	0.112	0.59
particle density	(Mg/m ³)	#2.70	50	0.589	0.055	
swelling pressure	(kPa)	N/A				
P'o to P'o +100 kPa	(kPa)					
laboratory temperature	(°C)	20 ± 2				
method of time fitting		root time				
remarks: # denotes particle density has been assigned an assumed value.					CONTRACT 31710	CHECKED CA

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES



BS.1377 : Part 5 : 1990 : 3

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	14U
		SAMPLE DEPTH (m)	6.50
DESCRIPTION	Grey brown slightly sandy silty CLAY	SPECIMEN DEPTH (m)	6.50



Test and sample details			Test results			
			pressure stage (kPa)	voids ratio	laboratory coefficients of compressibility (m ² /MN)	consolidation (m ² /year)
specimen diameter	(mm)	63.19				
specimen height	(mm)	19.99				
initial moisture content	(%)	26.5				
final moisture content	(%)	25.4				
initial bulk density	(Mg/m ³)	1.91	200	0.710	0.211	2.0
initial dry density	(Mg/m ³)	1.51	400	0.677	0.096	0.41
initial voids ratio		0.785	800	0.633	0.066	0.38
initial degree of saturation	(%)	91	1600	0.579	0.042	0.40
particle density	(Mg/m ³)	#2.70	200	0.648	0.031	
swelling pressure	(kPa)	N/A				
P'o to P'o +100 kPa	(kPa)					
laboratory temperature	(°C)	20 ± 2				
method of time fitting		root time				
remarks: # denotes particle density has been assigned an assumed value.					CONTRACT 31710	CHECKED CA

UNDRAINED TRIAXIAL COMPRESSION**BS.1377 : Part 7 : 1990 : 8 and 9**

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole /trial pit no.	sample		specimen depth (m)	code	moisture content (%)	density		cell pressure (kPa)	deviator stress (kPa)	failure strain (%)	failure mode	shear strength* (kPa)	description and remarks
	no./ type	depth (m)				bulk (Mg/m ³)	dry (Mg/m ³)						
BH01	15U	6.50	6.55	UU100	25.4	2.04	1.63	135	219	6.8	S	110	Greyish brown slightly sandy silty CLAY
BH01	23U	9.50	9.55	UU100	25.2	2.09	1.67	195	328	8.7	S	164	Greyish brown slightly sandy silty CLAY
BH01	31U	12.50	12.65	UU100	24.4	2.08	1.67	255	234	6.8	S	117	Brown slightly sandy CLAY
BH01	39U	15.50	15.55	UU100	22.4	2.10	1.71	315	470	8.3	S	235	Greyish brown sandy silty CLAY with rare shell fragments
BH02	14U	8.00	8.10	UU100	25.2	2.00	1.60	165	239	7.3	S	120	Dark brownish grey slightly sandy silty CLAY
BH02	22U	11.00	11.05	UU100	23.7	1.99	1.61	225	219	4.3	S	110	Greyish brown slightly sandy silty CLAY
BH02	30U	14.00	14.08	UU100	21.8	2.07	1.70	285	480	7.7	S	240	Brown slightly sandy silty CLAY with rare shell fragments
BH02	37U	17.00	17.23	UU100	22.6	2.04	1.66	345	390	5.8	S	195	Brown mottled grey slightly sandy silty CLAY
BH03	23UT	10.00	10.05	UU100	24.1	2.06	1.66	205	275	5.8	S	138	Dark brown slightly sandy silty CLAY
BH03	31U	13.00	13.05	UU100	25.8	2.04	1.62	265	226	6.3	S	113	Brown slightly sandy silty CLAY
BH03	39U	16.00	16.14	UU100	21.5	2.13	1.75	325	394	6.8	S	197	Brown sandy silty CLAY
BH04	14U	6.50	6.55	UU100	23.7	2.06	1.66	135	217	6.8	S	109	Brown slightly sandy silty CLAY
BH04	22U	9.50	9.55	UU100	25.1	2.07	1.66	195	333	5.8	S	167	Greyish brown slightly sandy silty CLAY
BH04	30UT	12.50	12.55	UU100	25.9	2.00	1.59	255	187	2.9	S	94	Brown slightly sandy silty CLAY with rare shell fragments
BH04	38UT	15.50	15.58	UU100	21.4	2.06	1.70	315	483	5.8	S	242	Brown slightly sandy slightly gravelly silty CLAY

general remarks: * shear strength taken as half deviator stress at failure for each stage.
denotes sample unsuitable to test.

code:
 CD - Consolidated drained M - Multistage 38 - 38mm dia. x 76mm
 CU - Consolidated undrained S - Set of 3 specimens 70 - 69mm dia. x 140mm
 UU - Unconsolidated undrained R - Remoulded 100 - 106mm dia. x 200mm

failure mode:
 B - barrelling (plastic failure) I - intermediate
 S - shear (brittle failure) O - other (see remarks)

membrane correction applied
 sample taken vertically (unless specified)
 rate of strain = 2%/min (unless specified)

membrane thickness:
 38 - 0.2mm 70 - 0.4mm
 106 - 0.4mm

CONTRACT
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CA



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT	KNOWLES & SON (OXFORD) LTD	BH/TP No.	BH03
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	15UT
		SAMPLE DEPTH (m)	7.00-7.45
DESCRIPTION	Grey brown, slightly sandy, slightly gravelly, silty CLAY	SPECIMEN DEPTH (m)	7.15

TYPE OF SPECIMEN	Undisturbed / Vertical
TYPE OF TEST	Single Specimen Multistage
SIDE DRAINS FITTED	Yes
DRAINAGE CONDITIONS	Both ends and radial boundary

		STAGE	1	2	3	
INITIAL CONDITIONS	Length	mm	206.35	204	*	202 *
	Diameter	mm	103.18	102	*	101 *
	Moisture Content	%	25			
	Bulk Density	Mg/m ³	2.00			
	Dry Density	Mg/m ³	1.60			
FINAL CONDITIONS	Moisture Content	%				21
	Bulk Density	Mg/m ³				2.05
	Dry Density	Mg/m ³				1.69
SATURATION (by cell pressure and back pressure increments)	Initial PWP	kPa	-3			
	Saturated PWP	kPa	393			
	Final Cell Pressure	kPa	400			
	B Value		1			
CONSOLIDATION	Cell Pressure	kPa	412.5	485		630
	Back Pressure	kPa	340	340		340
	Initial PWP	kPa	404	430		516
	Final PWP	kPa	340	339		340
	c _v	m ² /yr	0.21	0.18		0.12
	m _v	m ² /MN	0.655	0.284		0.163
	k (calculated value)	m/s	4.3E-11	1.6E-11		6.0E-12
COMPRESSION	Cell Pressure	kPa	412.5	485		630
	Back Pressure	kPa	340	340		340
	σ ₃	kPa	72.5	145		290
	Rate of Strain	%/hr	0.062	0.054		0.0365
FAILURE CONDITIONS (based on maximum stress ratio)	Axial Strain (ε)	%	2.7	2.9		6.3
	δu _f	kPa	32	58		113
	σ _{3f}	kPa	41	87		177
	(σ ₁ - σ ₃) _f	kPa	71	131		269
	(σ ₁ /σ ₃) _f		2.7	2.5		2.5
FAILURE MODE (also see photo)	EFFECTIVE STRESS PARAMETERS		c' kPa :		φ' deg :	
	INTER		2.6		25.0	
remarks	* Calculated values		CONTRACT		CHECKED	
			31710		NP	



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT KNOWLES & SON (OXFORD) LTD

BH/TP No.

BH03

SITE UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SAMPLE No./TYPE

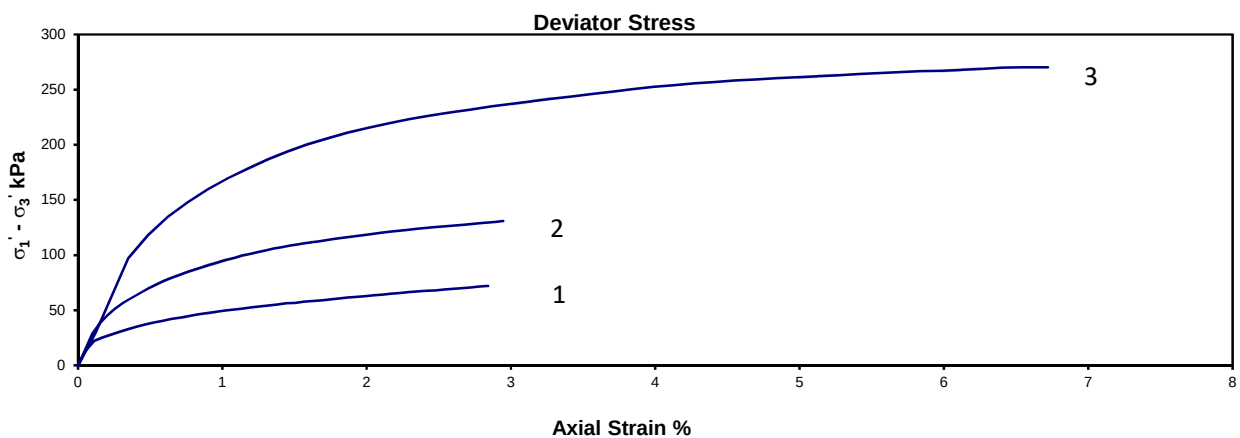
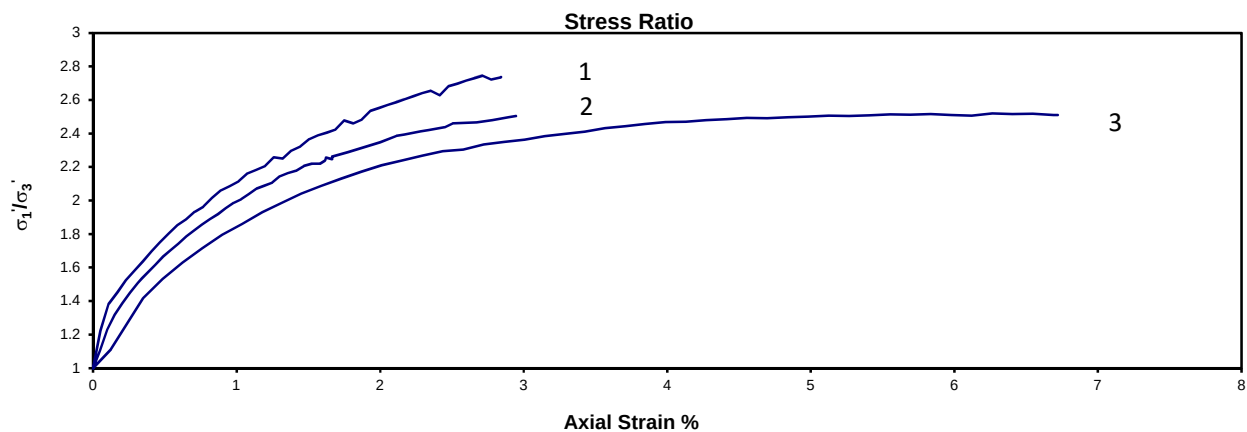
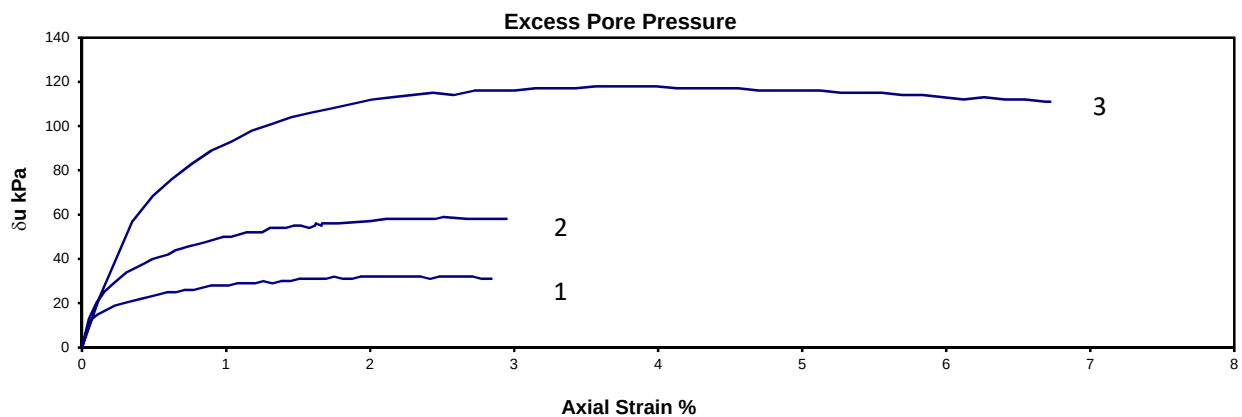
15UT

SAMPLE DEPTH (m)

7.00-7.45

SPECIMEN DEPTH (m)

7.15



remarks

CONTRACT

CHECKED

31710

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT KNOWLES & SON (OXFORD) LTD

BH/TP No.

BH03

SITE UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SAMPLE No./TYPE

15UT

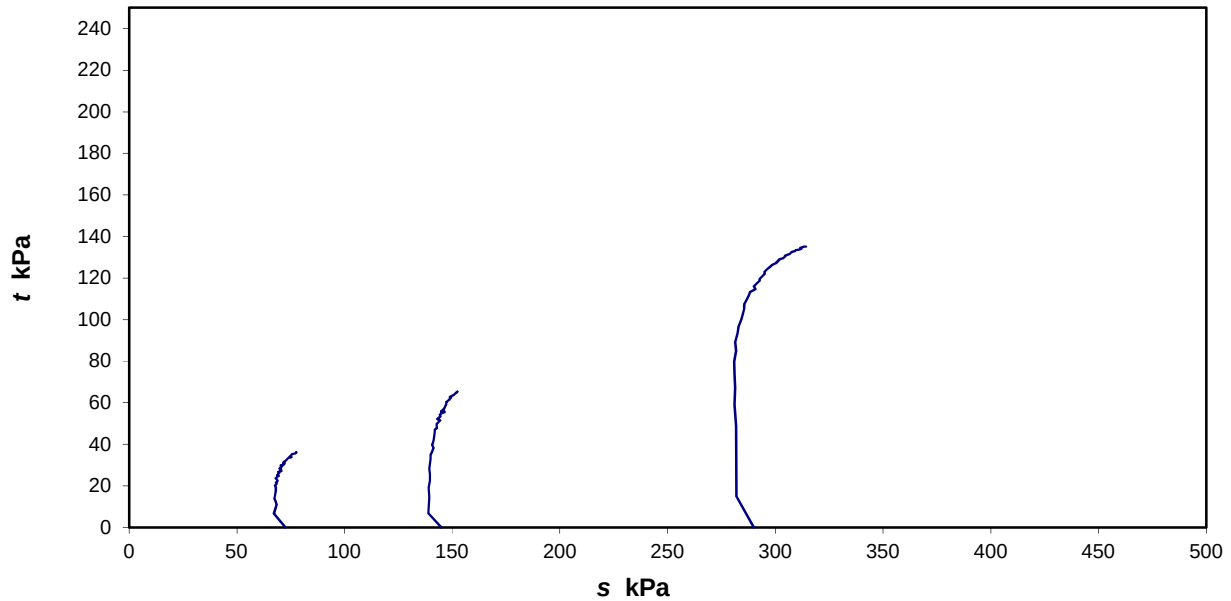
SAMPLE DEPTH (m)

7.00-7.45

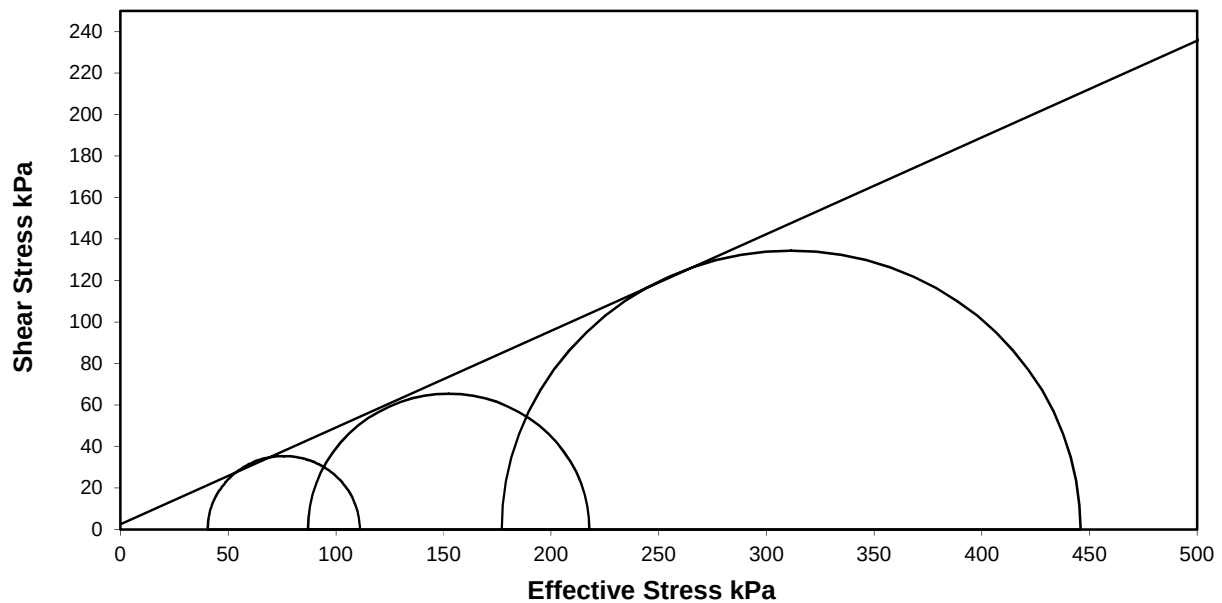
SPECIMEN DEPTH (m)

7.15

Stress Path



Mohr Circles



remarks

CONTRACT

31710

CHECKED

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT	KNOWLES & SON (OXFORD) LTD	BH/TP No.	BH03
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	15UT
		SAMPLE DEPTH (m)	7.00-7.45
		SPECIMEN DEPTH (m)	7.15



Failure Mode

INTER

remarks

Please note the photo is intended to show the mode of failure only.

CONTRACT

31710

CHECKED

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT	KNOWLES AND SON (OXFORD) LTD	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	6U
DESCRIPTION	Orangish brown mottled light grey, slightly gravelly, sandy CLAY	SAMPLE DEPTH (m)	2.70-3.15
		SPECIMEN DEPTH (m)	2.90

TYPE OF SPECIMEN	Undisturbed / Vertical
TYPE OF TEST	Single Specimen Multistage
SIDE DRAINS FITTED	Yes
DRAINAGE CONDITIONS	Both ends and radial boundary

		STAGE	1	2	3	
INITIAL CONDITIONS	Length	mm	206.45	207	*	206 *
	Diameter	mm	105.23	106	*	105 *
	Moisture Content	%	22			
	Bulk Density	Mg/m ³	2.03			
	Dry Density	Mg/m ³	1.66			
FINAL CONDITIONS	Moisture Content	%				22
	Bulk Density	Mg/m ³				2.04
	Dry Density	Mg/m ³				1.67
SATURATION (by cell pressure and back pressure increments)	Initial PWP	kPa	-3			
	Saturated PWP	kPa	386			
	Final Cell Pressure	kPa	400			
	B Value		1			
CONSOLIDATION	Cell Pressure	kPa	370	400		460
	Back Pressure	kPa	340	340		340
	Initial PWP	kPa	358	367		342
	Final PWP	kPa	338	338		372
	c _v	m ² /yr	0.46	0.41		0.32
	m _v	m ² /MN	0.227	0.254		0.409
	k (calculated value)	m/s	3.3E-11	3.2E-11		4.0E-11
COMPRESSION	Cell Pressure	kPa	370	400		460
	Back Pressure	kPa	340	340		340
	σ ₃ '	kPa	30	60		120
	Rate of Strain	%/hr	0.131	0.116		0.09
FAILURE CONDITIONS (based on maximum stress ratio)	Axial Strain (ε)	%	1.6	1.6		2.7
	δu _f	kPa	11	25		46
	σ _{3f} '	kPa	19	35		74
	(σ ₁ ' - σ ₃ ') _f	kPa	61	94		152
	(σ ₁ '/σ ₃ ') _f		4.2	3.7		3.1
FAILURE MODE (also see photo)	EFFECTIVE STRESS PARAMETERS		c' kPa :		φ' deg :	
	INTER		10.1		26.6	
remarks	* Calculated values		CONTRACT		CHECKED	
			31710		NP	

Geotechnical Engineering Ltd, Centurion House, Olympus Park, Quedgeley, Gloucester, GL2 4NF, Tel - 01452 527743



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT KNOWLES AND SON (OXFORD) LTD

BH/TP No.

BH04

SITE UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SAMPLE No./TYPE

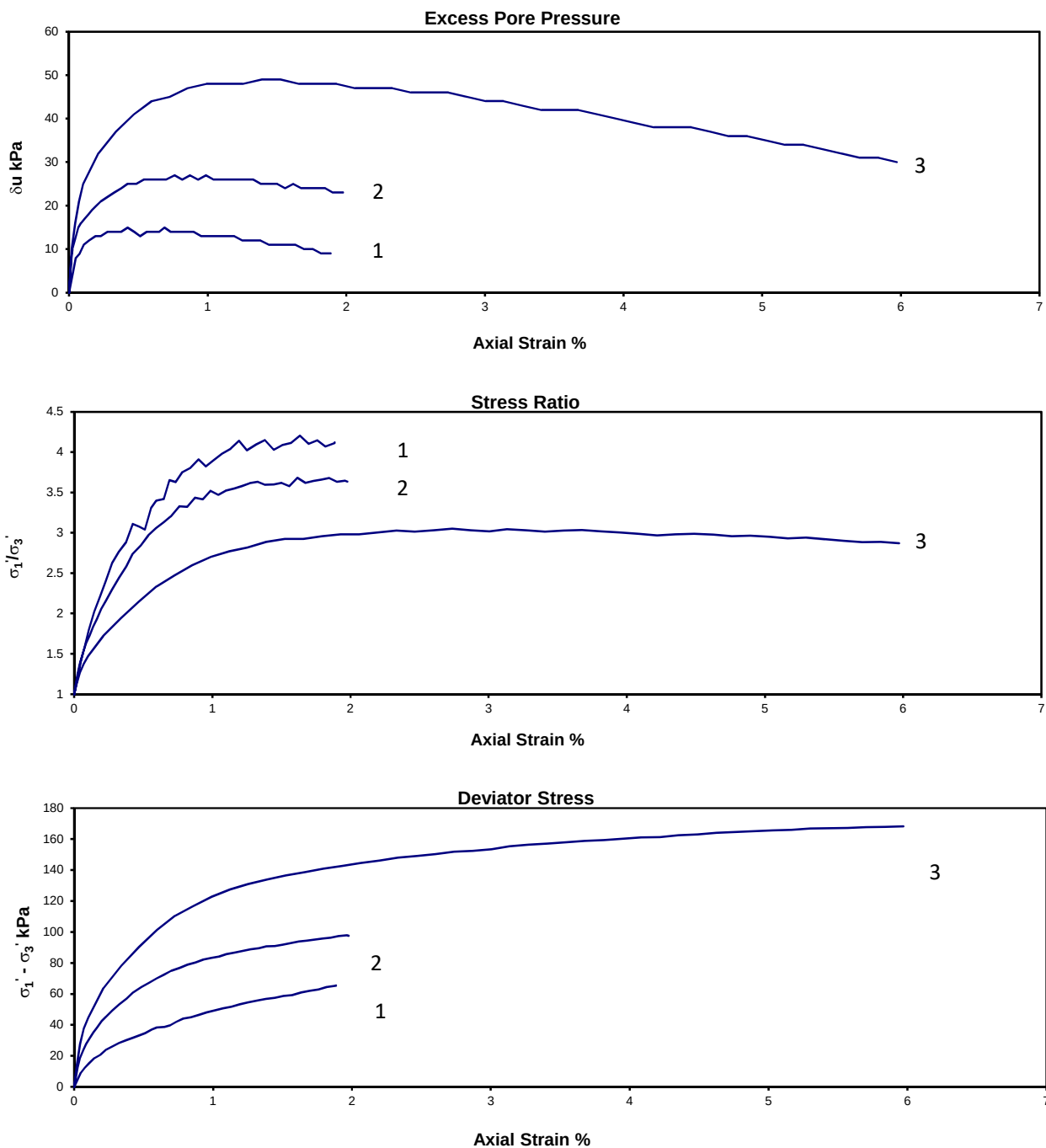
6U

SAMPLE DEPTH (m)

2.70-3.15

SPECIMEN DEPTH (m)

2.90



remarks

CONTRACT

CHECKED

31710

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT KNOWLES AND SON (OXFORD) LTD

BH/TP No.

BH04

SITE UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SAMPLE No./TYPE

6U

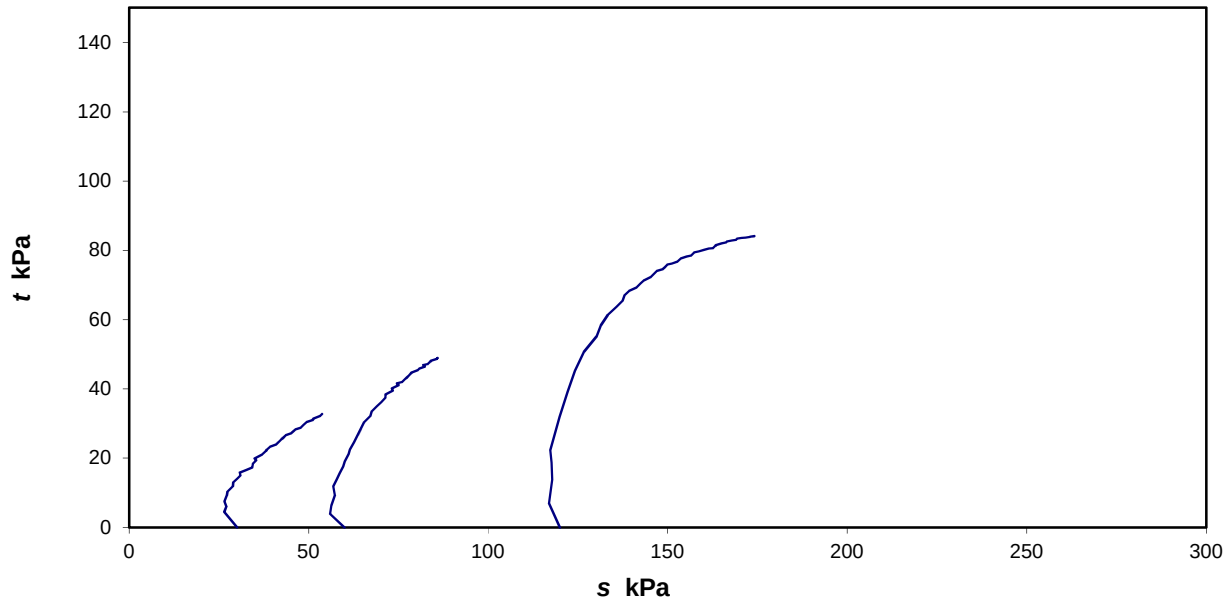
SAMPLE DEPTH (m)

2.70-3.15

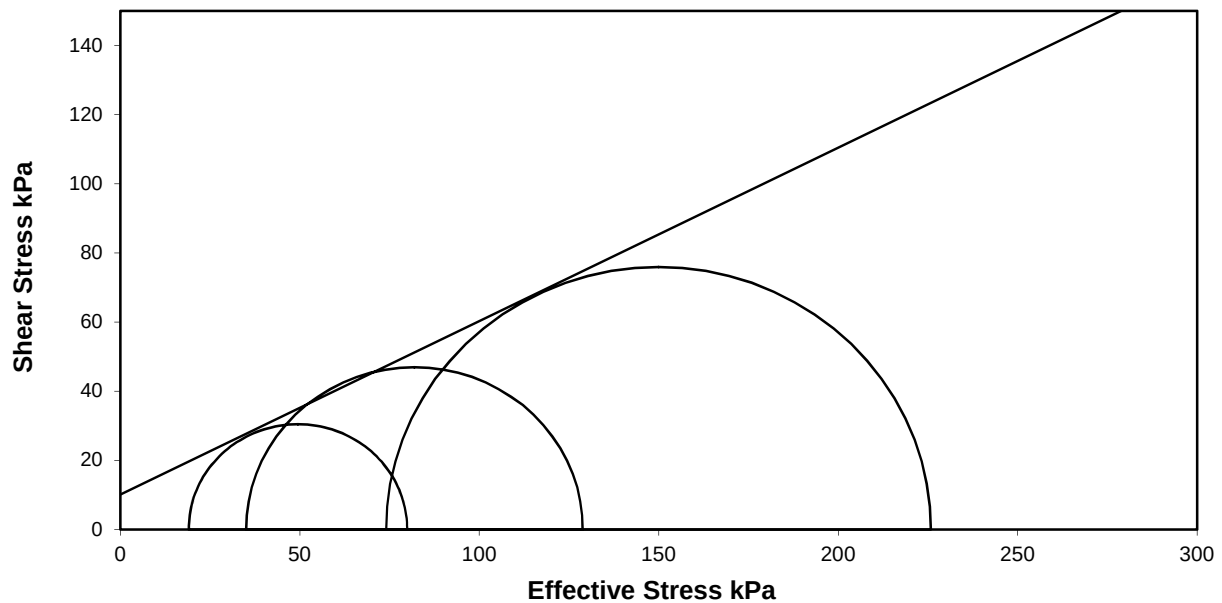
SPECIMEN DEPTH (m)

2.90

Stress Path



Mohr Circles



remarks

CONTRACT

31710

CHECKED

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT	KNOWLES AND SON (OXFORD) LTD	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	6U
		SAMPLE DEPTH (m)	2.70-3.15
		SPECIMEN DEPTH (m)	2.90



Failure Mode

INTER

remarks

Please note the photo is intended to show the mode of failure only.

CONTRACT

31710

CHECKED

NP

Geotechnical Engineering Limited

HAND VANE TEST RESULTS



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole /trial pit no.	sample		specimen depth (m)	Vane Strength (kPa)			description and remarks
	no./type	depth (m)		Top	Bottom	Average	
BH01	19U	8.00	8.00	>130			Dark grey slightly sandy silty CLAY
BH01	19U	8.00	8.20	>130			Dark grey slightly sandy silty CLAY
BH01	19U	8.00	8.45	>130			Dark grey slightly sandy silty CLAY
BH01	27U	11.00	11.00	>130			Dark grey slightly sandy silty CLAY
BH01	27U	11.00	11.21	>130			Dark grey slightly sandy silty CLAY
BH01	27U	11.00	11.45	>130			Dark grey slightly sandy silty CLAY
BH01	35U	14.00	14.00	>130			Dark grey slightly sandy silty CLAY
BH01	35U	14.00	14.20	>130			Dark grey slightly sandy silty CLAY
BH01	35U	14.00	14.40	>130			Dark grey slightly sandy silty CLAY
BH01	43U	17.00	17.00	>130			Dark grey slightly sandy silty CLAY
BH01	43U	17.00	17.25	>130			Dark grey slightly sandy silty CLAY
BH01	43U	17.00	17.45	>130			Dark grey slightly sandy silty CLAY
BH02	18U	9.50	9.50	>130			Dark grey slightly sandy silty CLAY
BH02	18U	9.50	9.70	>130			Dark grey slightly sandy silty CLAY
BH02	18U	9.50	9.90	>130			Dark grey slightly sandy silty CLAY
BH02	26U	12.50	12.50	>130			Dark grey slightly sandy silty CLAY
BH02	26U	12.50	12.70	>130			Dark grey slightly sandy silty CLAY
BH02	26U	12.50	12.90	>130			Dark grey slightly sandy silty CLAY
BH02	34U	15.50	15.50	>130			Dark grey slightly sandy silty CLAY
BH02	34U	15.50	15.73	>130			Dark grey slightly sandy silty CLAY
BH02	34U	15.50	15.95	>130			Dark grey slightly sandy silty CLAY
BH03	6UT	2.00	2.00	99			Brown and light grey slightly sandy slightly gravelly CLAY
BH03	6UT	2.00	2.20	85			Brown and light grey slightly sandy slightly gravelly CLAY
general remarks: Re - Denotes vane test refusal							
						CONTRACT 31710	CHECKED CA

Geotechnical Engineering Limited

HAND VANE TEST RESULTS



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole /trial pit no.	sample		specimen depth (m)	Vane Strength (kPa)			description and remarks
	no./type	depth (m)		Top	Bottom	Average	
BH03	6UT	2.00	2.40	126			Brown and light grey slightly sandy slightly gravelly CLAY
BH03	27UT	11.50	11.50	>130			Dark grey slightly sandy silty CLAY
BH03	27UT	11.50	11.72	>130			Dark grey slightly sandy silty CLAY
BH03	27UT	11.50	11.95	>130			Dark grey slightly sandy silty CLAY
BH03	35U	14.50	14.50	>130			Dark grey slightly sandy silty CLAY
BH03	35U	14.50	14.70	>130			Dark grey slightly sandy silty CLAY
BH03	35U	14.50	14.90	>130			Dark grey slightly sandy silty CLAY
BH03	43U	17.50	17.50	>130			Dark grey slightly sandy silty CLAY
BH03	43U	17.50	17.75	>130			Dark grey slightly sandy silty CLAY
BH03	43U	17.50	17.95	>130			Dark grey slightly sandy silty CLAY
BH04	18U	8.00	8.00	112			Dark grey slightly sandy silty CLAY
BH04	18U	8.00	8.17	>130			Dark grey slightly sandy silty CLAY
BH04	18U	8.00	8.35	>130			Dark grey slightly sandy silty CLAY
BH04	26U	11.00	11.00	>130			Dark grey slightly sandy silty CLAY
BH04	26U	11.00	11.15	>130			Dark grey slightly sandy silty CLAY
BH04	26U	11.00	11.25	>130			Dark grey slightly sandy silty CLAY
BH04	34UT	14.00	14.00	>130			Dark grey slightly sandy silty CLAY
BH04	34UT	14.00	14.35	>130			Dark grey slightly sandy silty CLAY
BH04	34UT	14.00	14.45	>130			Dark grey slightly sandy silty CLAY
BH04	42UT	17.00	17.00	>130			Dark grey slightly sandy silty CLAY
BH04	42UT	17.00	17.20	>130			Dark grey slightly sandy silty CLAY
BH04	42UT	17.00	17.40	>130			Dark grey slightly sandy silty CLAY
general remarks: Re - Denotes vane test refusal							
						CONTRACT 31710	CHECKED CA



Final Report

Report No.: 16-08961-1

Initial Date of Issue: 25-Apr-2016

Client Geotechnical Engineering Ltd

Client Address: Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Contact(s): Claire Andrew

Project 31710 - University Of Reading Health
And Life Sciences

Quotation No.: **Date Received:** 19-Apr-2016

Order No.: 31710 **Date Instructed:** 19-Apr-2016

No. of Samples: 10

Turnaround (Wkdays): 5 **Results Due:** 25-Apr-2016

Date Approved: 25-Apr-2016

Approved By:



Details: Robert Monk, Technical Development
Chemist

Project: 31710 - University Of Reading Health And Life Sciences

Client: Geotechnical Engineering Ltd	Chemtest Job No.:				16-08961	16-08961	16-08961	16-08961	16-08961	16-08961	16-08961	16-08961
Quotation No.:	Chemtest Sample ID.:				282051	282052	282053	282054	282055	282056	282057	282058
Order No.: 31710	Client Sample Ref.:				TP03	TP03	BH01	BH01	BH01	BH01	BH02	BH02
	Client Sample ID.:				2B	4B	3B	7D	11B	18D	9D	17D
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.7	1.8	1.0	2.8	5.0	7.5	6.0	9.0
	Date Sampled:				15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016
Determinand	Accred.	SOP	Units	LOD								
Moisture	N	2030	%	0.020	14	16	14	21	22	20	20	20
pH	U	2010		N/A	8.0	7.9	7.9	7.3	7.1	8.1	8.2	8.3
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.17	0.11	0.10
Total Sulphur	U	2175	%	0.010	0.040	0.020	0.010	0.020	0.010	0.52	0.32	0.51
Sulphate (Acid Soluble)	U	2430	%	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.071	0.048	0.047

Project: 31710 - University Of Reading Health And Life Sciences

Client: Geotechnical Engineering Ltd	Chemtest Job No.:				16-08961	16-08961
Quotation No.:	Chemtest Sample ID.:				282059	282060
Order No.: 31710	Client Sample Ref.:				BH02	BH02
	Client Sample ID.:				25D	35D
	Sample Type:				SOIL	SOIL
	Top Depth (m):				12.0	15.95
	Date Sampled:				15-Apr-2016	15-Apr-2016
Determinand	Accred.	SOP	Units	LOD		
Moisture	N	2030	%	0.020	19	16
pH	U	2010		N/A	8.3	8.1
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.096	0.24
Total Sulphur	U	2175	%	0.010	0.79	0.92
Sulphate (Acid Soluble)	U	2430	%	0.010	0.073	0.068

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at our Coventry laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



APPENDIX F

CHEMICAL TESTING



Geotechnical Engineering Ltd
Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Attention: Jon Ind

CERTIFICATE OF ANALYSIS

Date: 14 April 2016
Customer: H_GEOTECHEN_GLO
Sample Delivery Group (SDG): 160403-9
Your Reference:
Location: University of Reading
Report No: 357003

We received 3 samples on Saturday April 02, 2016 and 2 of these samples were scheduled for analysis which was completed on Thursday April 14, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13194124	BH03	ES	0.20 - 0.30	31/03/2016
13194125	BH03	ES	0.60 - 0.70	31/03/2016
13194126	BH03	ES	1.50	31/03/2016

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



SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

SOLID Results Legend X Test N No Determination Possible	Lab Sample No(s)		13194124	13194125
	Customer Sample Reference		BH03	BH03
	AGS Reference		ES	ES
	Depth (m)		0.20 - 0.30	0.60 - 0.70
	Container		250g Amber Jar (AL) 1kg TUB	250g Amber Jar (AL) 1kg TUB
Anions by Kone (soil)	All	NDPs: 0 Tests: 2	X	X
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2	X	X
Boron Water Soluble	All	NDPs: 0 Tests: 2	X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 2	X	X
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 1	X	
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 1	X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 1		X
Metals in solid samples by OES	All	NDPs: 0 Tests: 2	X	X
PAH by GCMS	All	NDPs: 0 Tests: 2	X	X
pH	All	NDPs: 0 Tests: 2	X	X
Phenols Spec MS (S)	All	NDPs: 0 Tests: 2	X	X
Sample description	All	NDPs: 0 Tests: 2	X	X
Total Organic Carbon	All	NDPs: 0 Tests: 2	X	X
Total Sulphate	All	NDPs: 0 Tests: 2	X	X
TPH CWG GC (S)	All	NDPs: 0 Tests: 1	X	



SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2		
13194124	BH03	0.20 - 0.30	Dark Brown	Sand	0.063 - 2.00 mm	Concrete/Aggre gate	Stones		
13194125	BH03	0.60 - 0.70	Light Brown	Sandy Loam	0.063 - 2.00 mm	Concrete/Aggre gate	Stones		

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

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

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



CERTIFICATE OF ANALYSIS

Validated

SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Results Legend		Customer Sample R Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	BH03					
#	ISO17025 accredited.		BH03					
M	mCERTS accredited.		0.60 - 0.70					
aq	Aqueous / settled sample.		Soil/Solid					
diss.filt	Dissolved / filtered sample.		Soil/Solid					
tot.unfilt	Total / unfiltered sample.		31/03/2016					
*	Subcontracted test.		.					
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery		02/04/2016					
(F)	Trigger breach confirmed		160403-9					
1-5&\$#@	Sample deviation (see appendix)		13194125					
		ES						
Component	LOD/Units	Method						
Moisture Content Ratio (% of as received sample)	%	PM024	9.3	9.6				
Soil Organic Matter (SOM)	<0.35 %	TM132	0.595	0.44				
			#	#				
pH	1 pH Units	TM133	11.1	10.9				
			M	M				
Cyanide, Total	<1 mg/kg	TM153	<1	<1				
			M	M				
Arsenic	<0.6 mg/kg	TM181	13.2	9.14				
			M	M				
Cadmium	<0.02 mg/kg	TM181	0.174	0.189				
			M	M				
Chromium	<0.9 mg/kg	TM181	19.1	12				
			M	M				
Copper	<1.4 mg/kg	TM181	5.46	4.01				
			M	M				
Lead	<0.7 mg/kg	TM181	14.8	11.2				
			M	M				
Mercury	<0.14 mg/kg	TM181	<0.14	<0.14				
			M	M				
Nickel	<0.2 mg/kg	TM181	15.2	8.57				
			M	M				
Selenium	<1 mg/kg	TM181	<1	<1				
			#	#				
Zinc	<1.9 mg/kg	TM181	33.8	22.9				
			M	M				
Sulphate, Total	<48 mg/kg	TM221	4760	312				
			M	M				
Boron, water soluble	<1 mg/kg	TM222	1.05	<1				
			M	M				
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243	0.164	0.0803				
			M	M				

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Page 6 of 15

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Page 7 of 15



CERTIFICATE OF ANALYSIS

SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

TPH CWG (S)

Results Legend		Customer Sample R	BH03					
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.20 - 0.30 Soil/Solid 31/03/2016 . 02/04/2016 160403-9 13194124 ES					
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5	@	Sample deviation (see appendix)							
Component	LOD/Units			Method				
GRO Surrogate % recovery**	%	TM089	77					
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089	86.9 M					
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5 #					
Benzene	<10 µg/kg	TM089	<10 M					
Toluene	<2 µg/kg	TM089	<2 M					
Ethylbenzene	<3 µg/kg	TM089	<3 M					
m,p-Xylene	<6 µg/kg	TM089	<6 M					
o-Xylene	<3 µg/kg	TM089	<3 M					
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9					
sum of detected BTEX by GC	<24 µg/kg	TM089	<24					
Aliphatics >C5-C6	<10 µg/kg	TM089	<10					
Aliphatics >C6-C8	<10 µg/kg	TM089	<10					
Aliphatics >C8-C10	<10 µg/kg	TM089	<10					
Aliphatics >C10-C12	<10 µg/kg	TM089	36.3					
Aliphatics >C12-C16	<100 µg/kg	TM173	15800					
Aliphatics >C16-C21	<100 µg/kg	TM173	39600					
Aliphatics >C21-C35	<100 µg/kg	TM173	105000					
Aliphatics >C35-C44	<100 µg/kg	TM173	90000					
Total Aliphatics >C12-C44	<100 µg/kg	TM173	250000					
Aromatics >EC5-EC7	<10 µg/kg	TM089	<10					
Aromatics >EC7-EC8	<10 µg/kg	TM089	<10					
Aromatics >EC8-EC10	<10 µg/kg	TM089	<10					
Aromatics >EC10-EC12	<10 µg/kg	TM089	24.2					
Aromatics >EC12-EC16	<100 µg/kg	TM173	2520					
Aromatics >EC16-EC21	<100 µg/kg	TM173	8050					
Aromatics >EC21-EC35	<100 µg/kg	TM173	76700					
Aromatics >EC35-EC44	<100 µg/kg	TM173	127000					
Aromatics >EC40-EC44	<100 µg/kg	TM173	58100					
Total Aromatics >EC12-EC44	<100 µg/kg	TM173	214000					
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173	464000					



SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Asbestos Identification - Soil

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH03 ES 0.20 - 0.30 SOLID 31/03/2016 00:00:00 04/04/2016 16:15:35 160403-9 13194124 TM048	05/04/16	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH03 ES 0.60 - 0.70 SOLID 31/03/2016 00:00:00 08/04/2016 00:37:22 160403-9 13194125 TM048	14/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected



SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM072	Modified: US EPA Method 8141A	Determination of Phenols by GC-MS		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM221	Inductively Coupled Plasma - Atomic Emission Spectroscopy. An Atlas of Spectral Information: Winge, Fassel, Peterson and Floyd	Determination of Acid extractable Sulphate in Soils by IRIS Emission Spectrometer		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM243		Mixed Anions In Soils By Kone		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Test Completion Dates

Lab Sample No(s)	13194124	13194125
Customer Sample Ref.	BH03	BH03
AGS Ref.	ES	ES
Depth	0.20 - 0.30	0.60 - 0.70
Type	SOLID	SOLID

Anions by Kone (soil)	06-Apr-2016	06-Apr-2016
Asbestos ID in Solid Samples	07-Apr-2016	14-Apr-2016
Boron Water Soluble	05-Apr-2016	07-Apr-2016
Cyanide Comp/Free/Total/Thiocyanate	06-Apr-2016	07-Apr-2016
EPH CWG (Aliphatic) GC (S)	06-Apr-2016	
EPH CWG (Aromatic) GC (S)	06-Apr-2016	
GRO by GC-FID (S)	06-Apr-2016	
Metals in solid samples by OES	06-Apr-2016	07-Apr-2016
PAH by GCMS	06-Apr-2016	07-Apr-2016
pH	06-Apr-2016	06-Apr-2016
Phenols Spec MS (S)	08-Apr-2016	08-Apr-2016
Sample description	04-Apr-2016	05-Apr-2016
Total Organic Carbon	06-Apr-2016	08-Apr-2016
Total Sulphate	05-Apr-2016	07-Apr-2016
TPH CWG GC (S)	06-Apr-2016	



SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aliphatic) GC (S)

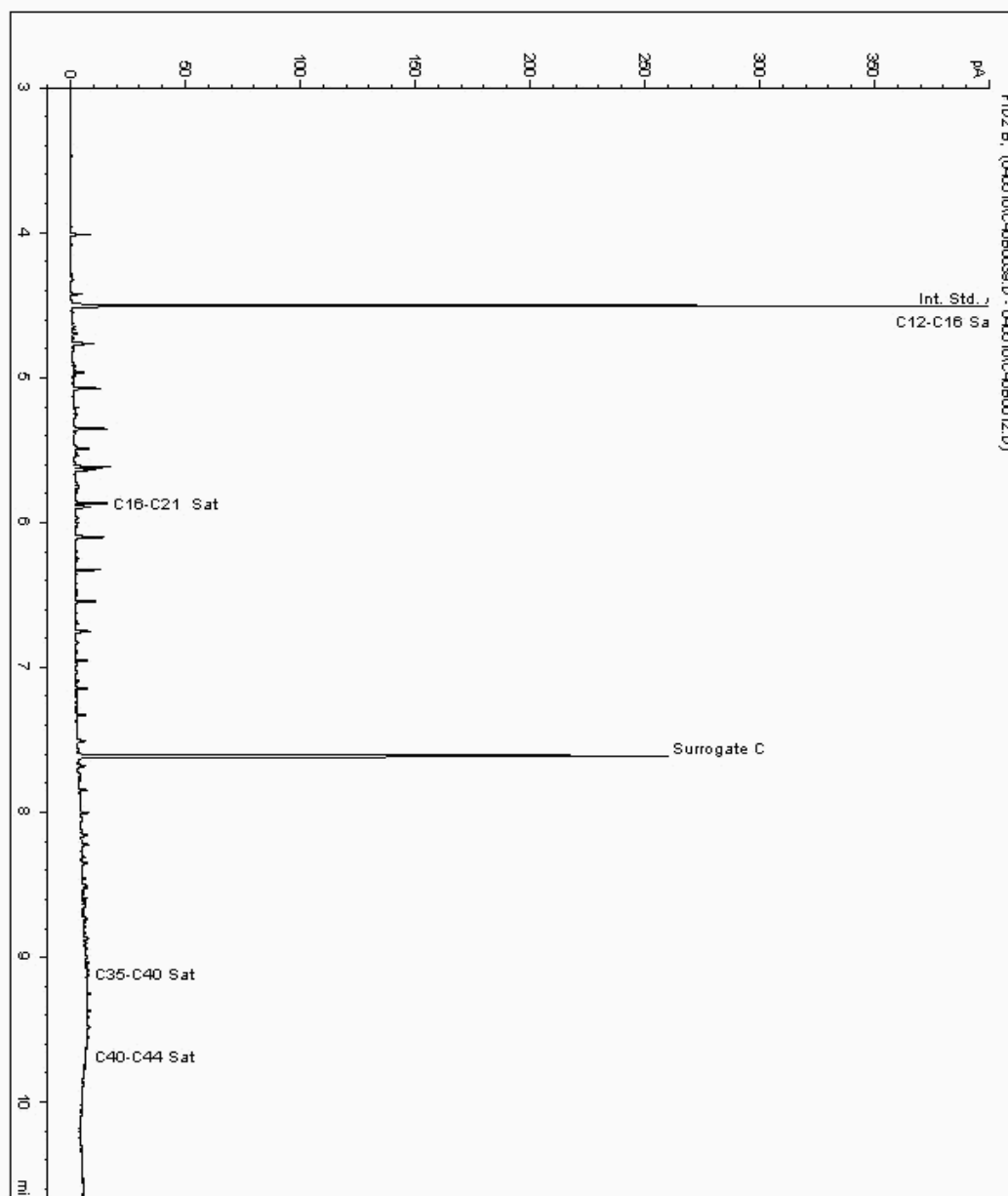
Sample No : 13199465
Sample ID : BH03

Depth : 0.20 - 0.30

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12431279-
Date Acquired : 05/04/2016 22:38:27 PM
Units : ppb
Dilution: BH03[0.20 - 0.30]

->





SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aromatic) GC (S)

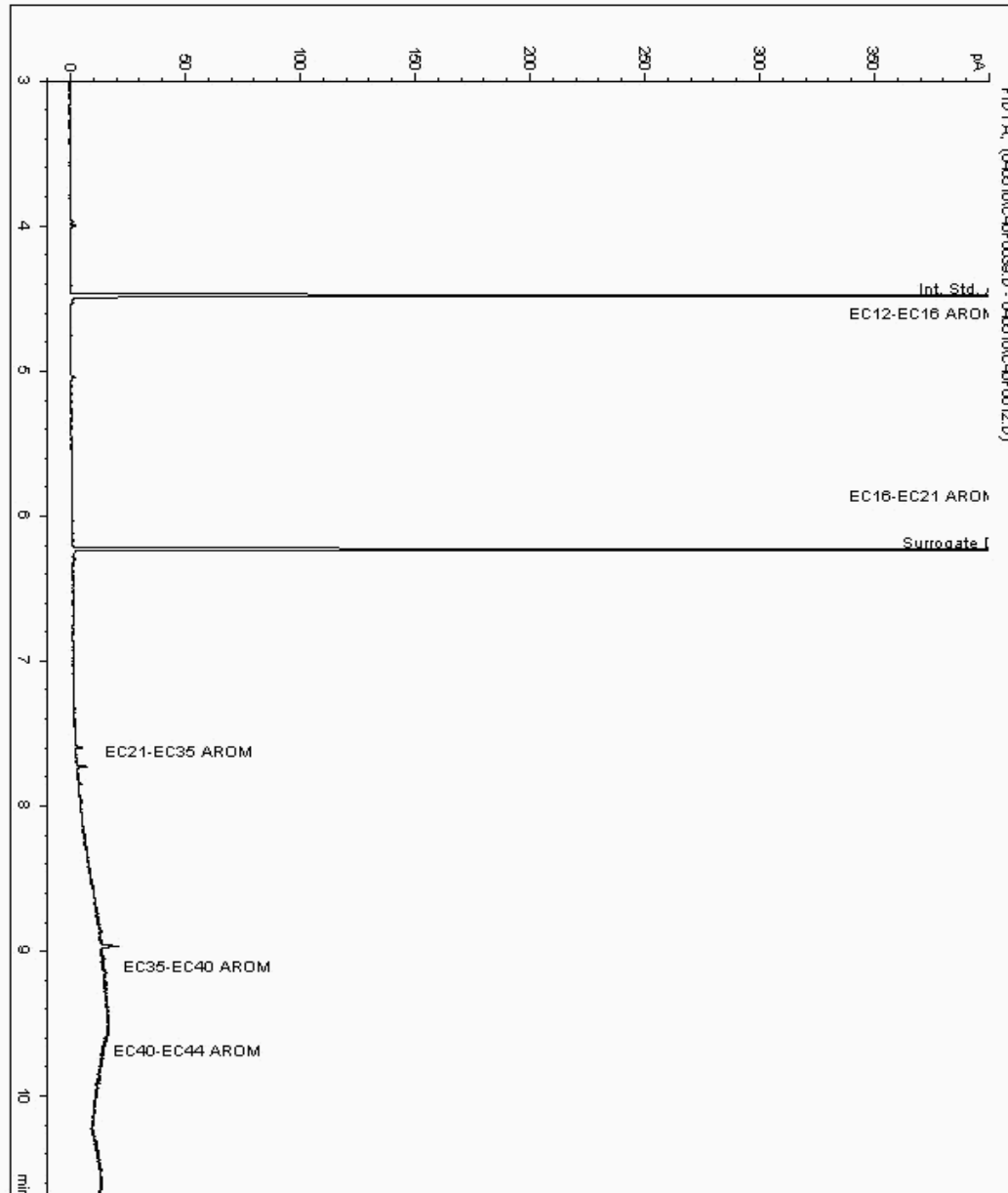
Sample No : 13199465
Sample ID : BH03

Depth : 0.20 - 0.30

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12431280-
Date Acquired : 05/04/2016 22:38:27 PM
Units : ppb
Dilution: BH03[0.20 - 0.30]

->





SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

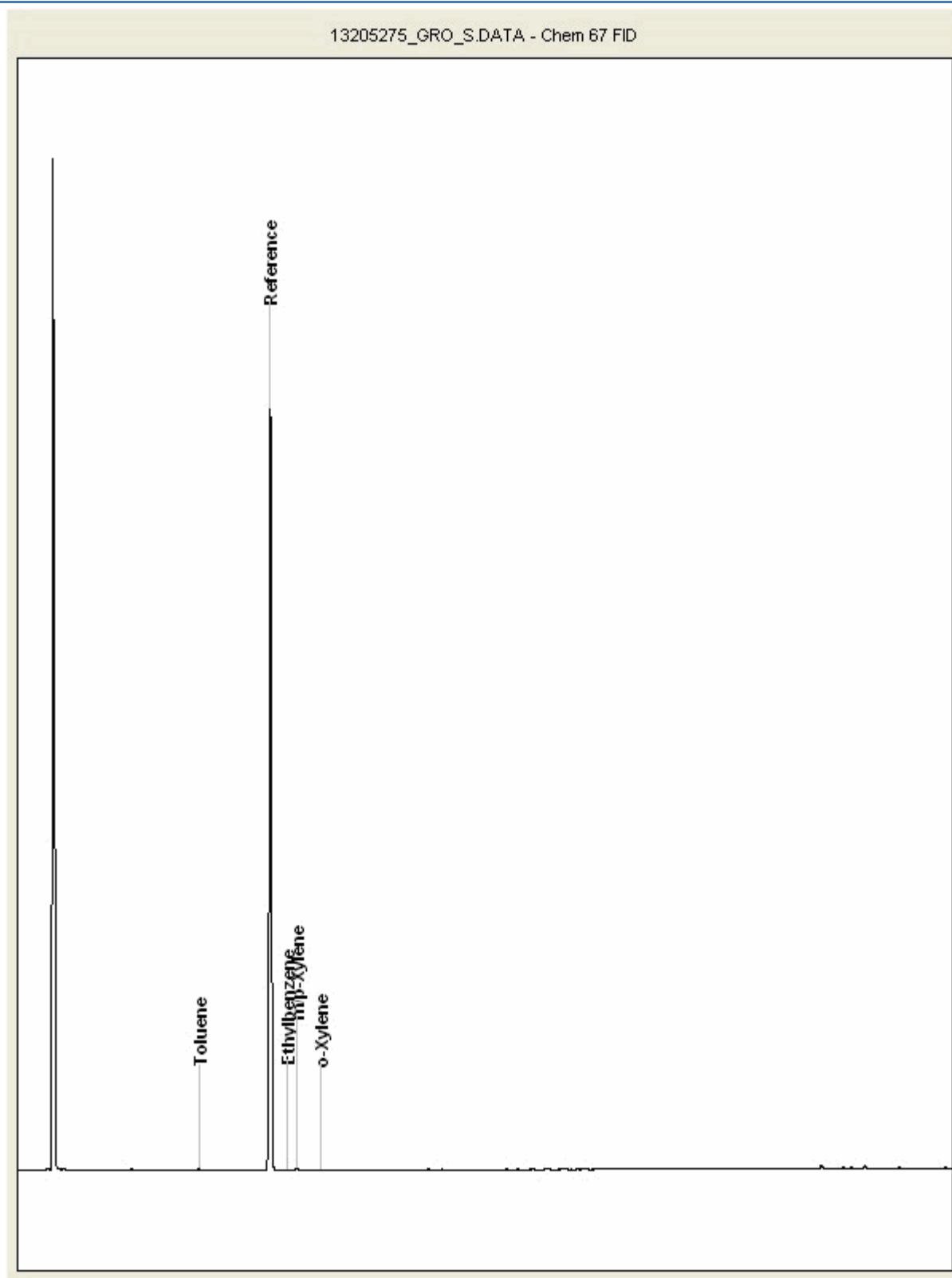
Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13205275
Sample ID : BH03

Depth : 0.20 - 0.30





SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Appendix

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

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

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

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

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

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

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

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

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

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

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

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

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

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

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

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

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

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

Visual Estimation Of Fibre Content

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

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

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



Geotechnical Engineering Ltd
Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Attention: Jon Ind

CERTIFICATE OF ANALYSIS

Date: 14 April 2016
Customer: H_GEOTECHEN_GLO
Sample Delivery Group (SDG): 160406-79
Your Reference:
Location: University of Reading
Report No: 356997

We received 18 samples on Wednesday April 06, 2016 and 6 of these samples were scheduled for analysis which was completed on Thursday April 14, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13212264	BH01		0.20 - 0.40	05/04/2016
13212265	BH01		0.50 - 0.70	05/04/2016
13212248	IP01		0.20	04/04/2016
13212249	IP01		0.60	04/04/2016
13212250	IP01		0.90 - 1.00	04/04/2016
13212251	IP02		0.20	04/04/2016
13212252	IP02		0.50	04/04/2016
13212253	IP02		1.00	04/04/2016
13212254	IP03		0.20	04/04/2016
13212255	IP03		0.50	04/04/2016
13212260	TP02		0.20	04/04/2016
13212261	TP02		0.80	04/04/2016
13212262	TP02		1.60	04/04/2016
13212263	TP02		2.50	04/04/2016
13212256	TP03		0.20	04/04/2016
13212257	TP03		0.70	04/04/2016
13212258	TP03		1.30	04/04/2016
13212259	TP03		1.80	04/04/2016

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



SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

SOLID Results Legend X Test N No Determination Possible	Lab Sample No(s)		Customer Sample Reference		AGS Reference		Depth (m)		Container	
	13212258		TP03				1.30		250g Amber Jar (AL 1kg TUB	
	13212257		TP03				0.70		60g VOC (ALE215) 250g Amber Jar (AL 1kg TUB	
	13212254		IP03				0.20		250g Amber Jar (AL 1kg TUB	
	13212253		IP02				1.00		250g Amber Jar (AL 1kg TUB	
	13212252		IP02				0.50		60g VOC (ALE215) 250g Amber Jar (AL 1kg TUB	
	13212249		IP01				0.60		60g VOC (ALE215) 250g Amber Jar (AL 1kg TUB	
Anions by Kone (soil)	All	NDPs: 0 Tests: 6								
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 5								
Boron Water Soluble	All	NDPs: 0 Tests: 6								
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 6								
Easily Liberated Sulphide	All	NDPs: 0 Tests: 6								
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 3								
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 3								
GRO by GC-FID (S)	All	NDPs: 0 Tests: 3								
Metals in solid samples by OES	All	NDPs: 0 Tests: 6								
PAH by GCMS	All	NDPs: 0 Tests: 6								
pH	All	NDPs: 0 Tests: 6								
Phenols Spec MS (S)	All	NDPs: 0 Tests: 6								
Sample description	All	NDPs: 0 Tests: 6								
Total Organic Carbon	All	NDPs: 0 Tests: 3								
TPH CWG GC (S)	All	NDPs: 0 Tests: 3								



SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
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Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
13212249	IP01	0.60	Dark Brown	Sandy Silt Loam	0.063 - 2.00 mm	Stones	None
13212252	IP02	0.50	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Stones	None
13212253	IP02	1.00	Dark Brown	Silty Clay	0.002 - 0.063 mm	Stones	None
13212254	IP03	0.20	Dark Brown	Sandy Silt Loam	0.063 - 2.00 mm	Stones	Vegetation
13212257	TP03	0.70	Dark Brown	Sandy Silt Loam	0.063 - 2.00 mm	Stones	None
13212258	TP03	1.30	Dark Brown	Sandy Loam	0.063 - 2.00 mm	Stones	None

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

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

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

SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

12:11:34 14/04/2016

Order Number: 31710/JL
Report Number: 356997
Superseded Report:

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CERTIFICATE OF ANALYSIS

SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Phenols Spec MS (S)

Results Legend		Customer Sample R	IP01	IP02	IP02	IP03	TP03	TP03
#	ISO17025 accredited.		0.60	0.50	1.00	0.20	0.70	1.30
M	mCERTS accredited.		Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
aq	Aqueous / settled sample.		04/04/2016	04/04/2016	04/04/2016	04/04/2016	04/04/2016	04/04/2016
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5&*\$@	Sample deviation (see appendix)							
Component		LOD/Units	Method					
4-Nitrophenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
2-Nitrophenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
2,4-Dichlorophenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
Pentachlorophenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
Phenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
4-Chloro-3-methylphenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
2,4-Dimethylphenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
2-Chlorophenol		<1 µg/kg	TM072	<10	<10	<10	<10	<10
Sum of Detected Phenols		<9 µg/kg	TM072	<90	<90	<90	<90	<90
</								



CERTIFICATE OF ANALYSIS

SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

TPH CWG (S)

Results Legend		Customer Sample R	IP01	IP02	TP03			
#	ISO17025 accredited.							
M	mCERTS accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.60 Soil/Solid 04/04/2016 06/04/2016 160406-79 13212249	0.50 Soil/Solid 04/04/2016 06/04/2016 160406-79 13212252	0.70 Soil/Solid 04/04/2016 06/04/2016 160406-79 13212257			
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5	@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
GRO Surrogate % recovery**	%	TM089	95	83	88			
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089	19500 M	107 M	<44 M			
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5 #	<5 #	<5 #			
Benzene	<10 µg/kg	TM089	<10 M	<10 M	<10 M			
Toluene	<2 µg/kg	TM089	<2 M	<2 M	2.34 M			
Ethylbenzene	<3 µg/kg	TM089	<3 M	<3 M	<3 M			
m,p-Xylene	<6 µg/kg	TM089	<6 M	<6 M	<6 M			
o-Xylene	<3 µg/kg	TM089	<3 M	<3 M	<3 M			
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9	<9	<9			
sum of detected BTEX by GC	<24 µg/kg	TM089	<24	<24	<24			
Aliphatics >C5-C6	<10 µg/kg	TM089	10.4	10.3	<10			
Aliphatics >C6-C8	<10 µg/kg	TM089	25.3	11.4	<10			
Aliphatics >C8-C10	<10 µg/kg	TM089	5020	23.9	<10			
Aliphatics >C10-C12	<10 µg/kg	TM089	6680	21.7	<10			
Aliphatics >C12-C16	<100 µg/kg	TM173	6070	173	<100			
Aliphatics >C16-C21	<100 µg/kg	TM173	6060	<100	<100			
Aliphatics >C21-C35	<100 µg/kg	TM173	7260	2190	2840			
Aliphatics >C35-C44	<100 µg/kg	TM173	<100	<100	<100			
Total Aliphatics >C12-C44	<100 µg/kg	TM173	19400	2360	2840			
Aromatics >EC5-EC7	<10 µg/kg	TM089	<10	<10	<10			
Aromatics >EC7-EC8	<10 µg/kg	TM089	<10	<10	<10			
Aromatics >EC8-EC10	<10 µg/kg	TM089	3350	23.9	<10			
Aromatics >EC10-EC12	<10 µg/kg	TM089	4450	14.8	<10			
Aromatics >EC12-EC16	<100 µg/kg	TM173	3550	538	<100			
Aromatics >EC16-EC21	<100 µg/kg	TM173	9080	2580	<100			
Aromatics >EC21-EC35	<100 µg/kg	TM173	27900	9850	2570			
Aromatics >EC35-EC44	<100 µg/kg	TM173	6350	3210	976			
Aromatics >EC40-EC44	<100 µg/kg	TM173	1600	1020	<100			
Total Aromatics >EC12-EC44	<100 µg/kg	TM173	46900	16200	3540			
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173	85800	18600	6390			



SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Asbestos Identification - Soil

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	IP01 0.60 SOLID 04/04/2016 00:00:00 07/04/2016 13:07:00 160406-79 13212249 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	IP02 0.50 SOLID 04/04/2016 00:00:00 07/04/2016 12:58:28 160406-79 13212252 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	IP03 0.20 SOLID 04/04/2016 00:00:00 07/04/2016 20:51:46 160406-79 13212254 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP03 0.70 SOLID 04/04/2016 00:00:00 07/04/2016 20:58:45 160406-79 13212257 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP03 1.30 SOLID 04/04/2016 00:00:00 07/04/2016 15:36:45 160406-79 13212258 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected



SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM072	Modified: US EPA Method 8141A	Determination of Phenols by GC-MS		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)'	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM243		Mixed Anions In Soils By Kone		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



CERTIFICATE OF ANALYSIS

Validated

SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Test Completion Dates

Lab Sample No(s)	13212249	13212252	13212253	13212254	13212257	13212258
Customer Sample Ref.	IP01	IP02	IP02	IP03	TP03	TP03
AGS Ref.						
Depth	0.60	0.50	1.00	0.20	0.70	1.30
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID

Anions by Kone (soil)	13-Apr-2016	12-Apr-2016	12-Apr-2016	13-Apr-2016	13-Apr-2016	12-Apr-2016
Asbestos ID in Solid Samples	13-Apr-2016	13-Apr-2016		13-Apr-2016	13-Apr-2016	13-Apr-2016
Boron Water Soluble	11-Apr-2016	13-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016	13-Apr-2016
Cyanide Comp/Free/Total/Thiocyanate	11-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016
Easily Liberated Sulphide	13-Apr-2016	13-Apr-2016	13-Apr-2016	08-Apr-2016	08-Apr-2016	08-Apr-2016
EPH CWG (Aliphatic) GC (S)	11-Apr-2016	11-Apr-2016			11-Apr-2016	
EPH CWG (Aromatic) GC (S)	11-Apr-2016	11-Apr-2016			11-Apr-2016	
GRO by GC-FID (S)	11-Apr-2016	11-Apr-2016			11-Apr-2016	
Metals in solid samples by OES	12-Apr-2016	12-Apr-2016	11-Apr-2016	12-Apr-2016	12-Apr-2016	12-Apr-2016
PAH by GCMS	11-Apr-2016	11-Apr-2016	12-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016
pH	11-Apr-2016	11-Apr-2016	08-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016
Phenols Spec MS (S)	14-Apr-2016	14-Apr-2016	14-Apr-2016	14-Apr-2016	14-Apr-2016	14-Apr-2016
Sample description	07-Apr-2016	07-Apr-2016	08-Apr-2016	07-Apr-2016	07-Apr-2016	07-Apr-2016
Total Organic Carbon			13-Apr-2016	13-Apr-2016	13-Apr-2016	
TPH CWG GC (S)	11-Apr-2016	11-Apr-2016			11-Apr-2016	



SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

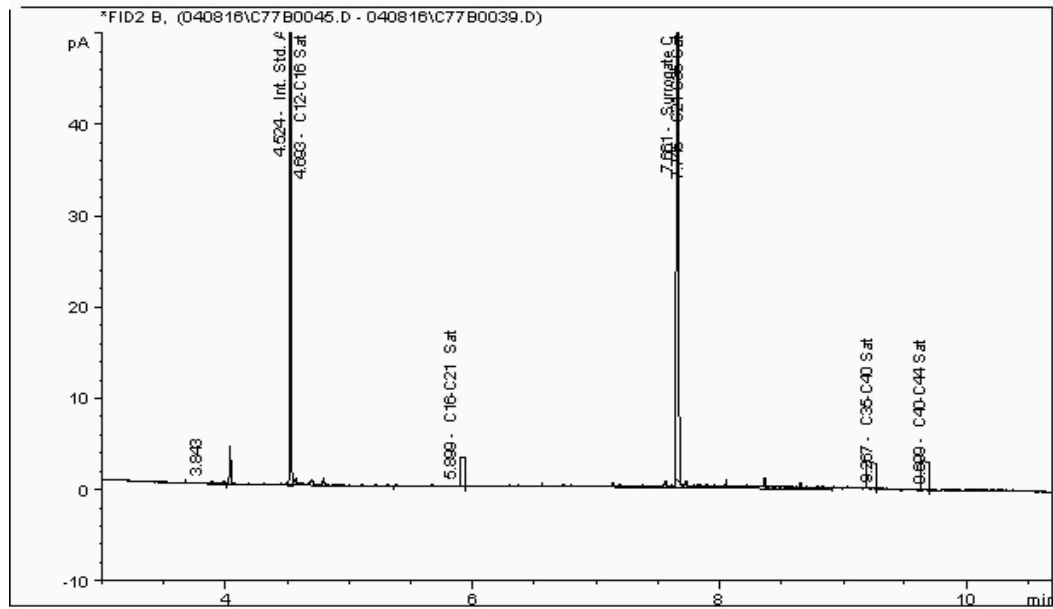
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 13221373
Sample ID : TP03

Depth : 0.70

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443920-
Date Acquired : 08/04/2016 23:46:14 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

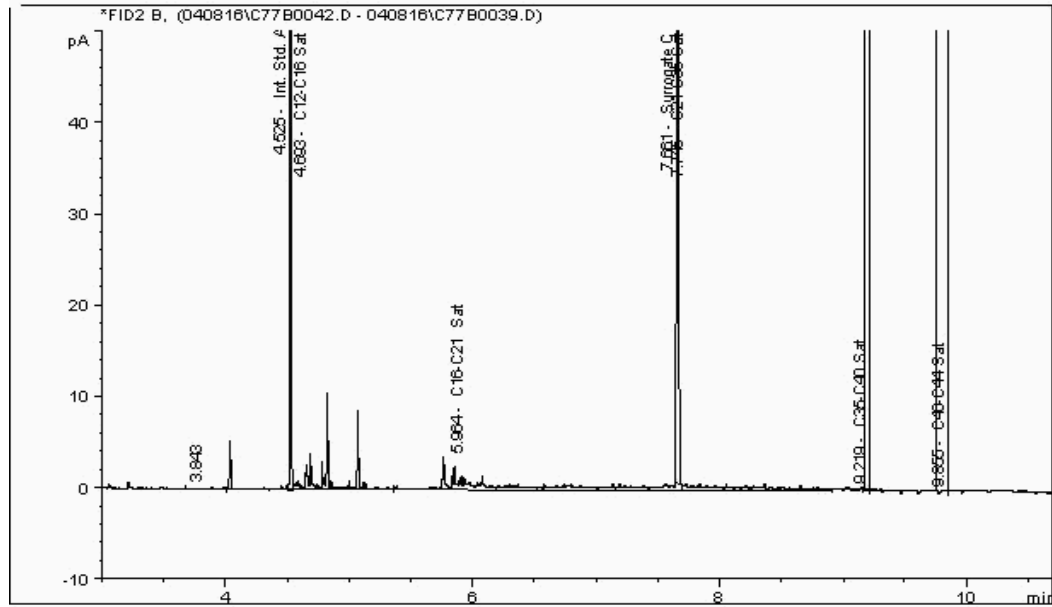
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 13221385
Sample ID : IP01

Depth : 0.60

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443793-
Date Acquired : 08/04/2016 22:53:13 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

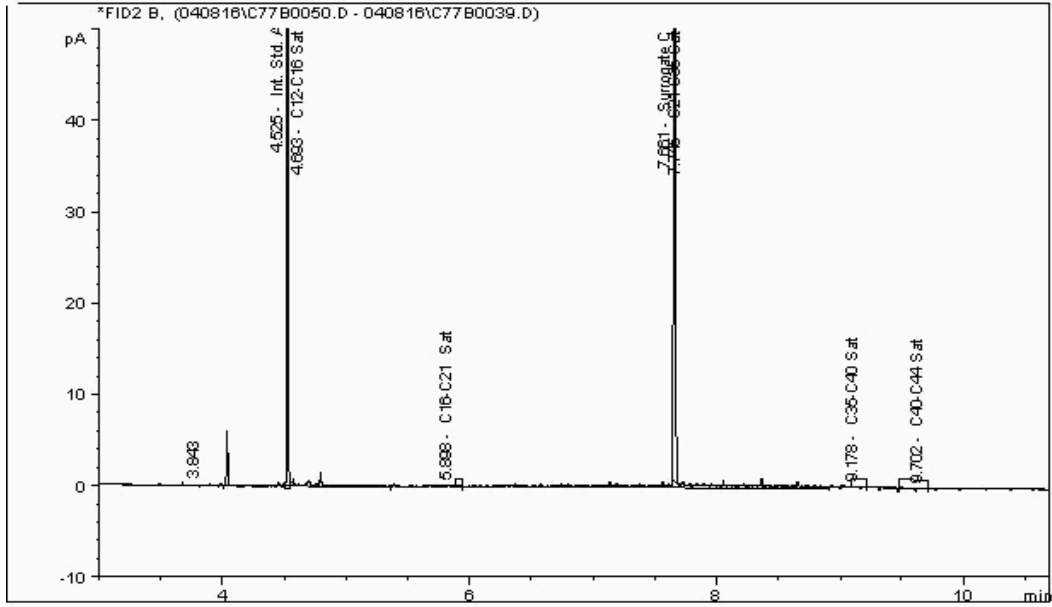
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 13221420
Sample ID : IP02

Depth : 0.50

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443833-
Date Acquired : 09/04/2016 01:11:33 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

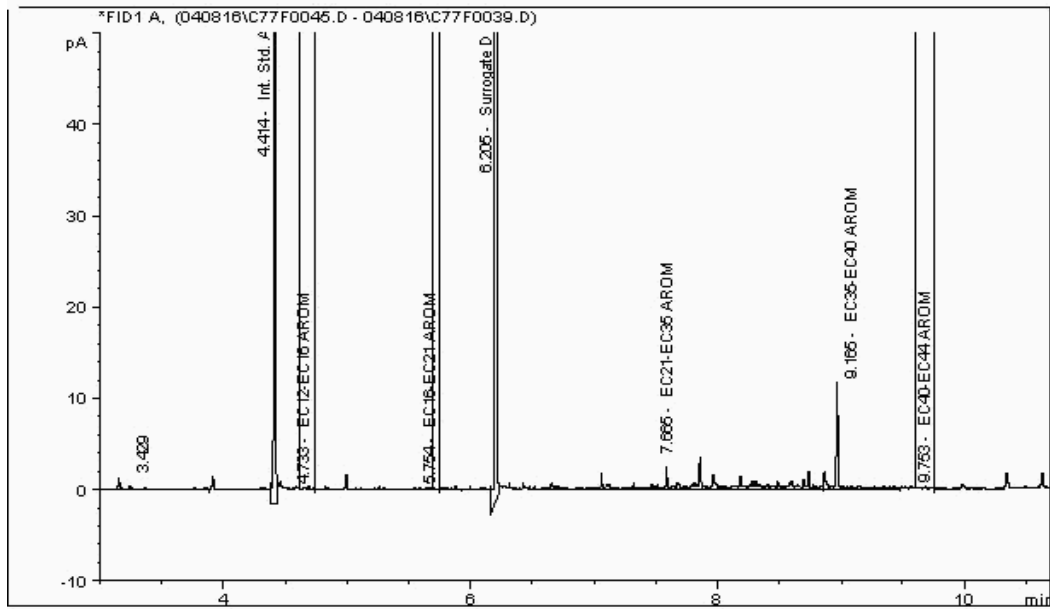
Analysis: EPH CWG (Aromatic) GC (S)

Sample No : 13221373
Sample ID : TP03

Depth : 0.70

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443921-
Date Acquired : 08/04/2016 23:46:14 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

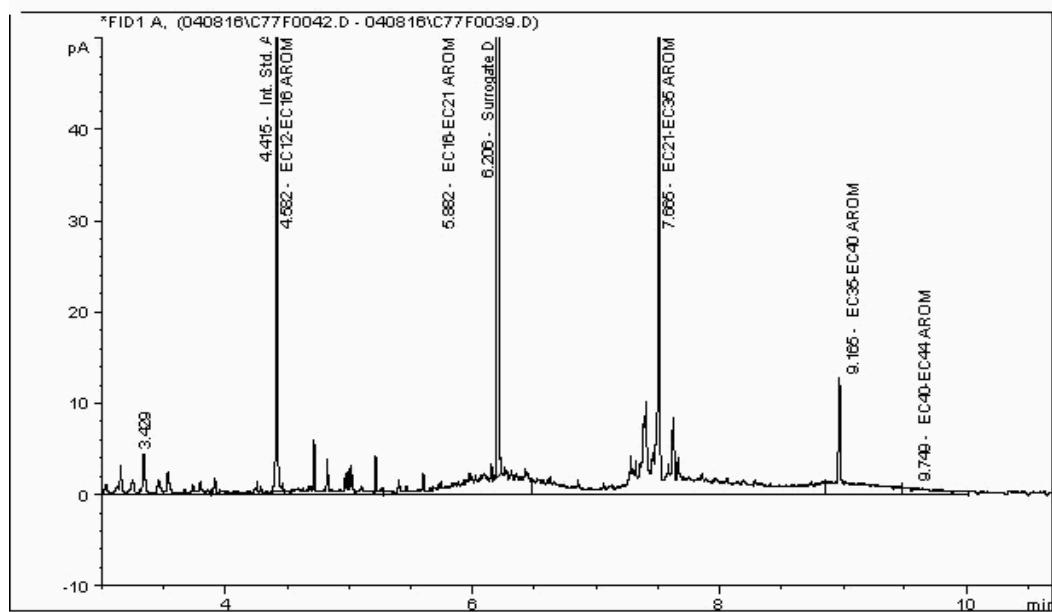
Analysis: EPH CWG (Aromatic) GC (S)

Sample No : 13221385
Sample ID : IP01

Depth : 0.60

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443794-
Date Acquired : 08/04/2016 22:53:13 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

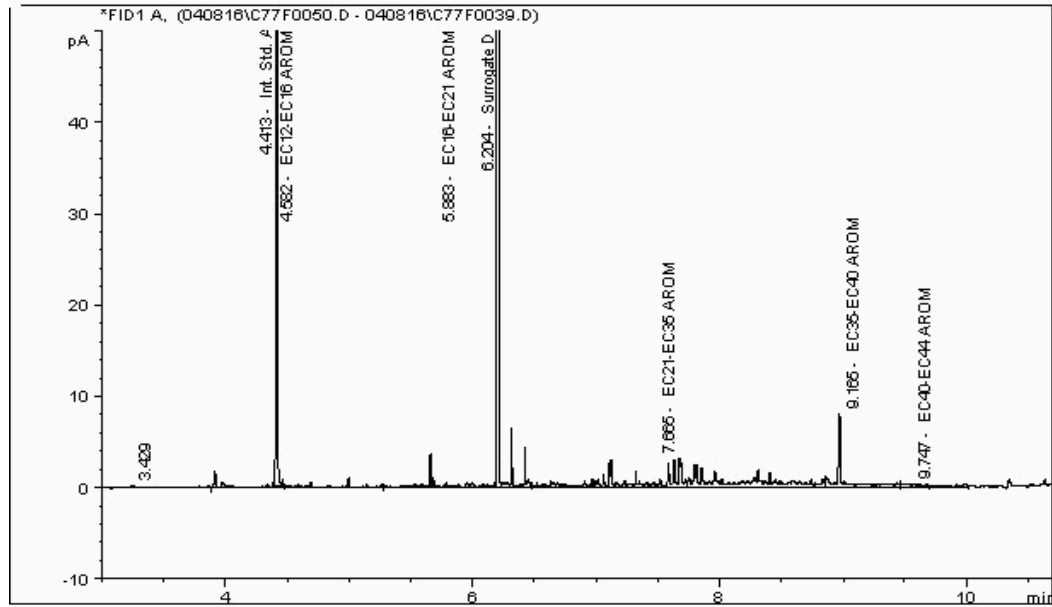
Analysis: EPH CWG (Aromatic) GC (S)

Sample No : 13221420
Sample ID : IP02

Depth : 0.50

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443834-
Date Acquired : 09/04/2016 01:11:33 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

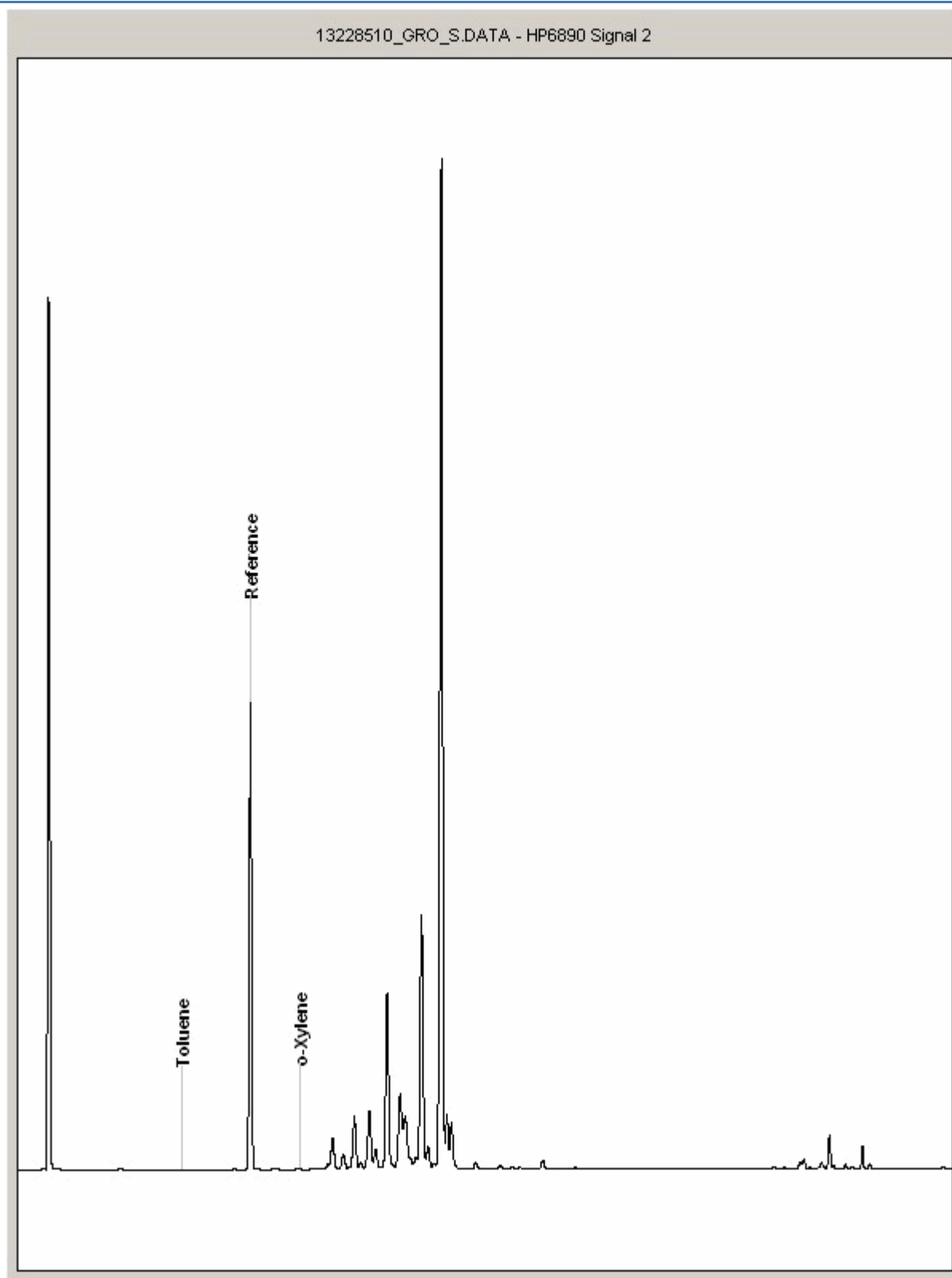
Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13228510
Sample ID : IP01

Depth : 0.60





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

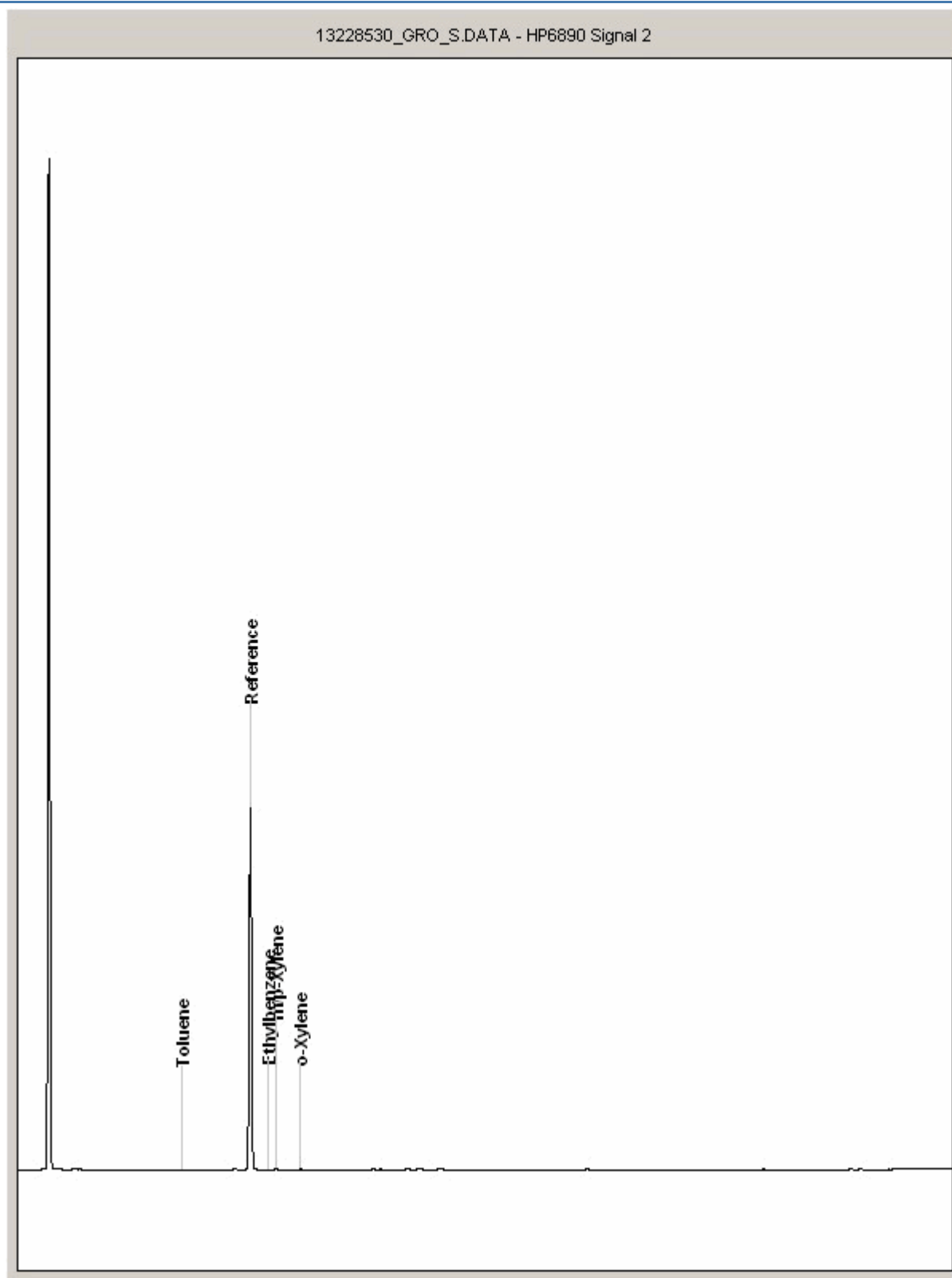
Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13228530
Sample ID : IP02

Depth : 0.50





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

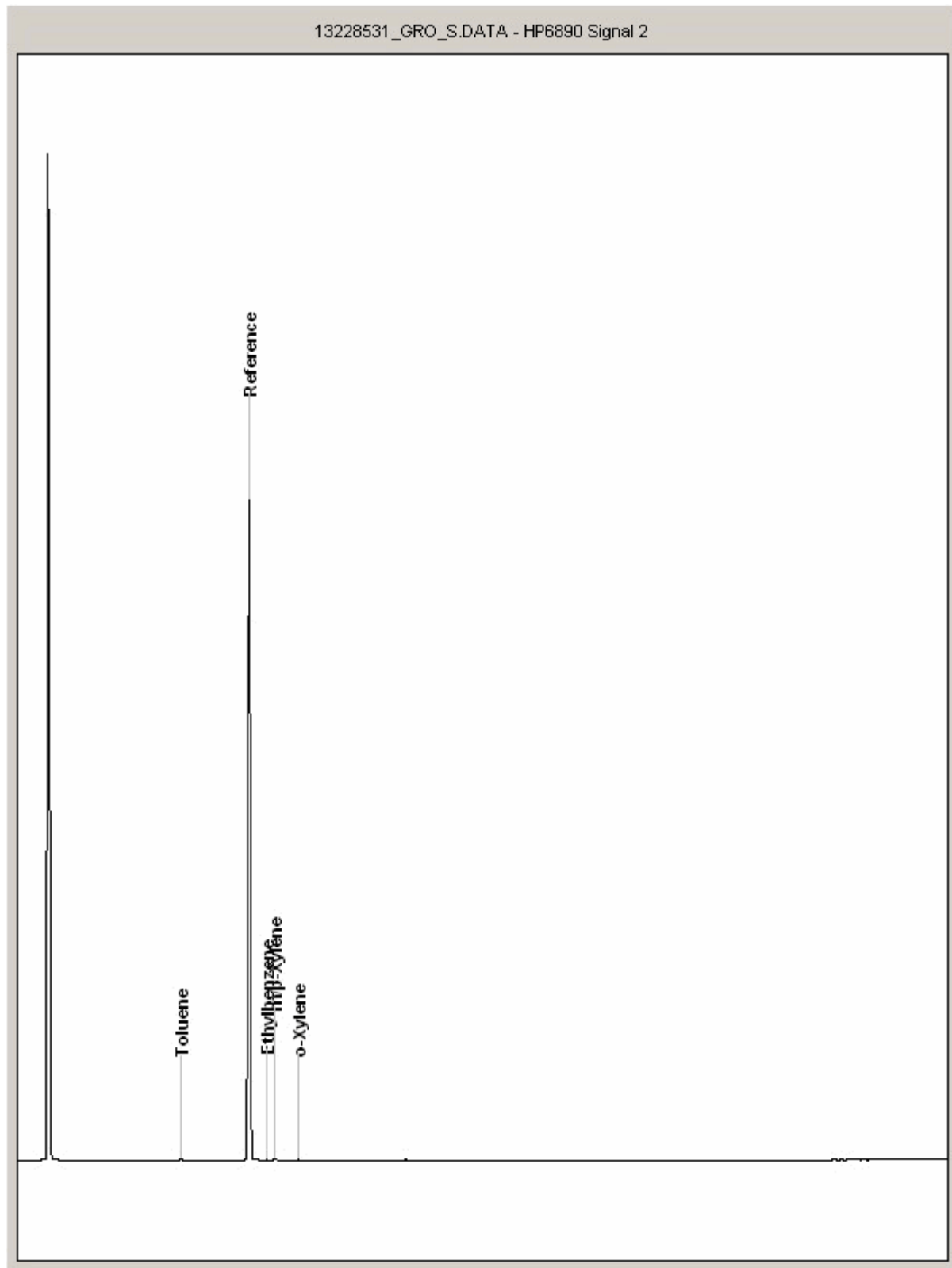
Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13228531
Sample ID : TP03

Depth : 0.70





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Appendix

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

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

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

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

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

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

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

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

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

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

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

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

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

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

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

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

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

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

Visual Estimation Of Fibre Content

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

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

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



Geotechnical Engineering Ltd
Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Attention: Jon Ind

CERTIFICATE OF ANALYSIS

Date: 22 April 2016
Customer: H_GEOTECHEN_GLO
Sample Delivery Group (SDG): 160413-30
Your Reference:
Location: University of Reading
Report No: 358159

We received 4 samples on Tuesday April 12, 2016 and 2 of these samples were scheduled for analysis which was completed on Friday April 22, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13244493	BH02		0.20 - 0.30	11/04/2016
13244494	BH02		0.50 - 0.70	11/04/2016
13244495	BH02		1.00 - 1.20	11/04/2016
13244496	BH02		2.00 - 2.20	11/04/2016

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



SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

SOLID Results Legend X Test N No Determination Possible	Lab Sample No(s)		13244494	13244495
	Customer Sample Reference		BH02	BH02
	AGS Reference			
	Depth (m)		0.50 - 0.70	1.00 - 1.20
	Container		250g Amber Jar (AL) 1kg TUB	250g Amber Jar (AL) 1kg TUB
Anions by Kone (soil)	All	NDPs: 0 Tests: 2	X	X
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2	X	X
Boron Water Soluble	All	NDPs: 0 Tests: 2	X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 2	X	X
Easily Liberated Sulphide	All	NDPs: 0 Tests: 2	X	X
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 1	X	
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 1	X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 1		X
Metals in solid samples by OES	All	NDPs: 0 Tests: 2	X	X
PAH by GCMS	All	NDPs: 0 Tests: 2	X	X
pH	All	NDPs: 0 Tests: 2	X	X
Phenols Spec MS (S)	All	NDPs: 0 Tests: 2	X	X
Sample description	All	NDPs: 0 Tests: 2	X	X
TPH CWG GC (S)	All	NDPs: 0 Tests: 1	X	



SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2		
13244494	BH02	0.50 - 0.70	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Vegetation	Stones		
13244495	BH02	1.00 - 1.20	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Vegetation	Stones		

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

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

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

Order Number:
Report Number: 358159
Superseded Report:

16:31:25 22/04/2016

Order Number:
Report Number: 358159
Superseded Report:

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Order Number:
Report Number: 358159
Superseded Report:

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CERTIFICATE OF ANALYSIS

SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

TPH CWG (S)

Results Legend		Customer Sample R		BH02				
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.50 - 0.70 Soil/Solid 11/04/2016 . 12/04/2016 160413-30 13244494					
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-58*\$@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
GRO Surrogate % recovery**	%	TM089	125					
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089	<44 M					
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5 #					
Benzene	<10 µg/kg	TM089	<10 M					
Toluene	<2 µg/kg	TM089	<2 M					
Ethylbenzene	<3 µg/kg	TM089	<3 M					
m,p-Xylene	<6 µg/kg	TM089	<6 M					
o-Xylene	<3 µg/kg	TM089	<3 M					
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9					
sum of detected BTEX by GC	<24 µg/kg	TM089	<24					
Aliphatics >C5-C6	<10 µg/kg	TM089	<10					
Aliphatics >C6-C8	<10 µg/kg	TM089	<10					
Aliphatics >C8-C10	<10 µg/kg	TM089	<10					
Aliphatics >C10-C12	<10 µg/kg	TM089	<10					
Aliphatics >C12-C16	<100 µg/kg	TM173	<100					
Aliphatics >C16-C21	<100 µg/kg	TM173	<100					
Aliphatics >C21-C35	<100 µg/kg	TM173	<100					
Aliphatics >C35-C44	<100 µg/kg	TM173	259					
Total Aliphatics >C12-C44	<100 µg/kg	TM173	259					
Aromatics >EC5-EC7	<10 µg/kg	TM089	<10					
Aromatics >EC7-EC8	<10 µg/kg	TM089	<10					
Aromatics >EC8-EC10	<10 µg/kg	TM089	<10					
Aromatics >EC10-EC12	<10 µg/kg	TM089	<10					
Aromatics >EC12-EC16	<100 µg/kg	TM173	1640					
Aromatics >EC16-EC21	<100 µg/kg	TM173	24900					
Aromatics >EC21-EC35	<100 µg/kg	TM173	58300					
Aromatics >EC35-EC44	<100 µg/kg	TM173	22800					
Aromatics >EC40-EC44	<100 µg/kg	TM173	9060					
Total Aromatics >EC12-EC44	<100 µg/kg	TM173	108000					
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173	108000					



SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Asbestos Identification - Soil

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref.	BH02	21/4/16	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Depth (m)	0.50 - 0.70										
Sample Type	SOLID										
Date Sampled	11/04/2016										
Date Receieved	00:00:00										
SDG	18/04/2016										
Original Sample	10:06:53										
Method Number	160413-30										
	13244494										
	TM048										
Cust. Sample Ref.	BH02	21/4/16	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Depth (m)	1.00 - 1.20										
Sample Type	SOLID										
Date Sampled	11/04/2016										
Date Receieved	00:00:00										
SDG	18/04/2016										
Original Sample	10:12:05										
Method Number	160413-30										
	13244495										
	TM048										



SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM072	Modified: US EPA Method 8141A	Determination of Phenols by GC-MS		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished) ¹	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM243		Mixed Anions In Soils By Kone		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Test Completion Dates

Lab Sample No(s)	13244494	13244495
Customer Sample Ref.	BH02	BH02
AGS Ref.		
Depth	0.50 - 0.70	1.00 - 1.20
Type	SOLID	SOLID

Anions by Kone (soil)	21-Apr-2016	21-Apr-2016
Asbestos ID in Solid Samples	21-Apr-2016	21-Apr-2016
Boron Water Soluble	20-Apr-2016	19-Apr-2016
Cyanide Comp/Free/Total/Thiocyanate	20-Apr-2016	20-Apr-2016
Easily Liberated Sulphide	21-Apr-2016	21-Apr-2016
EPH CWG (Aliphatic) GC (S)	19-Apr-2016	
EPH CWG (Aromatic) GC (S)	19-Apr-2016	
GRO by GC-FID (S)	19-Apr-2016	
Metals in solid samples by OES	21-Apr-2016	21-Apr-2016
PAH by GCMS	21-Apr-2016	21-Apr-2016
pH	19-Apr-2016	19-Apr-2016
Phenols Spec MS (S)	22-Apr-2016	22-Apr-2016
Sample description	15-Apr-2016	15-Apr-2016
TPH CWG GC (S)	19-Apr-2016	



SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aliphatic) GC (S)

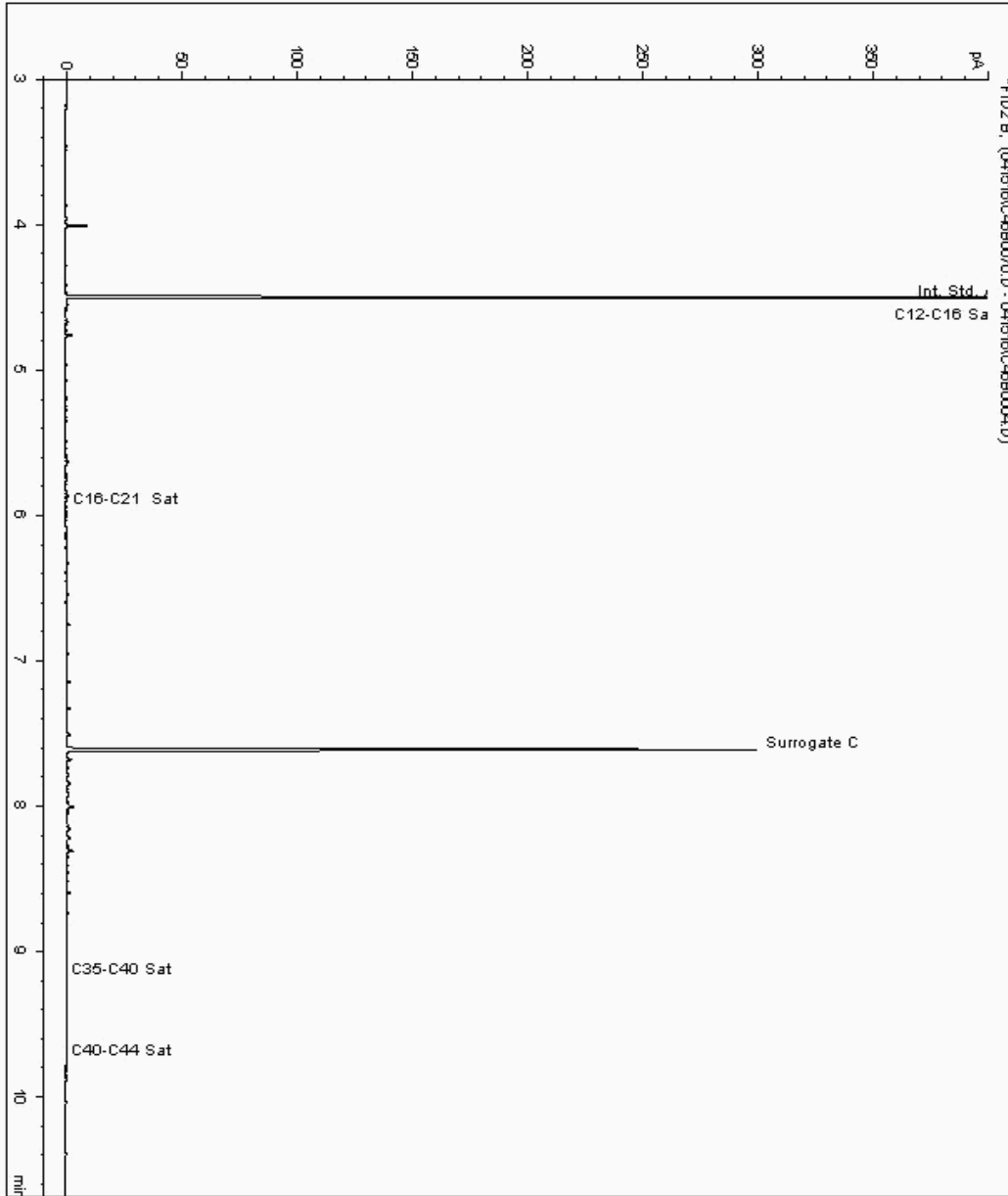
Sample No : 13261412
Sample ID : BH02

Depth : 0.50 - 0.70

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12475048-
Date Acquired : 18/04/2016 18:08:14 PM
Units : ppb
Dilution: BH02[0.50 - 0.70]

->





SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aromatic) GC (S)

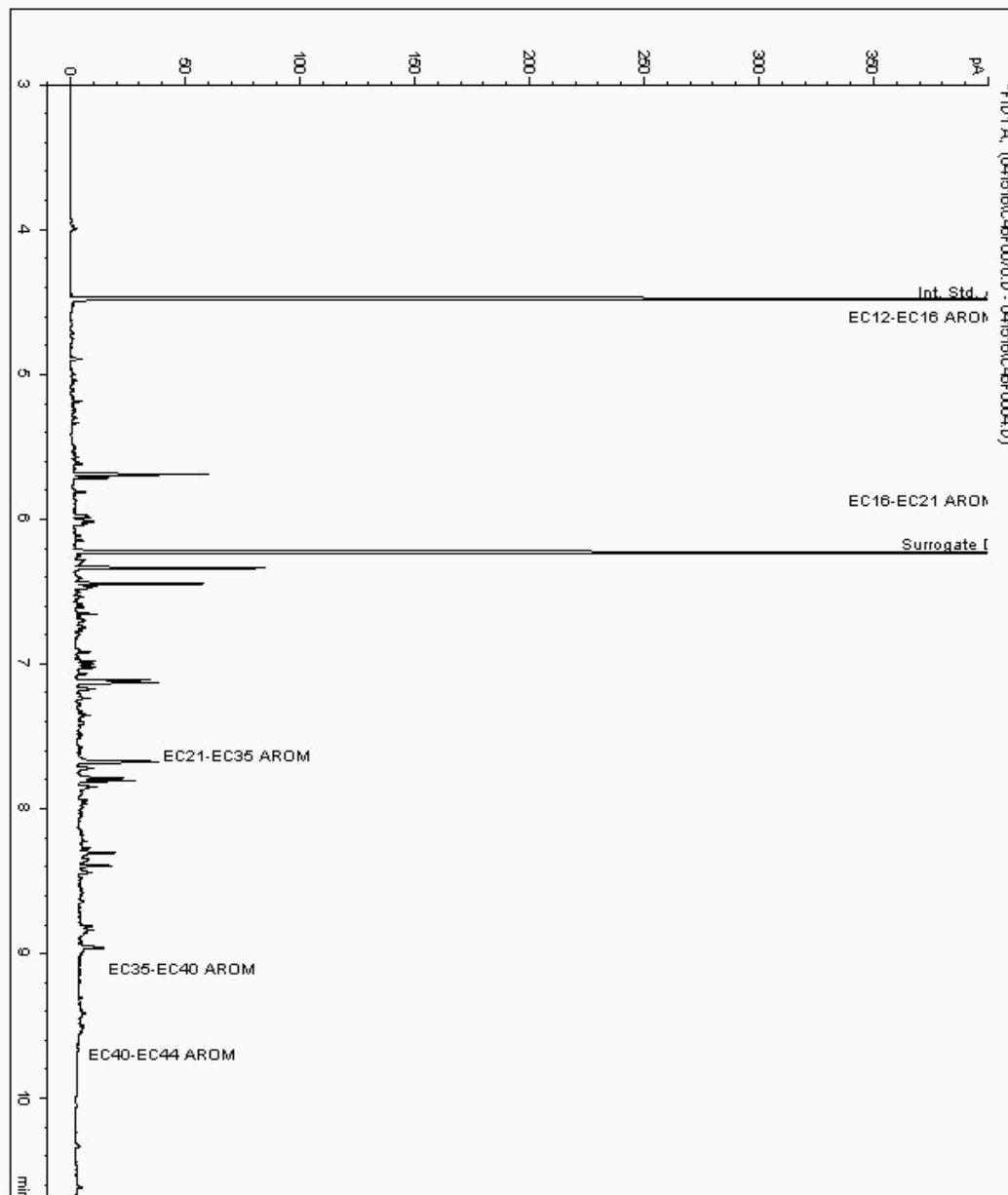
Sample No : 13261412
Sample ID : BH02

Depth : 0.50 - 0.70

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12475049-
Date Acquired : 18/04/2016 18:08:14 PM
Units : ppb
Dilution: BH02[0.50 - 0.70]

->





SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

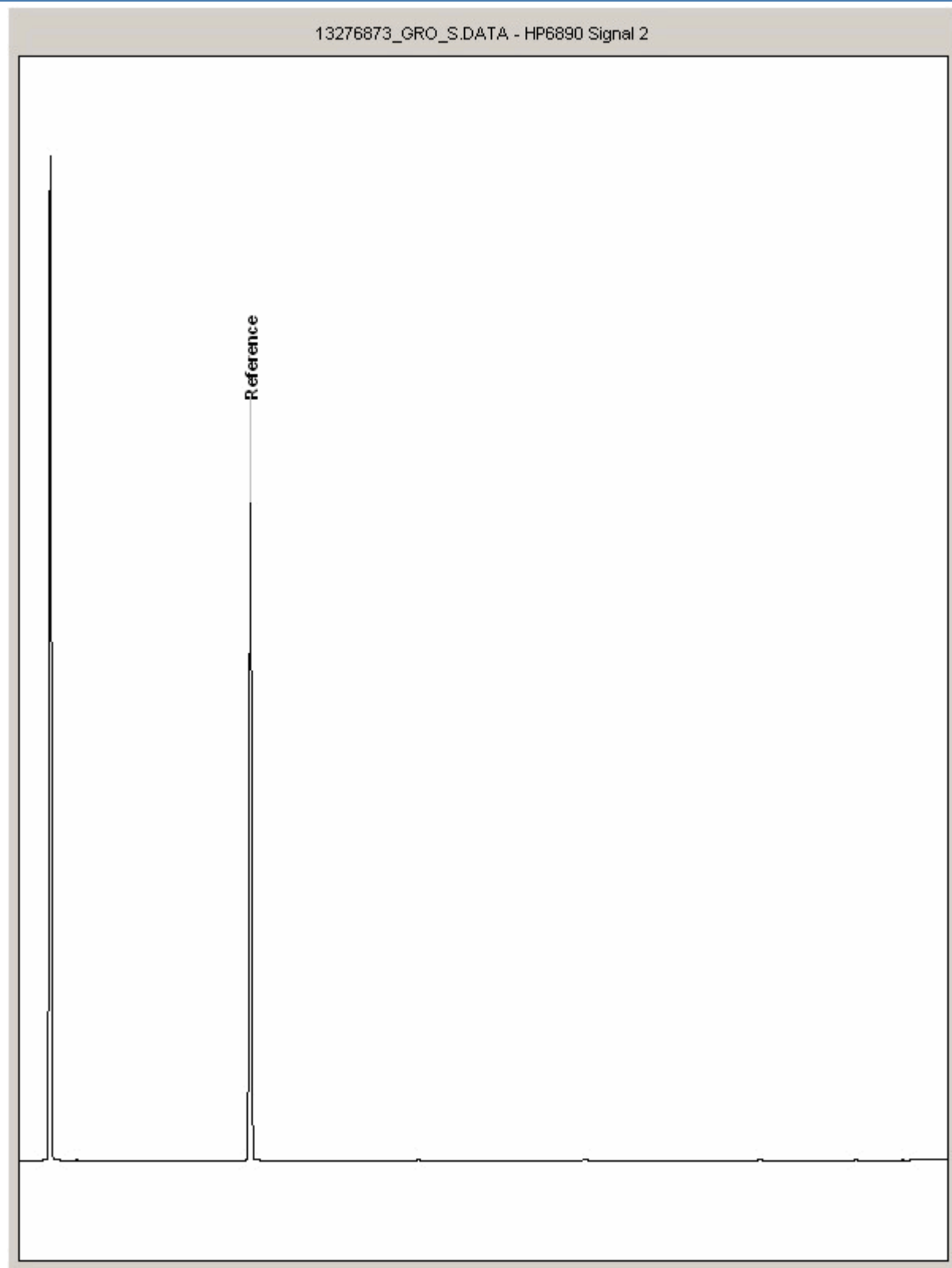
Order Number:
Report Number: 358159
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13276873
Sample ID : BH02

Depth : 0.50 - 0.70





SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

Appendix

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

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

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

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

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

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

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

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

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

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

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

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

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

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

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

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

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Almandine	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

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

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

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



Geotechnical Engineering Ltd
Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Attention: Jon Ind

CERTIFICATE OF ANALYSIS

Date: 27 April 2016
Customer: H_GEOTECHEN_GLO
Sample Delivery Group (SDG): 160419-67
Your Reference:
Location: University of Reading
Report No: 358783

We received 4 samples on Tuesday April 19, 2016 and 4 of these samples were scheduled for analysis which was completed on Wednesday April 27, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	160419-67	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358783
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13283521	BH01		3.91	18/04/2016
13283523	BH02		3.22	18/04/2016
13283519	BH03		3.52	18/04/2016
13283522	BH04		3.83	18/04/2016

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



SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

LIQUID Results Legend X Test N No Determination Possible	Lab Sample No(s)		13283521	13283523	13283519	13283522
	Customer Sample Reference		BH01	BH02	BH03	BH04
	AGS Reference					
	Depth (m)		3.91	3.22	3.52	3.83
	Container		Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)
Alkalinity as CaCO3	All	NDPs: 0 Tests: 4	X	X	X	X
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 4	X	X	X	X
Anions by Kone (w)	All	NDPs: 0 Tests: 4	X	X	X	X
COD Unfiltered	All	NDPs: 0 Tests: 4	X	X	X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4	X	X	X	X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 4	X	X	X	X
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 4	X	X	X	X
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 4	X	X	X	X
GRO by GC-FID (W)	All	NDPs: 0 Tests: 4		X	X	X
Mercury Dissolved	All	NDPs: 0 Tests: 4	X	X	X	X
Metals by iCap-OES Unfiltered (W)	All	NDPs: 0 Tests: 2	X	X		
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 4	X	X	X	X
pH Value	All	NDPs: 0 Tests: 4	X	X	X	X
Phenols by ms (w)	All	NDPs: 0 Tests: 4	X	X	X	X
Sulphide	All	NDPs: 0 Tests: 4	X	X	X	X



SDG:160419-67

Job:H_GEOTECHEN_GLO-236

Client Reference:

Location:University of Reading

Customer:Geotechnical Engineering Ltd

Attention:Jon Ind

Order Number:

Report Number:358783

Superseded Report:

LIQUID

Results Legend

X

Test

N

No Determination Possible

Lab Sample No(s)	13283521	13283523	13283519	13283522
Customer Sample Reference	BH01	BH02	BH03	BH04
AGS Reference				
Depth (m)	3.91	3.22	3.52	3.83
Container	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)
Total Metals by ICP-MS	All	NDPs: 0 Tests: 4		
TPH CWG (W)	All	NDPs: 0 Tests: 4		



CERTIFICATE OF ANALYSIS

SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Results Legend		Customer Sample R						
#	ISO17025 accredited.		BH01	BH02	BH03	BH04		
M	mCERTS accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	3.91	3.22	3.52	3.83		
aq	Aqueous / settled sample.		Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)		
diss.filt	Dissolved / filtered sample.		18/04/2016	18/04/2016	18/04/2016	18/04/2016		
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery		19/04/2016	19/04/2016	19/04/2016	19/04/2016		
(F)	Trigger breach confirmed		160419-67	160419-67	160419-67	160419-67		
1-58*\$@	Sample deviation (see appendix)		13283521	13283523	13283519	13283522		
Component	LOD/Units	Method						
Alkalinity, Total as CaCO3	<2 mg/l	TM043	347	343	96.9	421		
			#	#	#	#		
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2	<0.2	<0.2	<0.2		
			#	#	#	#		
Sulphide	<0.01 mg/l	TM101	<0.1	<0.1	1.3	<0.1		
			#	#	#	#		
COD, unfiltered	<7 mg/l	TM107	2450	722	424	1090		
			#	#	#	#		
Arsenic (diss.filt)	<0.12 µg/l	TM152	0.46	0.383	0.369	1.18		
			#	#	#	#		
Boron (diss.filt)	<9.4 µg/l	TM152	17.7	30.3	15.7	22.5		
			#	#	#	#		
Cadmium (diss.filt)	<0.1 µg/l	TM152	0.151	<0.1	0.209	<0.1		
			#	#	#	#		
Chromium (diss.filt)	<0.22 µg/l	TM152	4.22	4.66	2.76	4.47		
			#	#	#	#		
Copper (diss.filt)	<0.85 µg/l	TM152	0.9	1.91	0.946	1.96		
			#	#	#	#		
Lead (diss.filt)	<0.02 µg/l	TM152	0.057	0.158	0.05	0.065		
			#	#	#	#		
Nickel (diss.filt)	<0.15 µg/l	TM152	9.9	5.86	30.6	4.35		
			#	#	#	#		
Selenium (diss.filt)	<0.39 µg/l	TM152	6.92	2.28	1.53	26.5		
			#	#	#	#		
Zinc (diss.filt)	<0.41 µg/l	TM152	8.09	8.74	14.6	2.7		
			#	#	#	#		
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01	<0.01	<0.01	<0.01		
			#	#	#	#		
Sulphate	<2 mg/l	TM184	65.7	37.5	59	99.4		
			#	#	#	#		
Chromium (tot.unfilt)	<3 µg/l	TM191	597	410	208	209		
			#	#	#	#		
Phenol	<0.5 µg/l	TM205	<1	<1	<1	<1		
2-methylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
3-methylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
4-methylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2-chlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,4-dimethylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
4-chloro-3-methylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,6-dichlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
4-Chlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,4-dichlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2-nitrophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,4,6-trichlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,4,5-trichlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
4-nitrophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,3,5,6-tetrachlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,3,4,6-tetrachlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		

Order Number:
Report Number: 358783
Superseded Report:

17:05:39 27/04/2016

Order Number:
Report Number: 358783
Superseded Report:

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CERTIFICATE OF ANALYSIS

SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

TPH CWG (W)

Results Legend		Customer Sample R	BH01	BH02	BH03	BH04		
#	ISO17025 accredited.							
M	mCERTS accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	3.91 Water(GW/SW) 18/04/2016 19/04/2016 160419-67 13283521	3.22 Water(GW/SW) 18/04/2016 19/04/2016 160419-67 13283523	3.52 Water(GW/SW) 18/04/2016 19/04/2016 160419-67 13283519	3.83 Water(GW/SW) 18/04/2016 19/04/2016 160419-67 13283522		
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5	@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
GRO Surrogate % recovery**	%	TM245	93	94	92	90		
GRO >C5-C12	<50 µg/l	TM245	<50	<50	<50	<50		
Methyl tertiary butyl ether (MTBE)	<3 µg/l	TM245	<3	<3	<3	<3		
Benzene	<7 µg/l	TM245	<7	<7	<7	<7		
Toluene	<4 µg/l	TM245	<4	<4	<4	<4		
Ethylbenzene	<5 µg/l	TM245	<5	<5	<5	<5		
m,p-Xylene	<8 µg/l	TM245	<8	<8	<8	<8		
o-Xylene	<3 µg/l	TM245	<3	<3	<3	<3		
Sum of detected Xylenes	<11 µg/l	TM245	<11	<11	<11	<11		
Sum of detected BTEX	<28 µg/l	TM245	<28	<28	<28	<28		
Aliphatics >C5-C6	<10 µg/l	TM245	<10	<10	<10	<10		
Aliphatics >C6-C8	<10 µg/l	TM245	<10	<10	<10	<10		
Aliphatics >C8-C10	<10 µg/l	TM245	<10	<10	<10	<10		
Aliphatics >C10-C12	<10 µg/l	TM245	<10	<10	<10	<10		
Aliphatics >C12-C16 (aq)	<10 µg/l	TM174	12	10	15	<10		
Aliphatics >C16-C21 (aq)	<10 µg/l	TM174	273	110	313	20		
Aliphatics >C21-C35 (aq)	<10 µg/l	TM174	1410	514	1310	141		
Total Aliphatics >C12-C35 (aq)	<10 µg/l	TM174	1700	634	1640	161		
Aromatics >EC5-EC7	<10 µg/l	TM245	<10	<10	<10	<10		
Aromatics >EC7-EC8	<10 µg/l	TM245	<10	<10	<10	<10		
Aromatics >EC8-EC10	<10 µg/l	TM245	<10	<10	<10	<10		
Aromatics >EC10-EC12	<10 µg/l	TM245	<10	<10	<10	<10		
Aromatics >EC12-EC16 (aq)	<10 µg/l	TM174	21	<10	11	19		
Aromatics >EC16-EC21 (aq)	<10 µg/l	TM174	165	58	80	136		
Aromatics >EC21-EC35 (aq)	<10 µg/l	TM174	902	355	453	661		
Total Aromatics >EC12-EC35 (aq)	<10 µg/l	TM174	1090	413	544	816		
Total Aliphatics & Aromatics >C5-35 (aq)	<10 µg/l	TM174	2790	1070	2190	977		



SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser		
TM101	Method 4500B & C, AWWA/APHA, 20th Ed., 1999	Determination of Sulphide in soil and water samples using the Kone Analyser		
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM191	Standard Methods for the examination of waters and wastewaters 16th Edition, ALPHA, Washington DC, USA. ISBN 0-87553-131-8.	Determination of Unfiltered Metals in Water Matrices by ICP-MS		
TM205		Determination of Phenols in Waste Waters using Solid Phase Extraction, Acetylation, Gas Chromatography and Mass Selective Detection		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM228	US EPA Method 6010B	Determination of Major Cations in Water by iCap 6500 Duo ICP-OES		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
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Order Number:
Report Number: 358783
Superseded Report:

Test Completion Dates

Lab Sample No(s)	13283521	13283523	13283519	13283522
Customer Sample Ref.	BH01	BH02	BH03	BH04
AGS Ref.				
Depth	3.91	3.22	3.52	3.83
Type	LIQUID	LIQUID	LIQUID	LIQUID
Alkalinity as CaCO ₃	25-Apr-2016	25-Apr-2016	26-Apr-2016	25-Apr-2016
Ammoniacal Nitrogen	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
Anions by Kone (w)	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
COD Unfiltered	23-Apr-2016	21-Apr-2016	22-Apr-2016	22-Apr-2016
Cyanide Comp/Free/Total/Thiocyanate	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016
Dissolved Metals by ICP-MS	25-Apr-2016	25-Apr-2016	25-Apr-2016	25-Apr-2016
EPH CWG (Aliphatic) Aqueous GC (W)	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016
EPH CWG (Aromatic) Aqueous GC (W)	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016
GRO by GC-FID (W)	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016
Mercury Dissolved	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
Metals by iCap-OES Unfiltered (W)	26-Apr-2016	26-Apr-2016		
PAH Spec MS - Aqueous (W)	25-Apr-2016	22-Apr-2016	25-Apr-2016	22-Apr-2016
pH Value	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
Phenols by ms (w)	27-Apr-2016	27-Apr-2016	27-Apr-2016	27-Apr-2016
Sulphide	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
Total Metals by ICP-MS	26-Apr-2016	26-Apr-2016	26-Apr-2016	26-Apr-2016
TPH CWG (W)	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016



SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

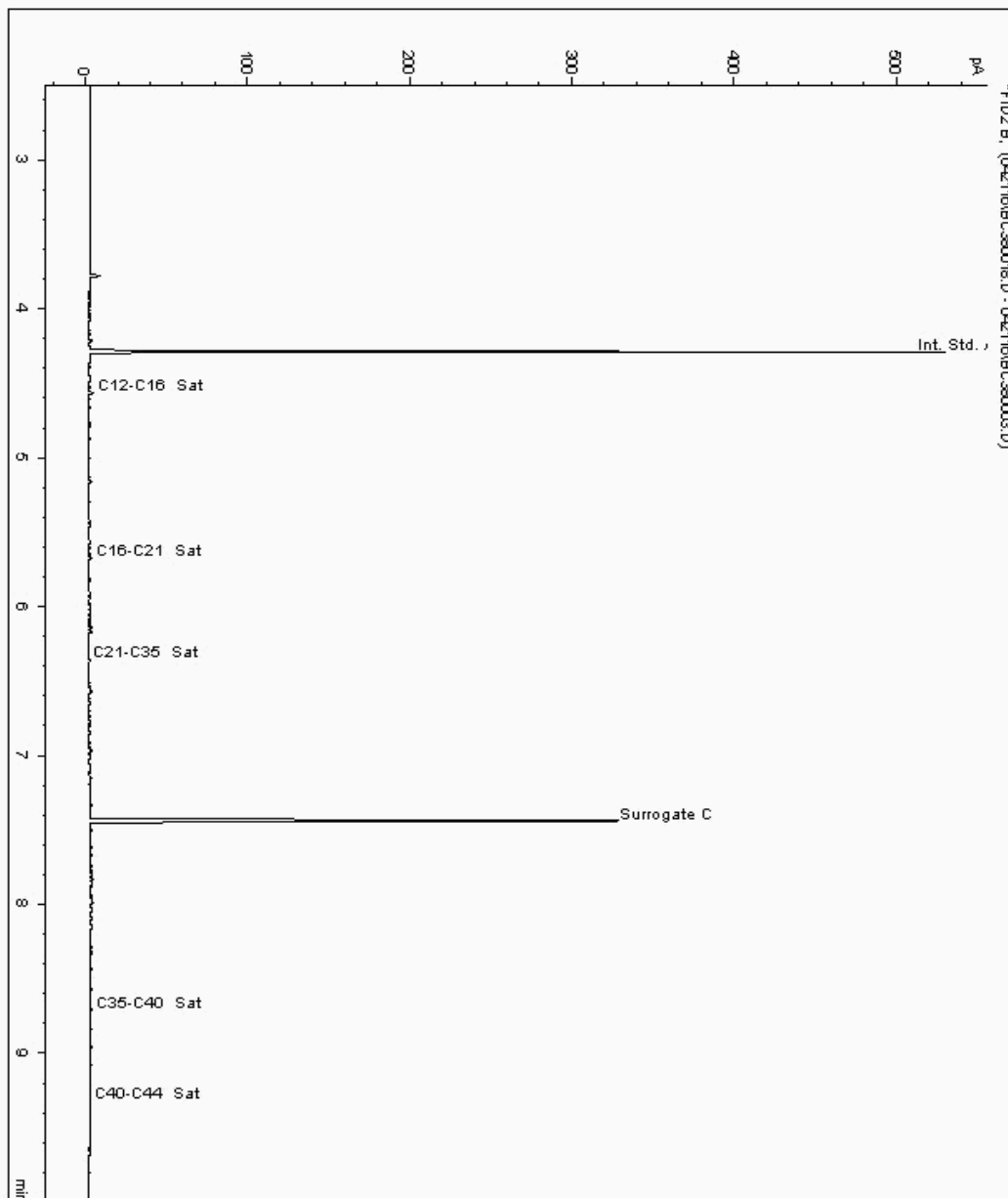
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 13288596
Sample ID : BH04

Depth : 3.83

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12507646-
Date Acquired : 21/04/16 20:37:01 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

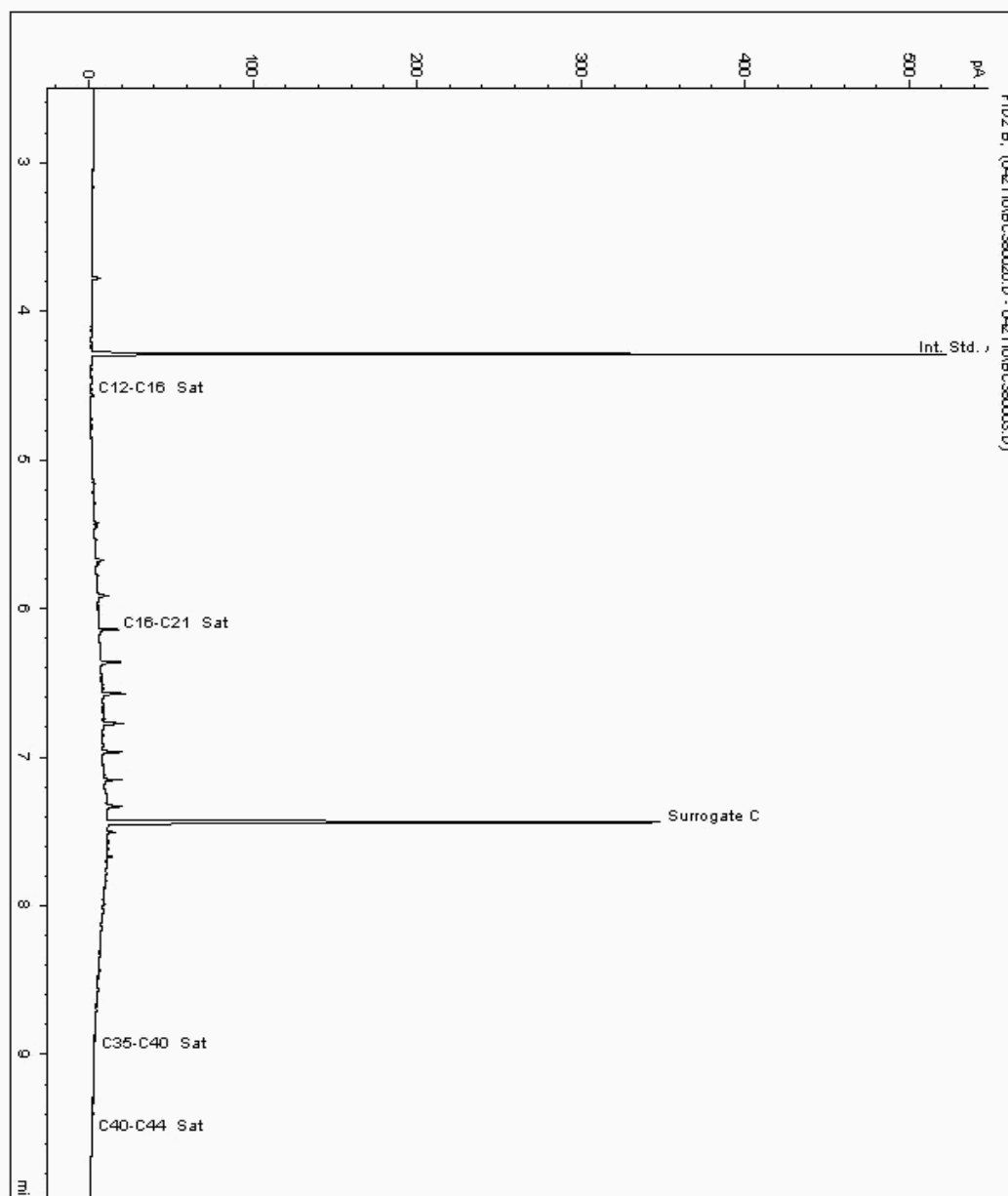
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 13288841
Sample ID : BH03

Depth : 3.52

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12507607-
Date Acquired : 21/04/16 21:04:37 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

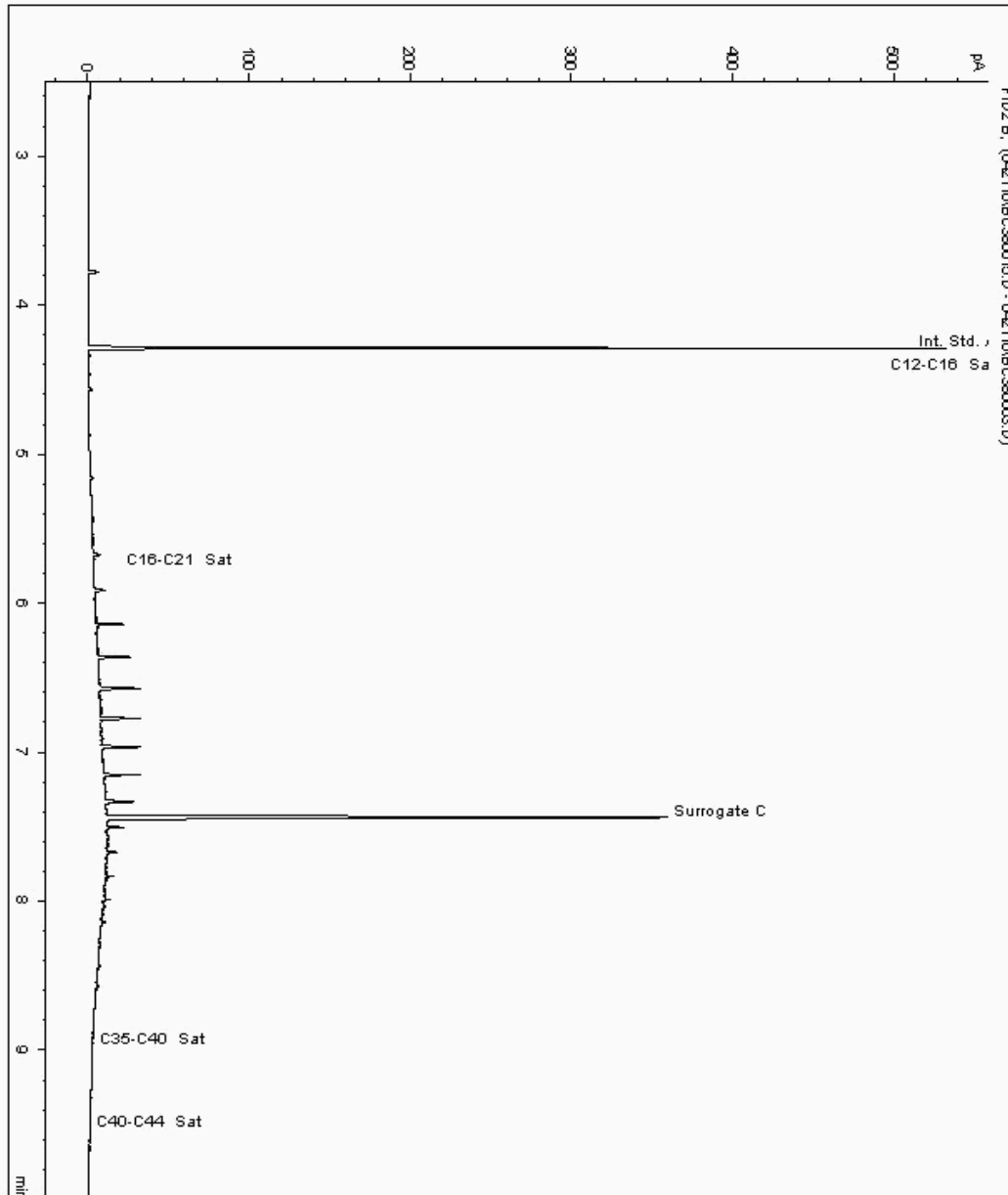
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 13288917
Sample ID : BH01

Depth : 3.91

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12507626-
Date Acquired : 21/04/16 19:50:40 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

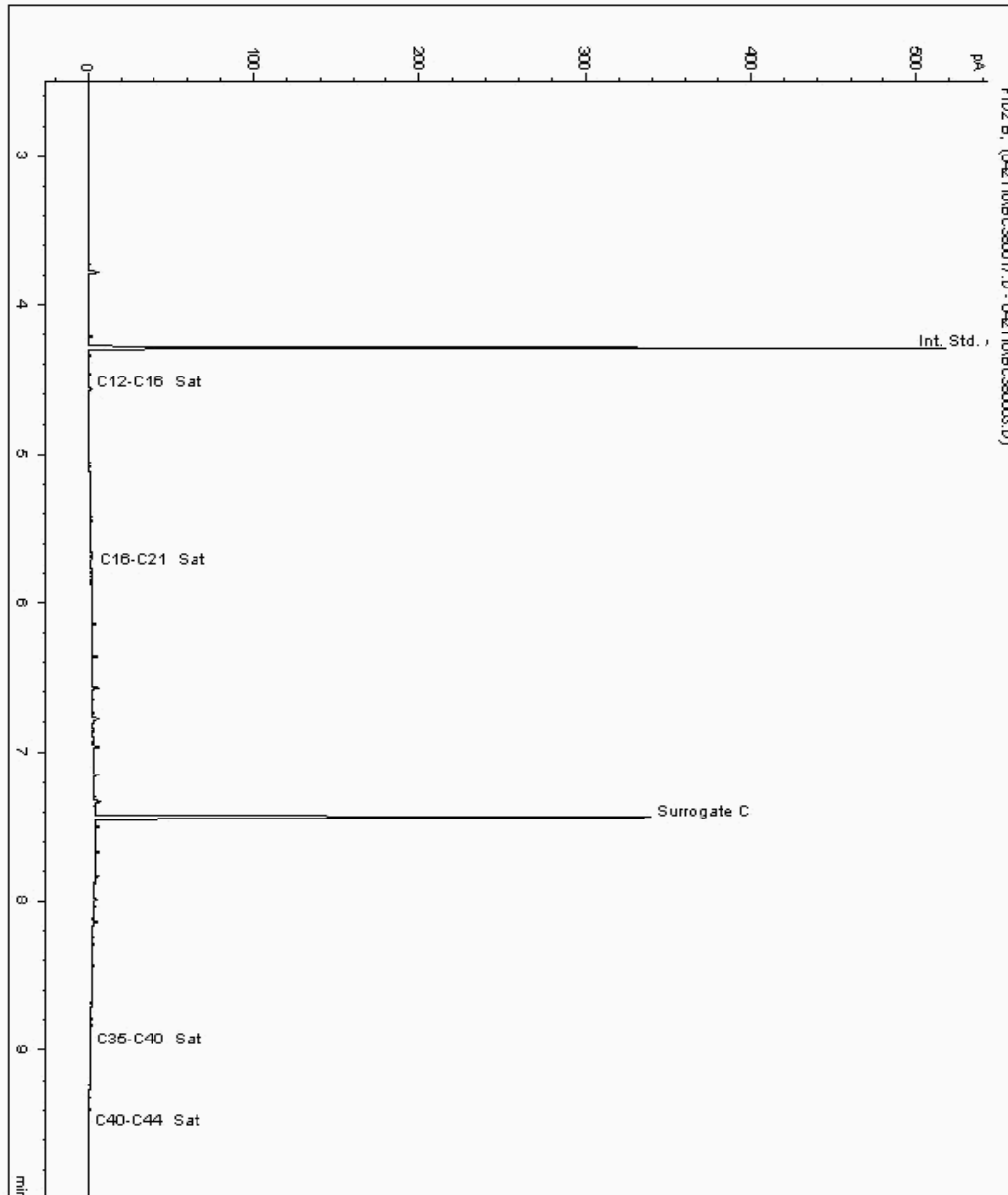
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 13289152
Sample ID : BH02

Depth : 3.22

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12507666-
Date Acquired : 21/04/16 20:18:29 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

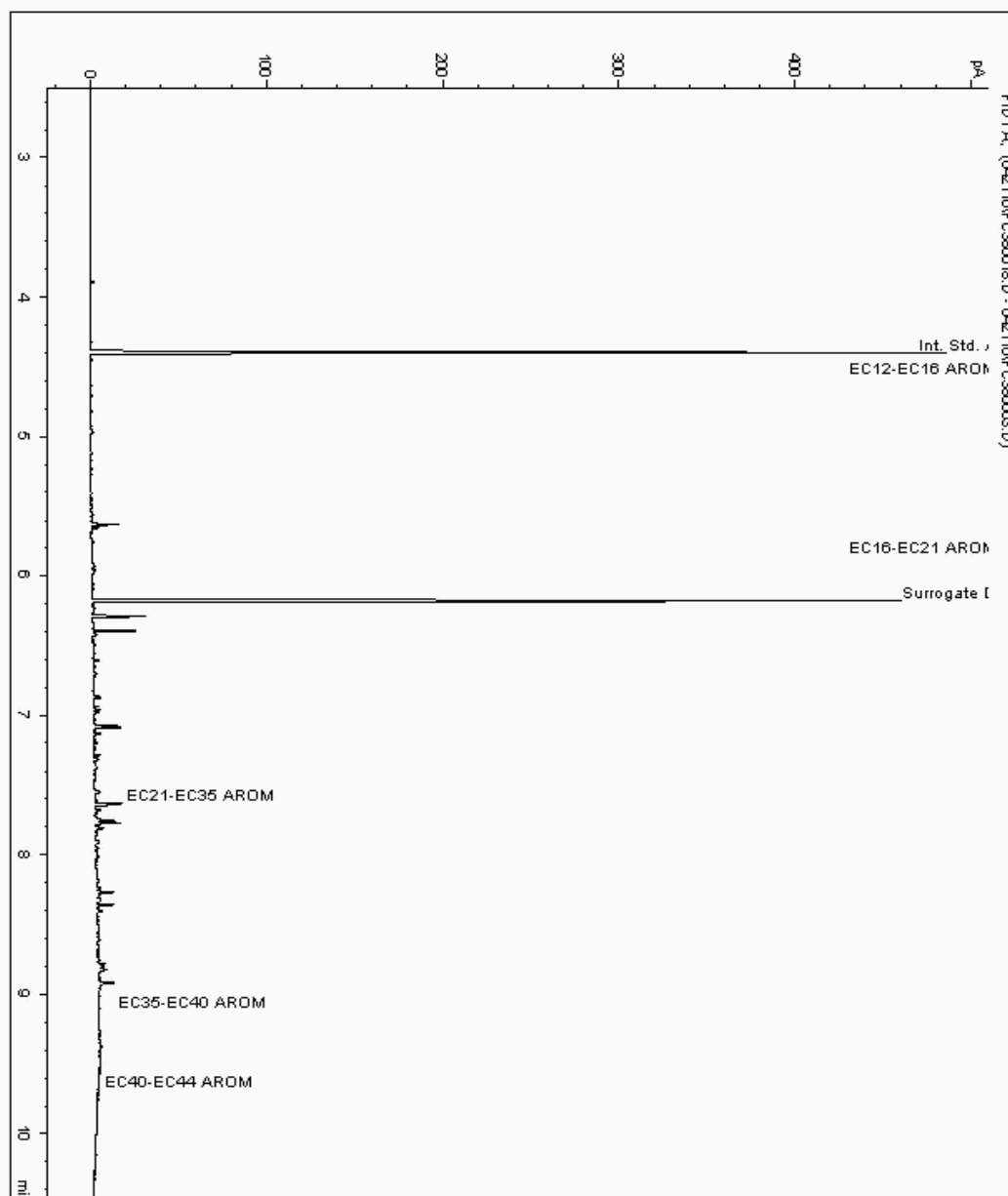
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 13288596
Sample ID : BH04

Depth : 3.83

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12507647-
Date Acquired : 21/04/16 20:37:01 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

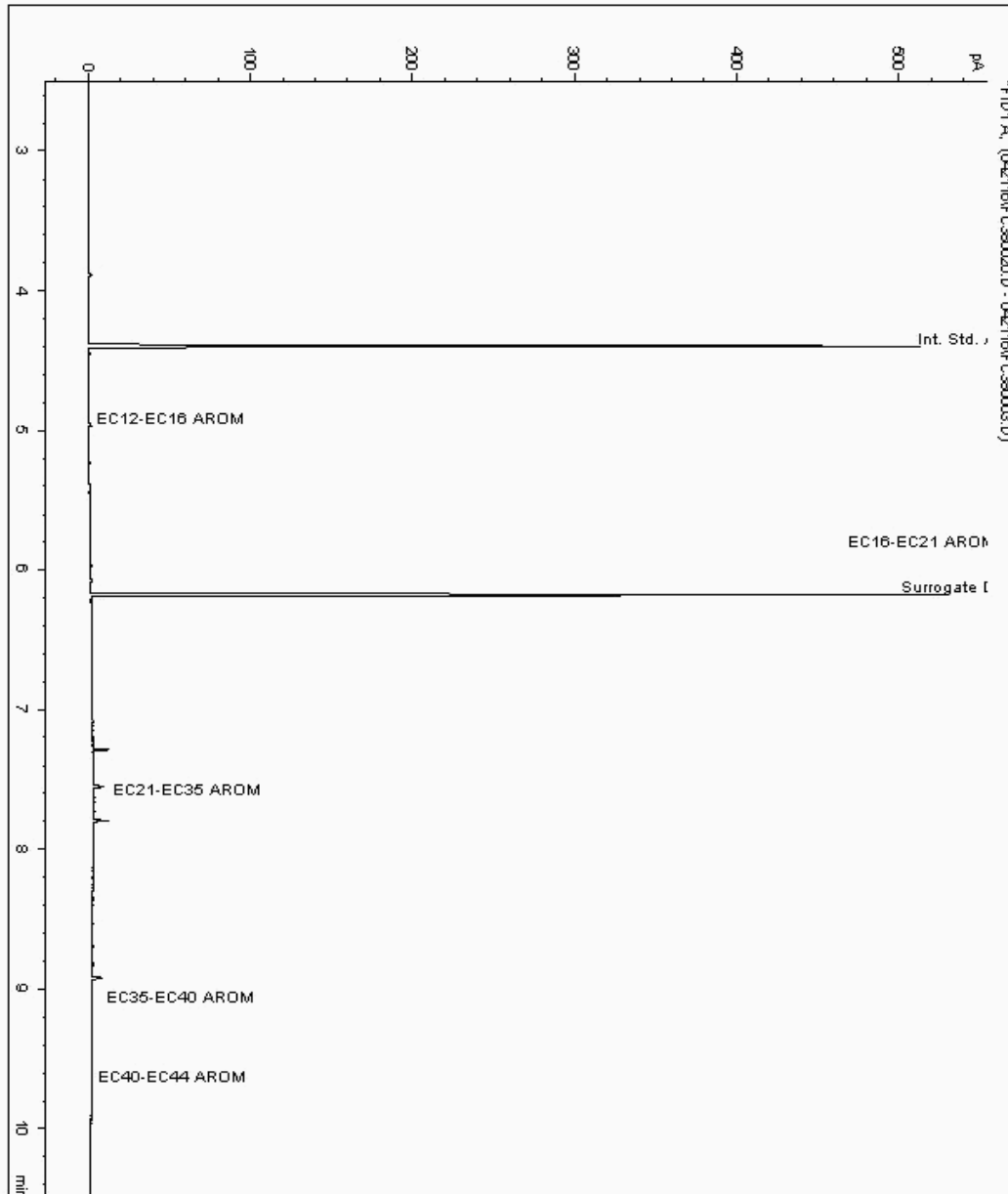
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 13288841
Sample ID : BH03

Depth : 3.52

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12507608-
Date Acquired : 21/04/16 21:04:38 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

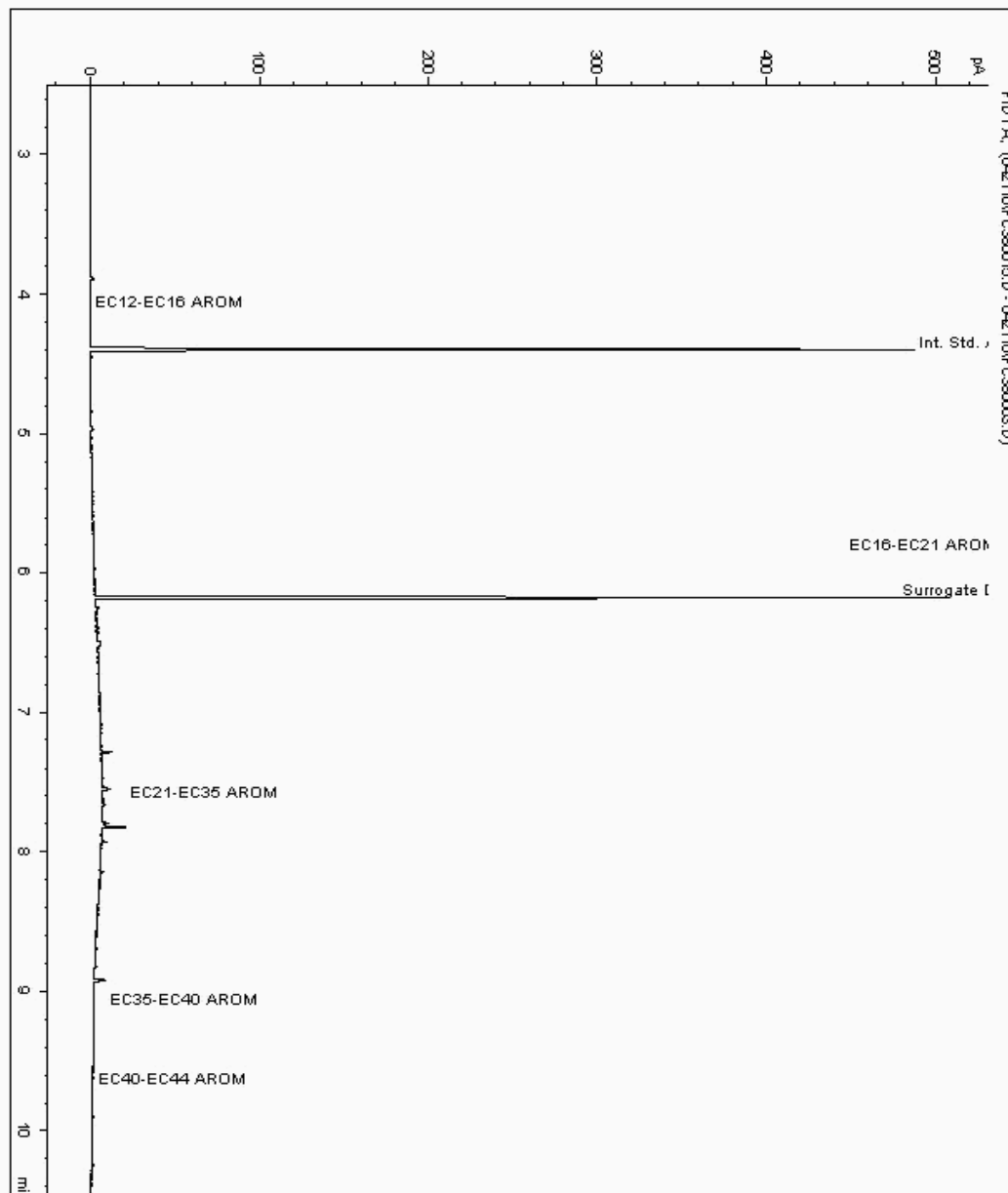
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 13288917
Sample ID : BH01

Depth : 3.91

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12507627-
Date Acquired : 21/04/16 19:50:40 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

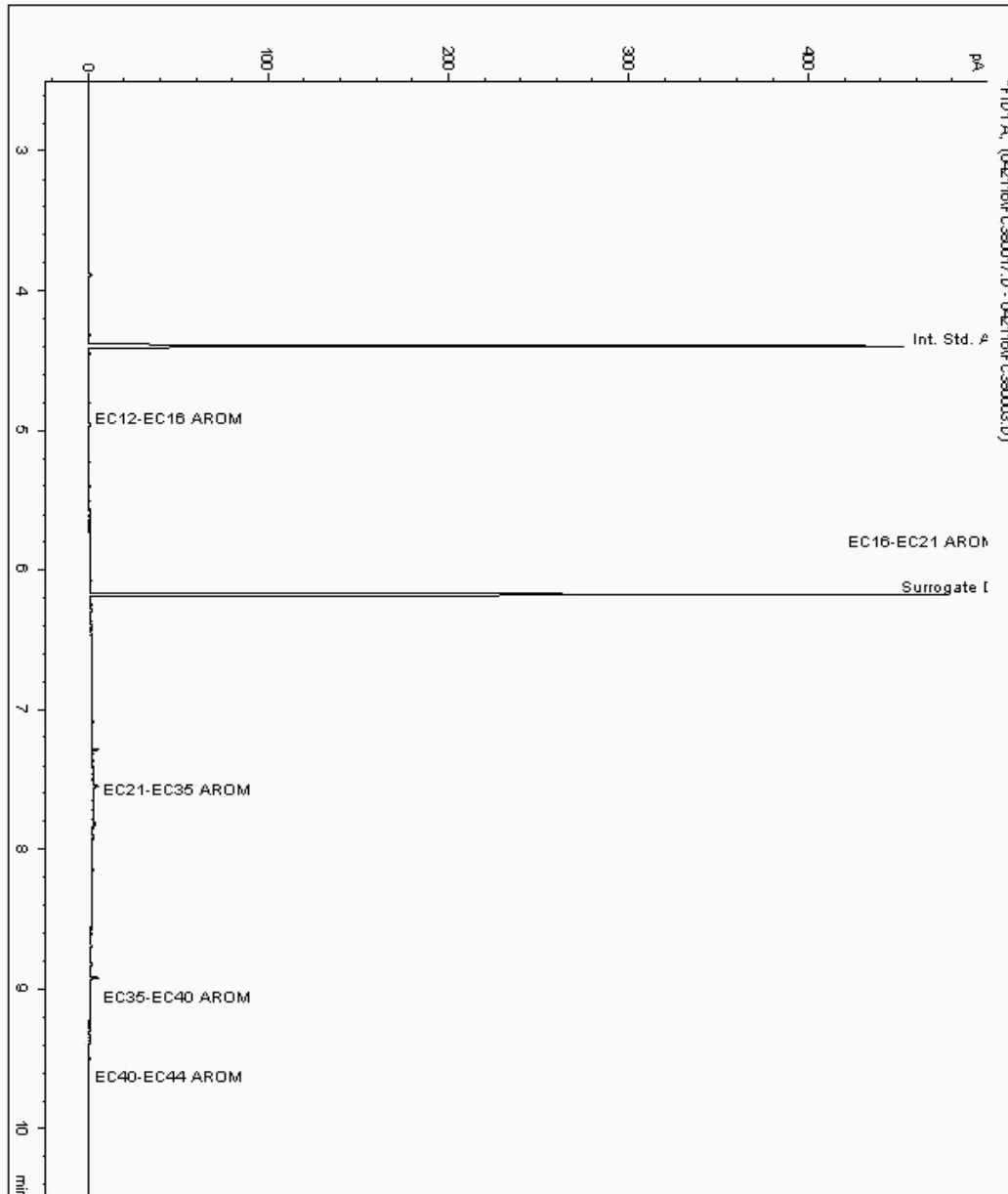
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 13289152
Sample ID : BH02

Depth : 3.22

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12507667-
Date Acquired : 21/04/16 20:18:29 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

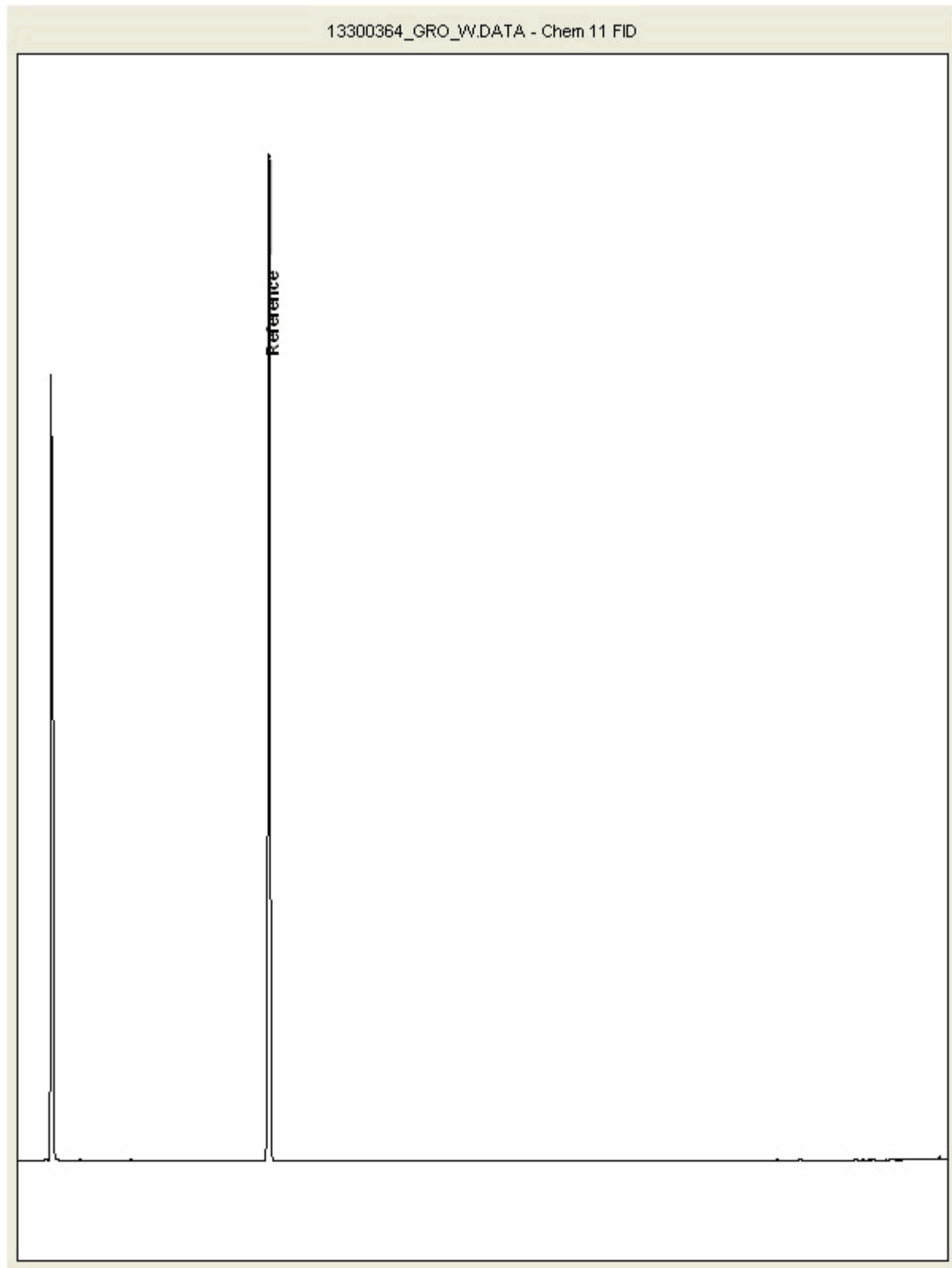
Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 13300364
Sample ID : BH02

Depth : 3.22





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

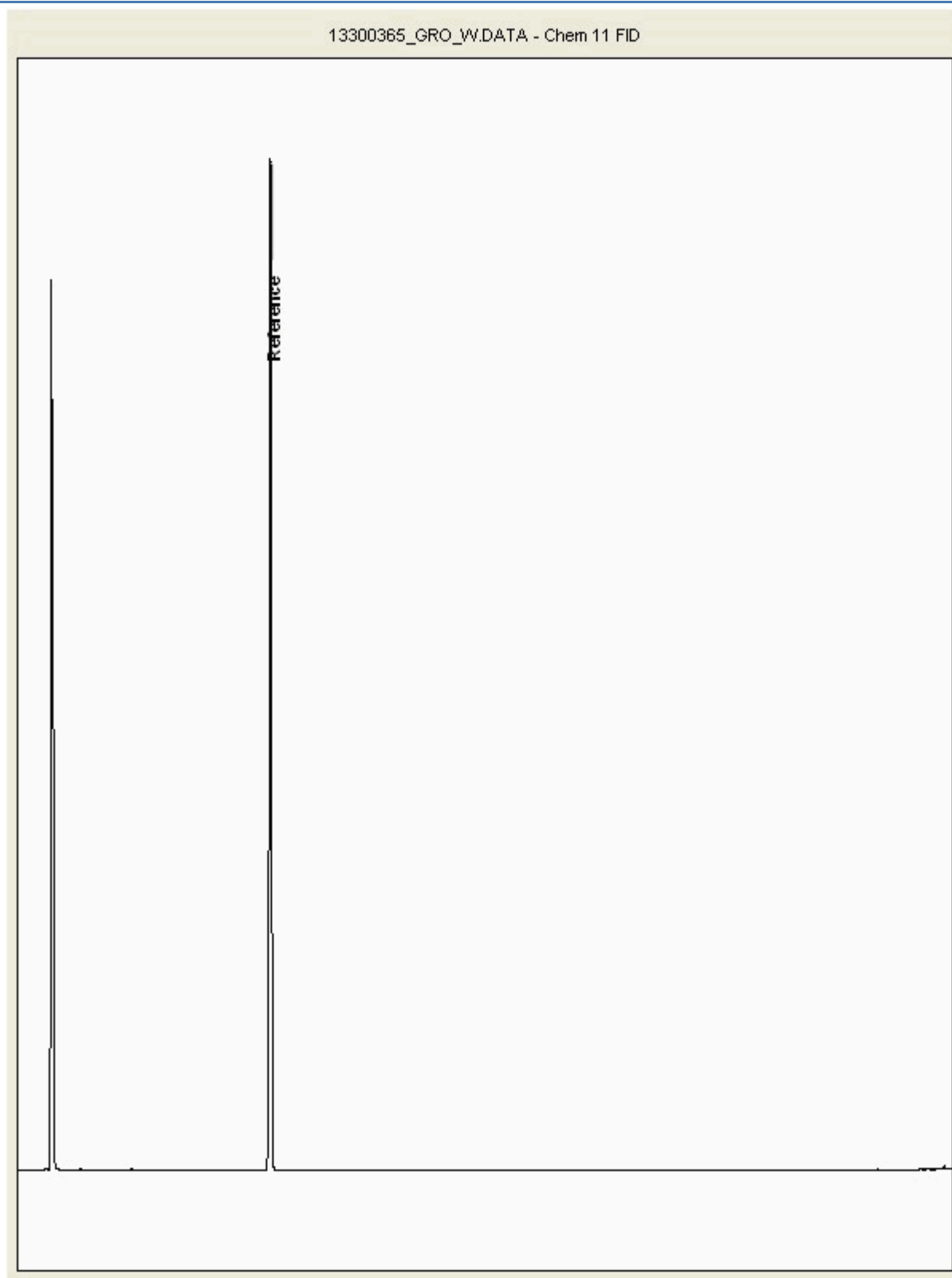
Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 13300365
Sample ID : BH04

Depth : 3.83





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

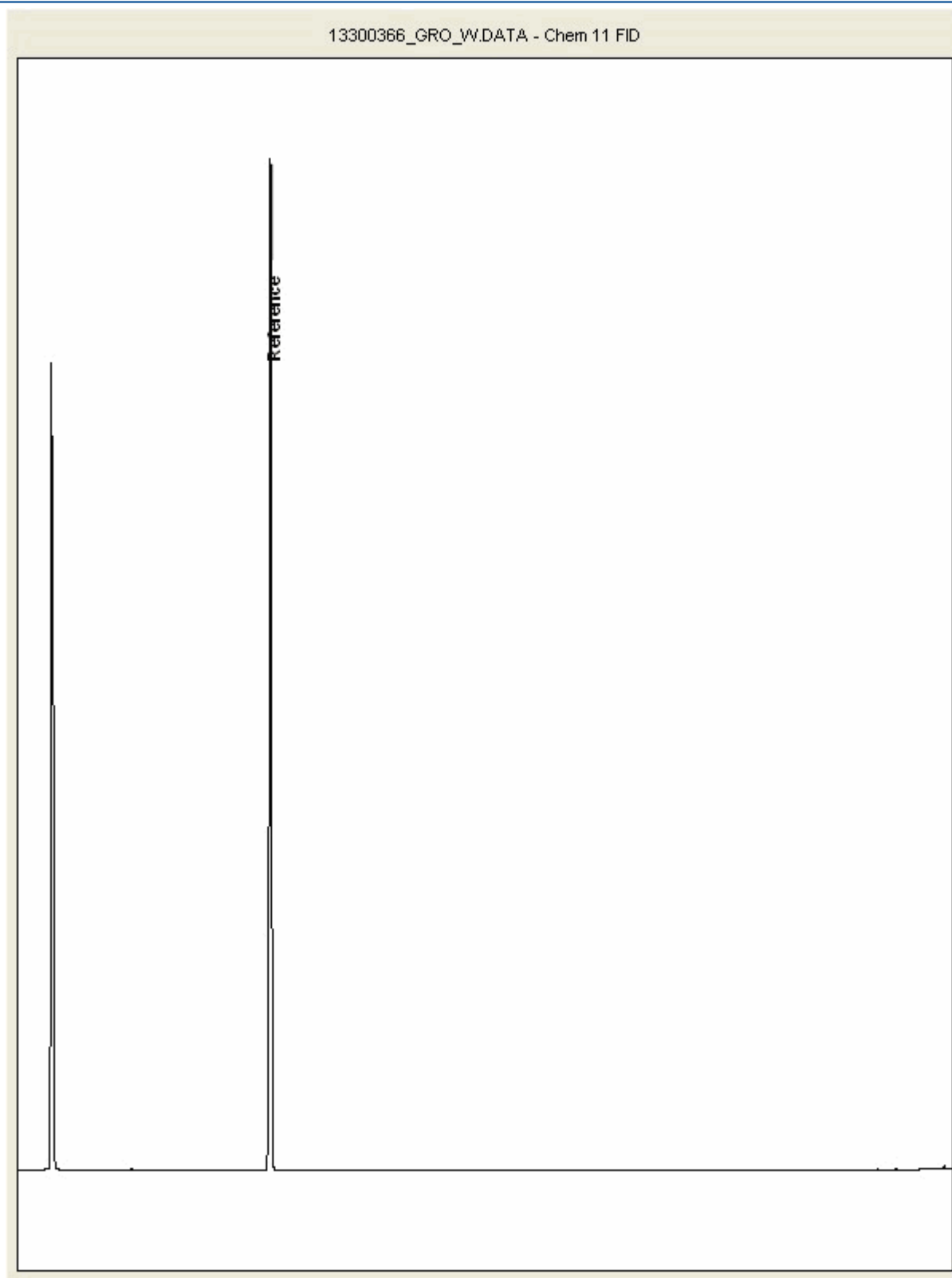
Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 13300366
Sample ID : BH01

Depth : 3.91





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

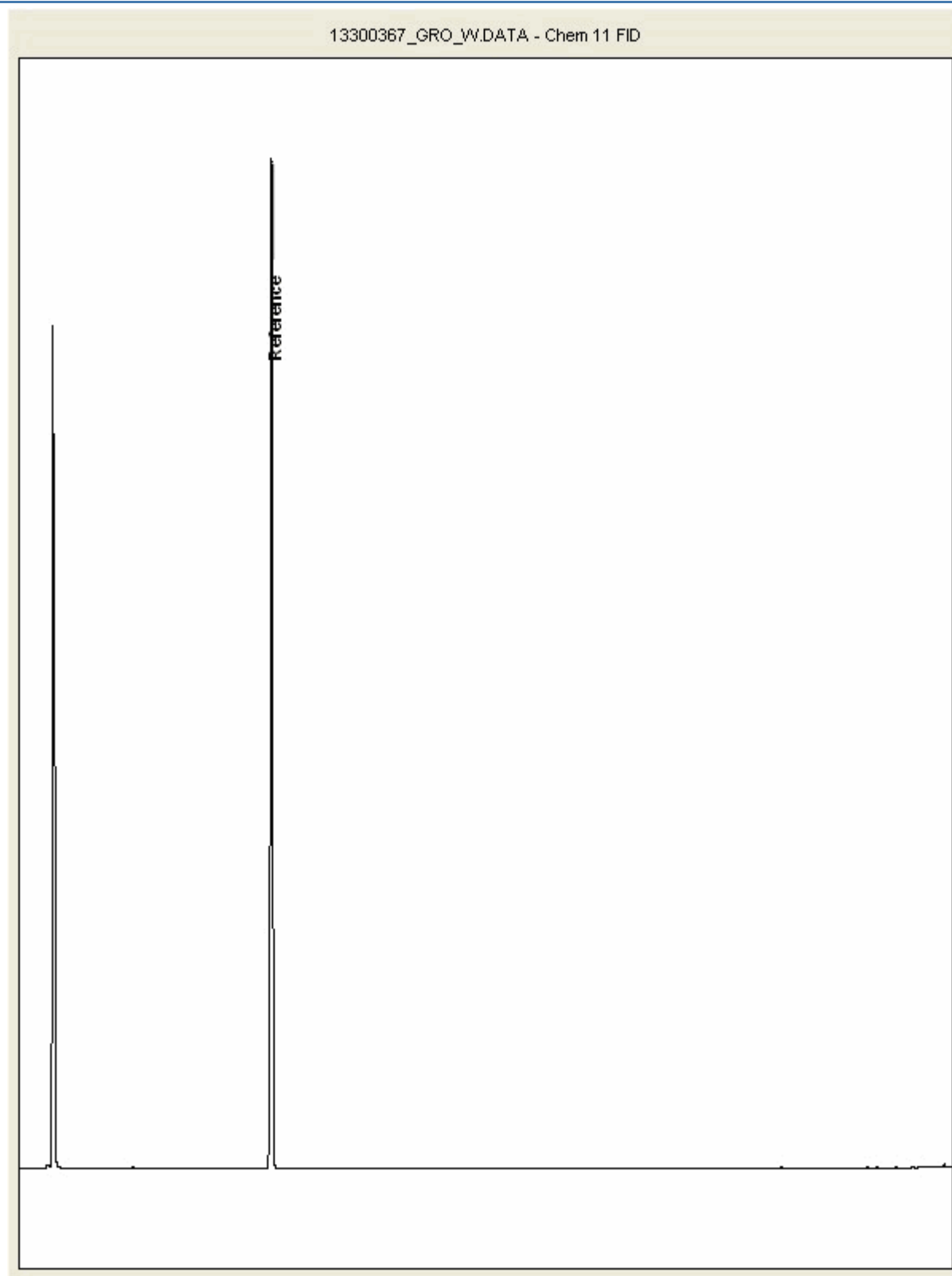
Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 13300367
Sample ID : BH03

Depth : 3.52





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Appendix

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

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

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

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

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

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

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

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

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

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

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

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

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

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

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

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

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

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

Visual Estimation Of Fibre Content

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

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

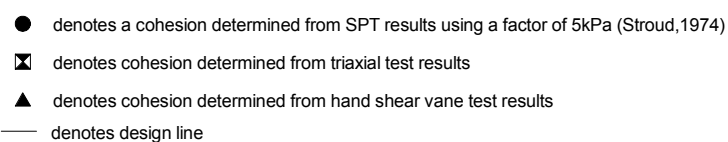
The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



APPENDIX G

GEOTECHNICAL PLOTS

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING



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APPENDIX H

BASIS FOR ASSESSMENT OF SOILS

BASIS FOR ASSESSMENT OF SOILS

The Contaminated Land Exposure Assessment (CLEA) model

The package consists of three main reports (SR2, SR3 and SR4) and supporting toxicology reviews for individual substances. Together, they provide a coherent, consistent approach for assessing risks to human health from contaminated soil.

The development of the CLEA (2009) model was a programme of work supported by DEFRA and the EA. Future publications will include evolution of the CLEA model and individual toxicology reviews.

The three reports (SC050021) are published as part of the SR (Science Report) series of documents and are briefly introduced below.

SR2 Human Health Toxicological Assessment of Contaminants in Soil. This report incorporates the updates to how the toxicity of chemicals in soil are assessed that were introduced in *Guidance on the legal definition of contaminated land* (Defra, 2008b) together with further guidance on chemical risk assessments for soil. The report describes a framework developed by the Environment Agency (in collaboration with the Health Protection Agency and the Food Standards Agency) for the collation and review of toxicological data in order to derive Health Criteria Values (HCVs).

HCVs describe a benchmark level of exposure to a chemical at which, unless stated otherwise, long-term human exposure to chemicals in soil is tolerable or poses a minimal risk. HCVs are derived from available toxicity data. HCVs are used to derive SGVs.

SR3 Updated Technical Background to the CLEA Model. This report incorporates many of the updates to exposure assessment introduced in *Soil Guideline Values: The*

Way Forward (Defra, 2006a) together with other changes. The report describes the technical principles of the Contaminated Land Exposure Assessment (CLEA) model.

The CLEA model uses generic assumptions about the fate and transport of chemicals in the environment, and a generic conceptual model (referred to in this report as generic land use scenarios) for site conditions and human behaviour, to estimate child and adult exposures to soil contaminants for those living, working and/or playing on contaminated sites over long time periods. The CLEA model is used to derive SGVs.

SR4 CLEA Software (Version 1.06) & Handbook (Version 1.05). The software enables assessors to derive assessment criteria (AC) to assist in the evaluation of the risks posed to human health from chronic exposure to chemicals in soil in relation to land use. Assumptions in the CLEA software apply to the derivation of generic assessment criteria (GAC), but also offer a useful starting point for the development of site-specific assessment criteria (SSAC). The introduction of version 1.05 will have only a minor effect on assessment criteria calculated using the CLEA software v1.04.

The accompanying handbook contains further information on using the CLEA software (outside the scope of the CLEA report SR3) for deriving SSAC. The CLEA software version 1.05 handbook is still relevant to version 1.06 and has not been changed. The CLEA software is used to derive SGVs.

The introduction of the new CLEA methodology now means that the SGVs and GACs derived using the old methodology will require updating. The former SGVs have been withdrawn and the Environment Agency have published revised SGV reports and associated TOX reports for the following eleven substances:

- Benzene
- Toluene
- Ethylbenzene
- Xylenes

- Mercury
- Selenium
- Arsenic
- Nickel
- Cadmium
- Phenol
- Dioxins, furans and dioxin-like PCBs

The publication of further SGVs is unlikely as HM Government and DEFRA have produced the document “Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance”. This introduces new Category 4 Screening Levels (C4SLs) where further guidance is proposed.

SGVs are scientifically based generic assessment criteria that can be used to simplify the assessment of human health risks arising from long-term and on-site exposure to chemical contamination in soil. They do not, however, consider risks to construction workers or risks from occupational exposure arising from activities in the work place.

SGVs are a screening tool for the generic quantitative risk assessment of land contamination. They are not (unless clearly stated otherwise) relevant for assessing risks to human health from short-term exposure to chemicals in soil including injury arising from direct bodily contact and do not take account of other types of risks to humans such as explosion or suffocation risks (associated with the build-up of gases such as methane and carbon dioxide) or aesthetic issues such as odour or colour.

SGVs do not take account of other non soil based sources of contamination such as contamination in groundwater, surface waters or drinking waters. They cannot be used to evaluate risks to non-human receptors such as controlled waters, ecosystems, buildings and services, domestic pets or garden plants. Where, for example, phytotoxic

effects are an important consideration in the current or future intended land use further investigation should be undertaken.

SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health. They represent an indicator to a risk assessor of when land is very unlikely to pose a significant possibility of significant harm to human health. Soil concentrations well above this level **may** pose a possibility of *significant harm* to human health. *Significance* is linked to:

- the magnitude of contamination;
- the duration and frequency of exposure;
- other site-specific factors that the enforcing authority may wish to take into account.

SGVs do not represent the threshold at which there is a *significant possibility of significant harm* (SPOSH). Nor do they automatically represent an unacceptable intake in the context of Part 2A of the Environmental Protection Act 1990. However, they are considered to be a useful starting point for such an assessment.

- SGVs can be used as a starting point for evaluating long-term risks to human health from chemicals in soil.
- SGVs can be used as an indication of chemical contamination in soil below which the long-term human health risks are considered to be tolerable or minimal.
- SGVs do not represent the “trigger” for an unacceptable intake.
- Unless specifically stated, SGVs do not cover other types of risk to humans such as fire, suffocation or explosion, or short term and acute exposures.
- SGVs cannot be used to evaluate risks to construction workers or nonhuman receptors.
- SGVs are not explicitly derived to define remediation standards.

Category 4 Screening Levels

The Impact Assessment that accompanied the revised Part 2A Statutory Guidance identified a potential role for new 'Category 4 Screening Levels' (C4SLs) in providing a simple test for deciding when land is suitable for use and definitely not contaminated land. It was envisaged that these new screening levels would allow 'low-risk' land to be dismissed from the need for further risk assessment more quickly and easily and allow regulators to focus efforts on the highest-risk land. The C4SLs were proposed to be more pragmatic (whilst still strongly precautionary) compared to existing generic screening levels. It is anticipated that, where they exist, C4SLs will be used as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the currently or previously available SGVs.

The Part 2A regime and the planning regime are inter-linked such that the National Planning Policy Framework states that "after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990" and that "Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner." The Part 2A Statutory Guidance and accompanying Impact Assessment were developed on the basis that Category 4 Screening Levels could be used under the planning regime, as they would be in Part 2A investigations directly. The estimated benefits that were expected to accrue from the changes to the Part 2A Statutory Guidance and specifically from the use of the new Category 4 Screening Levels were based on this assumption. However, policy responsibility for the National Planning Policy Framework and associated Planning Practice Guidance falls to the Department for Communities and Local Government.

The Category 4 Screening Levels consist of estimates of contaminant concentrations in soil that are considered to present an 'acceptable' level of risk, within the context of

Part 2A. The methodology for deriving both the Category 4 Screening Levels is based on CLEA methodology.

Where a valid Soil Guideline Value exists for a contaminant where a Category 4 Screening Level has also been derived, it is anticipated that risk assessors will use the Category 4 Screening Level in line with the Part 2A Statutory Guidance. In the absence of a suitable C4SL, risk assessors should identify and select appropriate generic assessment criteria in accordance with established good practice. It is for the Environment Agency to decide whether or not any of the Soil Guideline Values will be updated in the light of more recent toxicological data or whether any particular Soil Guideline Value should be withdrawn (as has already been the case with the SGV for lead).

LQM/CIEH Suitable for Use (S4UL) values

The “new” LQM/CIEH S4ULs¹ replace the 2nd edition of the LQM/CIEH Generic Assessment Criteria published in 2009. Generic values were developed by Land Quality Management Ltd (LQM) and the Chartered Institute of Environmental Health (CIEH) in 2014 to provide Generic Assessment Criteria (GACs) for a variety of land-uses, using the CLEA 1.06 (2009) model. These values are in accordance with Environment Agency publication SR4 (2009) which states that “You can derive GAC and SSAC using the CLEA software”. The properties used in the model were subject to a peer review process during a workshop in July 2014.

The LQM/CIEH S4ULs are intended for use in assessing the potential risks posed to human health by contaminants in soil and as transparently-derived and cautious “trigger values” above which further assessment of the risks or remedial action may be needed.

In the absence of LQM/CIEH S4ULS values developed by EIC/AGS/CL:AIRE and described below will be used.

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EIC/AGS/CL:AIRE values

The CL:AIRE project involved the collation and review of physico-chemical data, toxicological data and information on background exposure for 44 contaminants sometimes encountered on land affected by contamination in the UK and the derivation of Generic Assessment Criteria (GACs) for 351 of these using the CLEA model (v1.06). The GAC are intended to complement soil guideline values (SGV) produced by the Environment Agency of England and Wales and the 2nd edition GAC produced by LQM and CIEH (Nathanail et al, 2009). All three sets of assessment criteria have been derived in general accordance with the Environment Agency of England and Wales Contaminated Land Exposure Assessment (CLEA) guidance and thus the combined efforts of these three groups have resulted in a useful set of screening criteria for the assessment of risks to human health from soil contamination for more than 120 potentially contaminative substances.

Definition of what EIC/AGS/CL:AIRE GAC are:

- They are scientifically based screening criteria that have been derived using the CLEA model (v1.06) in general accordance with the CLEA framework;
- They can be used as a starting point for evaluating long-term risks to human health from chemicals in soil; and
- They provide an indication of the chemical concentration in soil below which the long-term human health risks for site occupants (for various generic land-use scenarios) are considered to be tolerable or minimal;
- They are screening criteria to determine the need for further investigations and the need for a DQRA.

Definition of what EIC/AGS/CL:AIRE GAC are NOT:

- They do not represent the “trigger” for unacceptable intake, i.e. exceedance of the GAC does not necessarily imply significant possibility of significant harm (SPOSH);

- They do not cover other types of risk to humans such as fire, suffocation or explosion, risks from chemicals in groundwater or ground gas or short term and acute exposures;
- They cannot be used to evaluate risks to construction workers or non-human receptors; and
- They are not explicitly derived to define remediation standards.

CLEA and other Guidance References

CL:AIRE (2010): Soil Generic Assessment Criteria for Human Health Risk Assessment. In association with the Association of Geotechnical and Geoenvironmental Specialists and The Environmental Industries Commission.

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Environment Agency. (2009), Science Report - SC050021/Dioxins SGV. Soil Guideline Values for dioxins, furans and dioxin-like PCBs in soil. Bristol: Environment Agency.

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Toxicological reports published under the new approach

Environment Agency. (2009), Science Report - SC050021/TOX1 Contaminants in soil: updated collation of toxicological data and intake values for humans Inorganic Arsenic.

Environment Agency. (2009), Science Report - SC050021//TOX8 Contaminants in soil: updated collation of toxicological data and intake values for humans Nickel.

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Mercury.

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Selenium.

Environment Agency. (2009), Science Report - SC050021/TOX3 Contaminants in soil: updated collation of toxicological data and intake values for humans. Cadmium

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Benzene.

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Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Dioxins, furans and dioxin-like PCBs.

Environment Agency. (2009), Science Report - SC050021/ TOX9 Contaminants in soil: updated collation of toxicological data and intake values for humans Cadmium.

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Environment Agency. (2002), Science Report - R&D Publication / TOX6 Contaminants in soil: collation of toxicological data and intake values for humans. Lead.

Environment Agency. (2002), Science Report - R&D Publication / TOX2 Contaminants in soil: collation of toxicological data and intake values for humans. Benzo(a)Pyrene.

Environment Agency. (2003), Science Report - R&D Publication / TOX20 Contaminants in soil: collation of toxicological data and intake values for humans. Naphthalene.

Environment Agency. (2004), Science Report - R&D Publication / TOX22 Contaminants in soil: collation of toxicological data and intake values for humans. 1,2-Dichloroethane.

Environment Agency. (2004), Science Report - R&D Publication / TOX16 Contaminants in soil: collation of toxicological data and intake values for humans. Tetrachloroethane.

Environment Agency. (2004), Science Report - R&D Publication / TOX24 Contaminants in soil: collation of toxicological data and intake values for humans. Trichloroethene.

Environment Agency. (2004), Science Report - R&D Publication / TOX18 Contaminants in soil: collation of toxicological data and intake values for humans. Vinyl Chloride.

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Environment Agency. (2004), Science Report - R&D Publication / TOX23 Contaminants in soil: collation of toxicological data and intake values for humans. Tetrachloroethene.

Environment Agency. (2004), Science Report - R&D Publication / TOX25 Contaminants in soil: collation of toxicological data and intake values for humans. 1,1,1-Trichloroethane.

Appendix C GEL 2016 Supplementary Gas Monitoring Report



UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SUPPLEMENTARY GROUND GAS RISK ASSESSMENT

Prepared for UNIVERSITY OF READING

Report Ref: 32362

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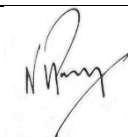
UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

SUPPLEMENTARY GROUND GAS RISK ASSESSMENT

Prepared for UNIVERSITY OF READING

Report Ref: 32362

PROJECT: Proposed development
PROJECT MANAGER: WSP / Parsons Brinckerhoff
CONSULTANT: AECOM

VOLUME - VERSION	STATUS	ORIGINATOR	CHECKER	APPROVED	DATE
1 of 1 – A	FINAL	JI	NP	NP	10/10/16
ORIGINATOR			APPROVER		
					
Jonathan Ind BSc (Hons) MSc FGS Geotechnical Consultant			N Parry BEng MSc CEng MICE MCIHT SiLC Director		

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APPENDICES

APPENDIX A	GAS MONITORING RESULTS
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1. INTRODUCTION

It is proposed to replace the existing Engineering Building at the University of Reading with a new purpose-built facility. Geotechnical Engineering Limited (GEL) previously carried out a ground investigation to provide a geotechnical and geoenvironmental assessment to assist in the development of the site (GEL Report Ref: 31710 Rev B, dated 24th May 2016). As recommended in Report 31710, GEL was instructed by WSP/Parsons Brinckerhoff (acting on behalf of the University of Reading), to carry out further ground gas risk assessment and provide recommendations for precautionary measures, in accordance with CIRIA C665 (Wilson et al, 2007) and BS8485:2015. This report presents the results of additional gas monitoring and comments accordingly; it should be read in conjunction with Report 31710 (2016).

The scope of work and terms and conditions of appointment were defined in correspondence by GEL, reference T24652 dated 16th September 2016.

This report describes the investigation, presents the findings and comments accordingly.

The comments given in this report and the opinions expressed assume that ground conditions do not vary beyond the range revealed by this investigation. There may however, be conditions at or adjacent to the site, which have not been disclosed by the investigation and which, therefore, have not been considered in this report. Accordingly, a careful watch should be maintained during any future groundworks and the recommendations of this report reviewed as necessary.

The recommendations given in this report should not be used for any other schemes on or adjacent to this site without further reference to GEL.



2. BACKGROUND SETTING

The site setting is recorded in detail within the Report 31710 (GEL, 2016), with a summary of key information taken from this report presented below.

2.1 Site Location and Description

The site is situated at the University of Reading Whiteknights Campus and may be located by its National Grid co-ordinates SU 7352, 7151 or the post code RG6 6UR. A location plan is presented as Figure 1.

The existing Engineering Building was roughly T-shaped in plan, comprising a four-storey brick structure at the northern end with a single-storey element extending to the south. The ground level fell gradually from southwest to northeast, up to around 2.5m. The building was bound by a tarmacadam-surfaced car park to the east with the entrance at its southern end. The area to the north and south was mainly surfaced with grass with pedestrian pathways and a number of semi-mature/mature trees. A block-paved pathway was located west of the building. The building was bound by various buried services which are highlighted on Figure 2.

2.2 Radon

The Building Research Establishment (BRE) indicates that no radon protective measures are necessary for the area (BR 211, 2007). It is advised that the local Building Control body is contacted to determine their minimum requirements in respect of radon protection.



3. CONCEPTUAL SITE MODEL

Notwithstanding the limitations of the desk study carried out as part of Report 31710 (2016) (and recommendations for further assessment to suitably establish the environmental setting), a significant thickness of Made Ground was recorded within the vicinity of the existing Engineering Building, up to 1.90m thick. Despite the material not containing any obvious putrescible material, the Made Ground is considered to represent a potential source of ground gases.

4. GROUD GAS RISK ASSESSMENT

4.1 Basis of Assessment

Approved Document Part C2 of the Building Regulations (DoE) recommends a tiered risk assessment approach in respect of “methane and other gases” (used to define hazardous soil gases which originate either from waste deposited in landfill sites or are generated naturally). Approved Document C does not include radon (which is dealt with separately) but does include volatile organic compounds (VOC’s). The methodology for the semi-quantitative risk assessment is defined in BS 8485:2015, which provides a framework in line with CLR 11 (Environment Agency, 2004). For gases not covered by BS8485:2015, a risk assessment basis is considered appropriate with standards taken from occupational exposure limits or other accepted data. Reference should also be made to CIRIA Report C665 (Wilson et al, 2007).

For the determination of the acceptability of volatile vapours (VOCs) in soils, values derived from Soil Gas Acceptance Criteria for the Protection of Indoor Air Quality for a commercial end-use, documented in the New Zealand Guidelines (1999) shall be used. A “trigger” value



of 100ppm was used for the determination of acceptability of soils based on the New Zealand Guidelines.

4.2 Comparison of Results

In order to address the risk of hazardous ground gases to the proposed development, four observation wells were installed in the boreholes, referenced BH01 to BH04, as part of the previous investigation (GEL, 2016). An exploratory hole location plan is presented as Figure 2. The standpipes were monitored on four occasions following completion of the ground investigation in order to provide a comprehensive data set in accordance with CIRIA guidance. The results are included in Appendix A and summarised in Table 4.1 below.



Borehole	Response Zone/Strata (m bgl)	Evidence of Contamination	No. of Monitoring Visits	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Flow (l/hr)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Volatile Organic Compounds (ppm)	Water Level (m bgl)	Atmospheric Pressure (Mb)
BH01	1.00 – 6.20/ HD & BHG	No	4	0.0-0.1	1.4-4.1	9.9-20.5	0.0	0-14	0	0.0-1.8	3.50-4.34	1003-1019
BH02	1.00-4.30/ MG, HD & BHG	No	4	0.0	0.6-5.1	11.2-20.0	0.0	0-20	0	0.0-1.7	3.22-3.85	1003-1018
BH03	1.00 – 6.30/ HD & BHG	No	4	0.0-0.1	0.0-9.2	0.0-20.5	-0.2 - 0.0	0-1	0-2	0.0—6.7	3.25-3.79	1004-1020
BH04	1.00 – 6.20/ HD & BHG	No	4	0.0	1.1-4.6	12.7-20.4	0.0	0-14	0	0.0-1.7	3.83-4.3	1003-1014

Notes: MG – Made Ground; HD – Head deposits; BHG – Boyn Hill Gravel Member

Table 4.1: Summary of Gas Monitoring Data

4.3 Ground Gas Protection Measures

The risk posed by gassing sites can be determined from a semi-quantitative assessment of the risk, as proposed by Wilson and Card (1999), following development of the system as detailed in BS8485:2015. The method uses both gas concentrations and borehole flow rates to define a characteristic situation (CS) for a site based on the limiting borehole gas volume-flow or “Gas Screening Value” (GSV) for methane and carbon dioxide. The GSV (litres of gas per hour) can be calculated from the borehole flow rate (litres per hour) and gas



concentration (%). The calculation is carried out for both methane and carbon dioxide and the worst case GSV value is generally adopted for comparison with the Classification Situation.

The results in Table 4.1 indicate a maximum concentration of carbon dioxide (CO₂) at 9.2% and methane (CH₄) at 0.1%. Carbon monoxide and hydrogen sulphide was recorded at a maximum concentration of 20ppm and 2ppm respectively. Oxygen concentrations varied between 0.0% and 20.5%. No positive gas flow was detected during the four visits, with a maximum negative flow of -0.2l/hr.

In accordance with the guidance in BS8485:2015, the GSV would indicate a Characteristic Gas Situation 1 (CS1), with a very low hazard, however since that the maximum recorded concentration of carbon dioxide is nearly twice the maximum “five percent” threshold, it is recommended that ground gas precautionary measures be adopted in accordance with Characteristic Situation 2 (CS2).

Once the proposed scheme has been finalised, details of the protection measures should be designed in accordance with BS8485:2015.

A maximum soil vapour concentration (VOCs) of 6.7ppm was recorded using the PID during the monitoring visits. Based on these results, vapour protection measures are not considered necessary for the site.

The requirements for radon protection (if any) should be agreed with the Local Authority.

GEOTECHNICAL ENGINEERING LIMITED



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Geotechnical Engineering Limited

LOCATION PLAN



CLIENT UNIVERSITY OF READING
SITE UNIVERSITY OF READING - HEALTH & LIFE SCIENCES BUILDING
SCALE Approximately 1:50,000

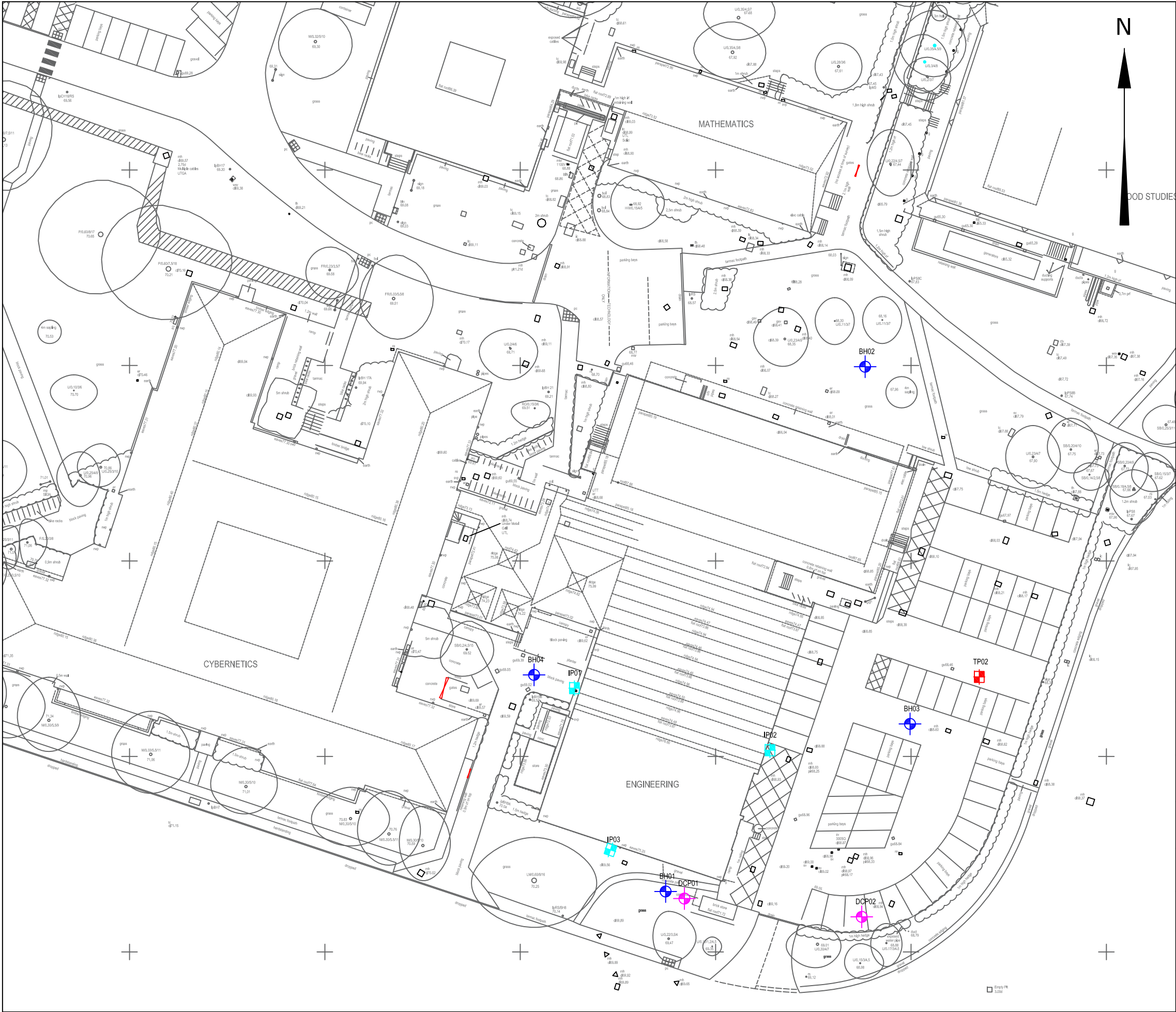
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CONTRACT

FIGURE

32362

1



Key.

- Borehole Location
- DCP Location
- Trial Pit Location
- Inspection Pit Location

Notes:

Drawing supplied by client.

geotechnical
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Client:

UNIVERSITY OF READING

Engineer:

AECOM

Site:

UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Title:

EXPLORATORY HOLE LOCATION PLAN

Drawn By:	GJS	Checked By:	JJ	Paper Size:	A3
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Scale:	1:500	Date:	October 2016
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Contract:	32362	Figure:	02
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APPENDIX A

GROUND GAS MONITORING RESULTS

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH01	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH01	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH01	18/04/16 09:50:00	1017	-0.52								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH01	18/04/16 09:51:00										0.0			
BH01	18/04/16 09:52:00										0.0			
BH01	18/04/16 09:53:00										0.0			
BH01	18/04/16 09:54:00										0.0			
BH01	18/04/16 09:55:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:56:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:57:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:58:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:59:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 10:00:00			3.4	0.0	13.0	0.0	0	0	1.7				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	18/04/16 10:01:00			3.3	0.0	13.0	0.0	0	0	1.7				
BH01	18/04/16 10:02:00			3.2	0.0	13.0	0.0	0	1	1.7				
BH01	18/04/16 10:03:00			3.1	0.0	13.0	0.0	0	1	1.6				
BH01	18/04/16 10:04:00			3.1	0.0	13.1	0.0	0	1	1.5				
BH01	18/04/16 10:05:00												3.91	
BH01	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH01	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	25/04/16 10:00:00	1003	0.38								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	25/04/16 10:01:00										0.0			
BH01	25/04/16 10:02:00										0.0			
BH01	25/04/16 10:03:00										0.0			
BH01	25/04/16 10:04:00										0.0			
BH01	25/04/16 10:05:00			2.8	0.1	11.2	2.0	0	0	1.8				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	25/04/16 10:06:00			2.8	0.1	11.1	2.0	0	0	1.8				
BH01	25/04/16 10:07:00			2.9	0.1	11.0	2.0	0	0	1.8				
BH01	25/04/16 10:08:00			2.9	0.1	11.0	2.0	0	0	1.8				
BH01	25/04/16 10:09:00			3.2	0.1	10.7	2.0	0	0	1.8				
BH01	25/04/16 10:10:00			3.5	0.1	10.5	2.0	0	0	1.8				
BH01	25/04/16 10:11:00			3.7	0.1	10.3	2.0	0	0	1.8				
BH01	25/04/16 10:12:00			3.9	0.1	10.1	2.0	0	0	1.8				
BH01	25/04/16 10:13:00			4.0	0.1	10.0	2.0	0	0	1.8				
BH01	25/04/16 10:14:00			4.1	0.1	9.9	2.0	0	0	1.8				
BH01	25/04/16 10:15:00												3.50	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH02	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH02	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH02	18/04/16 11:30:00	1010	-0.51								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH02	18/04/16 11:31:00										0.0			
BH02	18/04/16 11:32:00										0.0			
BH02	18/04/16 11:33:00										0.0			
BH02	18/04/16 11:34:00										0.0			
BH02	18/04/16 11:35:00			4.3	0.0	11.9	0.0	0	1	1.4				
BH02	18/04/16 11:36:00			4.3	0.0	11.8	0.0	0	0	1.4				
BH02	18/04/16 11:37:00			4.6	0.0	11.6	0.0	0	0	1.3				
BH02	18/04/16 11:38:00			4.8	0.0	11.4	0.0	0	0	1.3				
BH02	18/04/16 11:39:00			5.0	0.0	11.3	0.0	0	0	0.2				
BH02	18/04/16 11:40:00			5.1	0.0	11.2	0.0	0	0	1.1				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	18/04/16 11:41:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:42:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:43:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:44:00			5.0	0.0	11.3	0.0	0	0	1.1				
BH02	18/04/16 11:45:00												3.22	
BH02	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH02	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	25/04/16 11:00:00	1003	0.33								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	25/04/16 11:01:00										0.0			
BH02	25/04/16 11:02:00										0.0			
BH02	25/04/16 11:03:00										0.0			
BH02	25/04/16 11:04:00										0.0			
BH02	25/04/16 11:05:00			2.2	0.0	17.7	0.0	0	0	0.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	25/04/16 11:06:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:07:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:08:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:09:00			2.2	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:10:00			2.1	0.0	17.9	0.0	0	0	0.6				
BH02	25/04/16 11:11:00			2.1	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:12:00			2.1	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:13:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:14:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:15:00												3.82	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH03	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH03	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH03	18/04/16 09:00:00	1019	-0.81								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH03	18/04/16 09:01:00										0.0			
BH03	18/04/16 09:02:00										0.0			
BH03	18/04/16 09:03:00										0.0			
BH03	18/04/16 09:04:00										0.0			
BH03	18/04/16 09:05:00			0.2	0.0	19.8	0.0	0	0	0.9				
BH03	18/04/16 09:06:00			0.2	0.0	19.9	0.0	0	0	0.8				
BH03	18/04/16 09:07:00			0.3	0.0	19.7	0.0	0	0	0.8				
BH03	18/04/16 09:08:00			0.3	0.0	19.5	0.0	0	0	0.8				
BH03	18/04/16 09:09:00			0.4	0.0	19.2	1.0	0	0	0.8				
BH03	18/04/16 09:10:00			0.5	0.0	18.7	1.0	0	0	0.9				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	18/04/16 09:11:00			0.7	0.1	18.2	1.0	0	0	0.9				
BH03	18/04/16 09:12:00			0.9	0.1	17.9	1.0	0	1	0.9				
BH03	18/04/16 09:13:00			0.9	0.1	17.9	1.0	0	1	0.9				
BH03	18/04/16 09:14:00			0.9	0.1	18.0	1.0	0	1	0.9				
BH03	18/04/16 09:15:00												3.52	
BH03	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH03	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	25/04/16 10:00:00	1004									0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	25/04/16 10:01:00										0.0			
BH03	25/04/16 10:02:00										0.0			
BH03	25/04/16 10:03:00										0.0			
BH03	25/04/16 10:04:00										0.0			
BH03	25/04/16 10:05:00			3.4	0.0	16.1	0.0	0	0	0.8				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	25/04/16 10:06:00			3.8	0.1	15.6	1.0	0	0	0.8				
BH03	25/04/16 10:07:00			4.3	0.1	15.0	1.0	0	0	0.7				
BH03	25/04/16 10:08:00			5.0	0.1	14.2	1.0	0	0	0.6				
BH03	25/04/16 10:09:00			5.2	0.1	14.0	1.0	0	0	0.5				
BH03	25/04/16 10:10:00			5.0	0.1	14.3	1.0	0	0	0.5				
BH03	25/04/16 10:11:00			5.0	0.1	14.3	1.0	0	0	0.5				
BH03	25/04/16 10:12:00			4.7	0.1	14.6	1.0	0	0	0.5				
BH03	25/04/16 10:13:00			4.7	0.1	14.7	1.0	0	0	0.5				
BH03	25/04/16 10:14:00			4.7	0.1	14.8	1.0	0	0	0.5				
BH03	25/04/16 10:15:00												3.25	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

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SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH04	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH04	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH04	18/04/16 10:20:00	1016	-0.29								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH04	18/04/16 10:21:00										0.0			
BH04	18/04/16 10:22:00										0.0			
BH04	18/04/16 10:23:00										0.0			
BH04	18/04/16 10:24:00										0.0			
BH04	18/04/16 10:25:00			1.3	0.0	18.4	0.0	0	1	0.7				
BH04	18/04/16 10:26:00			1.3	0.0	18.5	0.0	0	0	0.7				
BH04	18/04/16 10:27:00			1.3	0.0	18.4	0.0	0	1	0.7				
BH04	18/04/16 10:28:00			1.1	0.0	18.7	0.0	0	0	0.6				
BH04	18/04/16 10:29:00			1.1	0.0	18.8	0.0	0	0	0.6				
BH04	18/04/16 10:30:00			1.3	0.0	18.6	0.0	0	0	0.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	18/04/16 10:31:00			1.4	0.0	18.4	0.0	0	0	0.6				
BH04	18/04/16 10:32:00			1.4	0.0	18.5	0.0	0	0	0.6				
BH04	18/04/16 10:33:00			1.6	0.0	18.2	0.0	0	0	0.6				
BH04	18/04/16 10:34:00			1.7	0.0	18.1	0.0	0	0	0.6				
BH04	18/04/16 10:35:00												3.83	
BH04	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH04	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	25/04/16 10:40:00	1003	0.68								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	25/04/16 10:41:00										0.0			
BH04	25/04/16 10:42:00										0.0			
BH04	25/04/16 10:43:00										0.0			
BH04	25/04/16 10:44:00										0.0			
BH04	25/04/16 10:45:00			2.6	0.0	16.1	0.0	0	1	1.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	25/04/16 10:46:00			2.7	0.0	16.0	0.0	0	0	1.7				
BH04	25/04/16 10:47:00			2.7	0.0	15.9	0.0	0	0	1.7				
BH04	25/04/16 10:48:00			2.8	0.0	15.8	0.0	0	0	1.6				
BH04	25/04/16 10:49:00			2.9	0.0	15.7	0.0	0	0	1.6				
BH04	25/04/16 10:50:00			3.0	0.0	15.6	0.0	0	0	1.5				
BH04	25/04/16 10:51:00			3.0	0.0	15.5	0.0	0	0	1.4				
BH04	25/04/16 10:52:00			3.0	0.0	15.5	0.0	0	0	1.4				
BH04	25/04/16 10:53:00			3.0	0.0	15.6	0.0	0	0	1.4				
BH04	25/04/16 10:54:00			3.0	0.0	15.6	0.0	0	0	1.4				
BH04	25/04/16 10:55:00												3.91	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	20/09/16 12:00:00	1021										15		Weather Underground data (Farnborough): steady barometric pressure, overcast.
BH01	21/09/16 12:00:00	1018										19		Weather Underground data (Farnborough): steady barometric pressure, partly cloudy.
BH01	22/09/16 12:00:00	1019										17		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH01	23/09/16 12:02:00	1013	0									20		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH01	23/09/16 12:03:00										0.0			
BH01	23/09/16 12:04:00										0.0			
BH01	23/09/16 12:05:00										0.0			
BH01	23/09/16 12:06:00										0.0			
BH01	23/09/16 12:07:00										0.0			
BH01	23/09/16 12:08:00										0.0			
BH01	23/09/16 12:09:00										0.0			
BH01	23/09/16 12:10:00										0.0			
BH01	23/09/16 12:11:00										0.0			
BH01	23/09/16 12:12:00										0.0			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks		
BH01	23/09/16 12:13:00			1.4	0.0	19.6	0.0	0	0	0.6						
BH01	23/09/16 12:14:00			1.5	0.0	19.6	0.0	0	0	0.6						
BH01	23/09/16 12:15:00			1.5	0.0	19.7	0.0	0	10	0.6						
BH01	23/09/16 12:16:00			1.6	0.0	19.6	0.0	0	10	0.4						
BH01	23/09/16 12:17:00			1.6	0.0	19.6	0.0	0	10	0.2						
BH01	23/09/16 12:18:00			1.6	0.0	19.6	0.0	0	10	0.2						
BH01	23/09/16 12:19:00			1.6	0.0	19.6	0.0	0	11	0.2						
BH01	23/09/16 12:20:00			1.6	0.0	19.6	0.0	0	11	0.2						
BH01	23/09/16 12:21:00			1.6	0.0	19.6	0.0	0	14	0.2						
BH01	23/09/16 12:22:00			1.6	0.0	19.6	0.0	0	0	0.2						
BH01	23/09/16 12:23:00	1013										17	4.34	Weather Underground data (Farnborough): falling barometric pressure, scattered clouds.		
BH01	30/09/16 12:00:00															
BH01	01/10/16 12:00:00															
BH01	02/10/16 11:50:00															
BH01	03/10/16 11:00:00	1019	0								0.0	18		Weather Underground data (Farnborough): steady barometric		
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362		CHECKED JI

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	03/10/16 11:01:00										0.0			pressure.
BH01	03/10/16 11:02:00										0.0			
BH01	03/10/16 11:03:00										0.0			
BH01	03/10/16 11:04:00										0.0			
BH01	03/10/16 11:05:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:06:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:07:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:08:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:09:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:15:00												4.34	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	20/09/16 12:00:00	1021										15		Weather Underground data (Farnborough): steady barometric pressure, overcast.
BH02	21/09/16 12:00:00	1018										19		Weather Underground data (Farnborough): steady barometric pressure, partly cloudy.
BH02	22/09/16 12:00:00	1019										17		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH02	23/09/16 10:52:00	1014	0									20		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH02	23/09/16 10:53:00										0.0			
BH02	23/09/16 10:54:00										0.0			
BH02	23/09/16 10:55:00										0.0			
BH02	23/09/16 10:56:00										0.0			
BH02	23/09/16 10:57:00										0.0			
BH02	23/09/16 10:58:00										0.0			
BH02	23/09/16 10:59:00										0.0			
BH02	23/09/16 11:00:00										0.0			
BH02	23/09/16 11:01:00										0.0			
BH02	23/09/16 11:02:00										0.0			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks		
BH02	23/09/16 11:03:00			4.4	0.0	15.6	0.0	0	0	1.7						
BH02	23/09/16 11:04:00			4.8	0.0	15.2	0.0	0	0	1.6						
BH02	23/09/16 11:05:00			5.0	0.0	15.1	0.0	0	0	1.2						
BH02	23/09/16 11:06:00			5.1	0.0	15.1	0.0	0	0	1.0						
BH02	23/09/16 11:07:00			5.1	0.0	15.1	0.0	0	0	0.9						
BH02	23/09/16 11:08:00			5.0	0.0	15.1	0.0	0	0	0.7						
BH02	23/09/16 11:09:00			5.0	0.0	15.1	0.0	0	0	0.6						
BH02	23/09/16 11:10:00			4.9	0.0	15.1	0.0	0	0	0.6						
BH02	23/09/16 11:11:00			5.0	0.0	15.4	0.0	0	0	0.5						
BH02	23/09/16 11:12:00			5.0	0.0	15.1	0.0	0	0	0.4						
BH02	23/09/16 11:13:00	1013										17	3.45	Weather Underground data (Farnborough): falling barometric pressure, scattered clouds.		
BH02	30/09/16 12:00:00															
BH02	01/10/16 12:00:00															
BH02	02/10/16 11:50:00															
BH02	03/10/16 11:40:00	1018	0								0.0	18		Weather Underground data (Farnborough): steady barometric		
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362		CHECKED JI

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	03/10/16 11:41:00										0.0			pressure.
BH02	03/10/16 11:42:00										0.0			
BH02	03/10/16 11:43:00										0.0			
BH02	03/10/16 11:44:00										0.0			
BH02	03/10/16 11:45:00			0.6	0.0	20.0	0.0	0	0	0.0				
BH02	03/10/16 11:46:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:47:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:48:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:49:00			0.7	0.0	20.0	0.0	0	0	0.0				
BH02	03/10/16 11:50:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:51:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:52:00			0.7	0.0	20.0	0.0	0	0	0.0				
BH02	03/10/16 11:53:00			0.7	0.0	19.8	0.0	0	10	0.0				
BH02	03/10/16 11:54:00			0.7	0.0	19.9	0.0	0	20	0.0				
BH02	03/10/16 11:55:00												3.44	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	20/09/16 12:00:00	1021										15		Weather Underground data (Farnborough): steady barometric pressure, overcast.
BH03	21/09/16 12:00:00	1018										19		Weather Underground data (Farnborough): steady barometric pressure, partly cloudy.
BH03	22/09/16 12:00:00	1019										17		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH03	23/09/16 10:14:00	1015	0									20		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH03	23/09/16 10:15:00										-0.2			
BH03	23/09/16 10:16:00										-0.1			
BH03	23/09/16 10:17:00										0.0			
BH03	23/09/16 10:18:00										0.0			
BH03	23/09/16 10:19:00										0.0			
BH03	23/09/16 10:20:00										0.0			
BH03	23/09/16 10:21:00										0.0			
BH03	23/09/16 10:22:00										0.0			
BH03	23/09/16 10:23:00										0.0			
BH03	23/09/16 10:24:00										0.0			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks	
BH03	23/09/16 10:25:00			8.0	0.0	0.0	2.6	0	0	4.2			3.77		
BH03	23/09/16 10:26:00			8.3	0.0	0.0	1.6	0	0	5.8					
BH03	23/09/16 10:27:00			8.6	0.0	0.0	0.9	0	0	6.3					
BH03	23/09/16 10:28:00			8.9	0.0	0.0	0.4	0	0	6.6					
BH03	23/09/16 10:29:00			9.0	0.0	0.0	0.4	1	0	6.7					
BH03	23/09/16 10:30:00			9.0	0.0	0.0	0.6	0	0	6.4					
BH03	23/09/16 10:31:00			9.1	0.0	0.0	0.2	0	0	6.6					
BH03	23/09/16 10:32:00			9.1	0.0	0.1	0.3	2	0	6.7					
BH03	23/09/16 10:33:00			9.2	0.0	0.0	0.3	0	0	6.7					
BH03	23/09/16 10:34:00			9.2	0.0	0.0	0.3	0	0	6.7					
BH03	23/09/16 10:35:00														
BH03	30/09/16 12:00:00	1013										17		Weather Underground data (Farnborough): falling barometric pressure, scattered clouds.	
BH03	01/10/16 12:00:00	1005										12		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.	
BH03	02/10/16 11:50:00	1017										13		Weather Underground data (Farnborough): rising barometric pressure, scattered clouds.	
BH03	03/10/16 10:45:00	1020	0								0.0	17		Weather Underground data (Farnborough): steady barometric	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362	CHECKED JI

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	03/10/16 10:46:00										0.0			pressure.
BH03	03/10/16 10:47:00										0.0			
BH03	03/10/16 10:48:00										0.0			
BH03	03/10/16 10:49:00										0.0			
BH03	03/10/16 10:50:00			0.2	0.0	20.4	0.0	0	0	0.0				
BH03	03/10/16 10:51:00			0.2	0.0	20.5	0.0	0	0	0.0				
BH03	03/10/16 10:52:00			0.1	0.0	20.4	0.0	0	0	0.0				
BH03	03/10/16 10:53:00			0.0	0.0	20.4	0.0	0	0	0.0				
BH03	03/10/16 10:54:00			0.0	0.0	20.4	0.0	0	0	0.0				
BH03	03/10/16 11:00:00												3.79	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	20/09/16 12:00:00	1021										15		Weather Underground data (Farnborough): steady barometric pressure, overcast.
BH04	21/09/16 12:00:00	1018										19		Weather Underground data (Farnborough): steady barometric pressure, partly cloudy.
BH04	22/09/16 12:00:00	1019										17		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH04	23/09/16 11:25:00	1014	0									18		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH04	23/09/16 11:26:00										0.0			
BH04	23/09/16 11:27:00										0.0			
BH04	23/09/16 11:28:00										0.0			
BH04	23/09/16 11:29:00										0.0			
BH04	23/09/16 11:30:00										0.0			
BH04	23/09/16 11:31:00										0.0			
BH04	23/09/16 11:32:00										0.0			
BH04	23/09/16 11:33:00										0.0			
BH04	23/09/16 11:34:00										0.0			
BH04	23/09/16 11:35:00										0.0			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks	
BH04	23/09/16 11:36:00			4.2	0.0	14.4	0.0	0	14	0.2					
BH04	23/09/16 11:37:00			4.3	0.0	13.3	0.0	0	0	0.5					
BH04	23/09/16 11:38:00			4.0	0.0	12.7	0.0	0	0	0.5					
BH04	23/09/16 11:39:00			4.5	0.0	13.0	0.0	0	0	0.4					
BH04	23/09/16 11:40:00			4.5	0.0	13.0	0.0	0	0	0.3					
BH04	23/09/16 11:41:00			4.6	0.0	13.0	0.0	0	0	0.4					
BH04	23/09/16 11:42:00			4.6	0.0	13.0	0.0	0	0	0.4					
BH04	23/09/16 11:43:00			4.6	0.0	13.0	0.0	0	0	0.4					
BH04	23/09/16 11:44:00			4.6	0.0	12.9	0.0	0	0	0.2					
BH04	23/09/16 11:45:00			4.6	0.0	12.8	0.0	0	0	0.2					
BH04	23/09/16 11:46:00											4.29			
BH04	30/09/16 12:00:00	1013										17		Weather Underground data (Farnborough): falling barometric pressure, scattered clouds.	
BH04	01/10/16 12:00:00	1005										12		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.	
BH04	02/10/16 11:50:00	1017										13		Weather Underground data (Farnborough): rising barometric pressure, scattered clouds.	
BH04	03/10/16 11:20:00	1013									0.0	14		Weather Underground data (Farnborough): steady barometric	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362	CHECKED JI



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Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks	
BH04	03/10/16 11:21:00										0.0			pressure.	
BH04	03/10/16 11:22:00										0.0				
BH04	03/10/16 11:23:00										0.0				
BH04	03/10/16 11:24:00										0.0				
BH04	03/10/16 11:25:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:26:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:27:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:28:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:29:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:30:00											4.30			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362	CHECKED JI

Appendix D – Site Reconnaissance Photographs

University of Reading – Engineering Building Walkover and Gas Monitoring

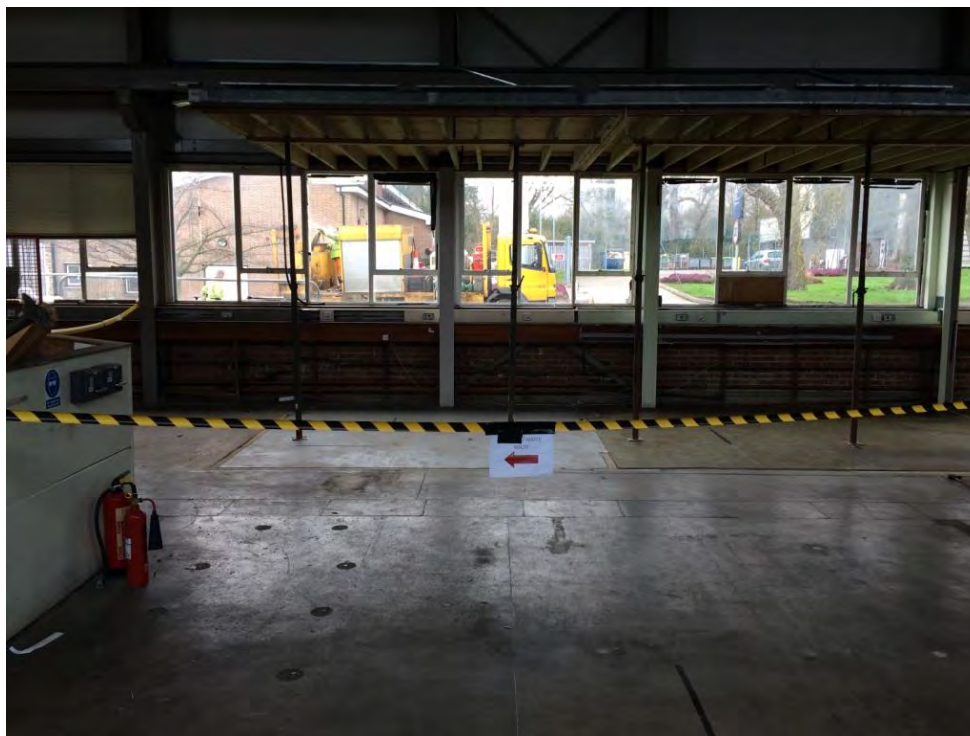


Photo 1 – Engineering workshop – cleared of all machinery, no visual olfactory evidence of contamination.



Photo 2 – Service ducts on ground floor of single storey south section. Asbestos removed from ducts, no visual olfactory evidence of contamination.

Title	Photolog		App'd:	Drawn JC	Date: March 2017
Location	Engineering Building (HLS Project)			Draft	Ref: Walkover
Client	University of Reading			Scale: N/A	Job No: 60441574
				Drg. Size: A4	PLATES



Photo 3 – Redundant fuse board in Engineering building. No transformer was noted in the accessible parts of the building. Site management confirms no transformer was present in the building.



Photo 4 – Plant room in basement. All machinery on raised plinths. Some water on floor, no visual or olfactory evidence of contamination.

Title	Photolog		App'd:	Drawn	Date:
				JC	March 2017
Location	Engineering Building (HLS Project)			Draft	Ref:
					Walkover
Client	University of Reading			Scale:	Job No:
				N/A	60441574
				Drg. Size:	PLATES
				A4	



Photo 5 – Site of BH01 to the south of the Engineering building.



Photo 6 – Site of BH02 to the north of the Engineering building. Contractor confirmed excavation of this well during subsurface utility re-routing/installations.

Title	Photolog		App'd:	Drawn	Date:
				JC	March 2017
Location	Engineering Building (HLS Project)		Draft		Ref: Walkover
			Scale:		Job No: 60441574
Client	University of Reading		Drg. Size:	A4	PLATES



Photo 7 – Site of BH03 in former car park. Currently a contractor compound. Despite scraping away spoil piles the well could not be located.



Photo 8 – Site of BH04, at right, to the west of the single storey element of the Engineering building.

Title	Photolog		App'd:	Drawn	Date:
Location	Engineering Building (HLS Project)			JC	March 2017
Client	University of Reading			Draft	Ref: Walkover
				Scale:	Job No: 60441574
				N/A	
				Drg. Size:	PLATES
				A4	



Photo 9 – View north to Engineering building from remediated Energy Centre site 30m to south.



Photo 10 – View west to Engineering building from campus road to east.

Title	Photolog		App'd:	Drawn JC	Date: March 2017
Location	Engineering Building (HLS Project)			Draft	Ref: Walkover
Client	University of Reading			Scale: N/A	Job No: 60441574
				Drg. Size: A4	PLATES



Photo 11 – View south-west to Engineering building from pathway to north.



Photo 12 – Pond in 'Harris Gardens' 210m east of the site.

Title	Photolog		App'd:	Drawn JC	Date: March 2017
Location	Engineering Building (HLS Project)			Draft	Ref: Walkover
Client	University of Reading			Scale: N/A	Job No: 60441574
				Drg. Size: A4	PLATES



Photo 13 – Start of drainage ditch approx. 175m south-east of the site. Observed as dry and does not appear to have received water for some time.



Photo 14 – Continuation of drainage ditch 150m east of the site – dry. Identified in Envirocheck as the nearest surface water feature to the site.

Title	Photolog		App'd:	Drawn JC	Date: March 2017
Location	Engineering Building (HLS Project)		Draft	Ref:	Walkover
Client	University of Reading		Scale:	Job No:	60441574
			N/A		
			Drg. Size: A4		PLATES



Photo 15 – Site of 'spring' indicated of OS mapping approximately 275m east of the site.



Photo 16 – Pond downstream (north) of spring site – start of Whiteknights Lake to north.

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Location	Engineering Building (HLS Project)			JC	March 2017
Client	University of Reading		Draft		Ref: Walkover
			Scale:		Job No: 60441574
			Drg. Size:		PLATES
			A4		



Photo 17 – View north from 'Friend's Bridge' at Whiteknights Lake. Discharge Consented drainage point visible at left.



Photo 18 – Detail of Discharge Consented drainage (surrendered) identified 286m NE of site in Envirocheck report.

Title	Photolog		App'd:	Drawn JC	Date: March 2017
Location	Engineering Building (HLS Project)			Draft	Ref: Walkover
Client	University of Reading			Scale: N/A	Job No: 60441574
				Drg. Size: A4	PLATES



Photo 19 - View north into overgrown surface drainage ditch identified in Envirocheck report, 186m south east of the site (up-gradient). Observed as dry and apparently inactive for some time.



Photo 20 - View of pond in school grounds, identified in Envirocheck report, 225m south west of the site (up-gradient).

Title	Photolog		App'd:	Drawn JC	Date: March 2017	
Location	Engineering Building (HLS Project)		Draft		Ref: Walkover	
Client	University of Reading		Scale: N/A		Job No: 60441574	
			Drg. Size: A4		PLATES	

Appendix E Background to Legislation on Contaminated Land

Legislative Framework

The contaminated land regime in Part 2A of the Environment Protection Act 1990 was introduced to specifically address the historical legacy of land contamination. Part 2A of the Environmental Protection Act 1990 (Amended April 2012) has introduced the following statutory definition for “contaminated land”:

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

- (a) significant harm is being caused or there is significant possibility of such harm being caused; or*
- (b) significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.”*

Part 2A provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment. Enforcing authorities are required to identify and deal with such land but Part 2A is only to be used by the Enforcing Authority where no appropriate alternative solution exists.

The Process of Risk Assessment

The assessment of contaminated land can be seen as a two phase risk based process, comprising:

- (1) A qualitative assessment of the likelihood of plausible contaminant linkages, i.e. there must not only be a source of contamination, but a pathway and a receptor; and
- (2) A quantitative element which will seek to determine the degree of harm and the significance of such harm on a receptor.

A “contaminant” is a substance which is in, on or under the land and which has the potential to cause significant harm to a receptor or to cause significant pollution of controlled waters.

A “pathway” is a route by which a receptor is or might be affected by a contaminant.

A “receptor” is something that could be adversely affected by a contaminant, for example a person, an organism, an ecosystem, property or controlled waters.

The term “contaminant linkage” indicates that all three elements (i.e. a contaminant, a pathway and a receptor) have been identified. The term “significant contaminant linkage” means a contaminant linkage which gives rise to a level of risk sufficient to justify a piece of land being determined as contaminated land (in other words, there is unacceptable risks posed by the land contamination to human health and or the environment). The term “significant contaminant” means the contaminant which forms part of a significant contaminant linkage.

Significant Harm to Human Health

The following health effects constitute significant harm: death, life threatening diseases (cancers), other diseases likely to have a serious impact on health, serious injury, birth defects and impairment of reproductive functions.

Significant Possibility of Significant Harm to Human Health

In deciding whether or not land is contaminated land on the grounds of significant possibility of significant harm to human health, the local authority use the following categorisations:

Category 1: Human Health

Land should be deemed to be a Category 1: Human Health case where:

- (a) the authority is aware that similar land or situations are known, or are strongly suspected on the basis of robust evidence, to have caused such harm before in the United Kingdom or elsewhere; or
- (b) the authority is aware that similar degrees of exposure (via any medium) to the contaminant(s) in question are known, or strongly suspected on the basis of robust evidence, to have caused such harm before in the United Kingdom, or elsewhere;
- (c) the authority considers that significant harm may already have been caused by contaminants in, on or under land, and that there is an unacceptable risk that it may continue or occur again if no action is taken.

Category 2: Human Health

Land should be placed into Category 2 if the authority concludes, on the basis that there is a strong case for considering that the risks from the land are of sufficient concern, that the land poses a significant possibility of significant harm. Category 2 may

include land where there is little or no direct evidence that similar land, situations or levels of exposure have caused harm before, but nonetheless the authority considers on the basis of the available evidence, including expert opinion, that there is a strong case for taking action under Part 2A on a precautionary basis.

Category 3: Human Health

Land should be placed into Category 3 if the authority concludes that the strong case of Category 2 does not exist. Category 3 may include land where risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted. This recognises that placing land in Category 3 would not stop others, such as the owner or occupier of the land, from taking action to reduce risks outside of the Part 2A regime if they choose.

Category 4: Human Health

The local authority should consider that the following types of land should be placed into Category 4: Human Health:

- (a) Land where no relevant contaminant linkage has been established.
- (b) Land where there are only normal levels of contaminants in the soil.
- (c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed generic assessment criteria.
- (d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).

“Normal” Presence of Contaminants

“Normal” levels of contaminants in soils should not be considered to cause land to qualify as contaminated land, unless there is particular reason to consider otherwise. “Normal” levels of contaminants in soils may result from:

- (a) The natural presence of contaminants (e.g. caused by underlying geology) at levels that might reasonably be considered typical in an area and have not been shown to pose an unacceptable risk.
- (b) The presence of contaminants caused by low level diffuse pollution, and common human activity. For example, this would include diffuse pollution from historic use of leaded petrol and the presence of benzo(a)pyrene from vehicle exhausts and the spreading of domestic ash in gardens that might reasonably be considered typical.

Significant Pollution of Controlled Waters

Pollution of controlled water means the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter. The term “controlled water” is as defined in Part 3 of the Water Resources Act 1991, except that ground waters does not include waters contained in underground strata but above the saturation zone (i.e. perched water).

The following criteria are used to establish whether significant pollution of controlled waters has occurred:

- (a) Pollution equivalent to “environmental damage” to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation)(England) Regulations 2015
- (b) Inputs resulting in the deterioration of the quality of water abstracted, or intended to be used in the future.
- (c) A breach of a statutory surface water Environmental Quality Standard, either directly or via a groundwater pathway.
- (d) Input of a substance into groundwater resulting in a significant and sustained upward trend in concentration of contaminants.

The following categories are adopted in relation to determining the significant possibility of significant pollution of controlled waters.

Category 1: Water

This covers land where the authority considers that there is a strong and compelling case for considering that a significant possibility of significant pollution of controlled waters exists. In particular, this would include cases where there is robust science-based evidence for considering that it is likely that high impact pollution would occur if nothing were done to stop it.

Category 2: Water

This covers land where:

- (a) The authority considers the strength of evidence to put the land into Category 1 does not exist; but
- (b) Nonetheless, on the basis of the available scientific evidence and expert opinion, the authority considers that the risks posed by the land are of sufficient concern that the land should be considered to pose a significant possibility of significant pollution of controlled waters on a precautionary basis, with all that this might involve (e.g. likely remediation requirements, and the benefits, costs and other impacts of regulatory intervention). Among other things, this category might include land where there is a relatively low likelihood that the most serious types of significant pollution might occur.

Category 3: Water

This covers land where the authority concludes that the risks are such that (whilst the authority and others might prefer they did not exist) the tests set out in Categories 1 and 2 are not met, and therefore regulatory intervention under Part 2A is not warranted. This category should include land where the authority considers that it is very unlikely that serious pollution would occur; or where there is a low likelihood that less serious types of significant pollution might occur.

Category 4: Water

This covers land where the authority concludes that there is no risk, or that the level of risk posed is low. In particular, the authority should consider that this is the case where:

- (a) No contaminant linkage has been established in which controlled waters are the receptor in the linkage; or
- (b) the possibility only relates to type of pollution that should not be considered to be significant pollution; or
- (c) The possibility of water pollution similar to that which might be caused by "background" contamination.

Terminology

The term 'Contaminated Land' is used to mean land which meets the Part 2A definition. Other terms, such as 'land affected by contamination' or 'land contamination' are used to describe much broader categories of land where contaminants are present but usually not at sufficient level of risk to be Contaminated Land.

Planning Policy and Land Contamination

The National Planning Policy Framework has replaced Planning Policy Statement PPS23: Planning and Pollution Control. Under the Part 2A Statutory Guidance the planning system is highlighted as one of the other ways in which land contamination can be addressed. The key parts of the policy specifically relating to soils, geology and contamination are summarised below (taken from the Section 11 – Conserving and enhancing the natural environment):

109. *The planning system should contribute to and enhance the natural and local environment by:*
- *protecting and enhancing valued landscapes, geological conservation interests and soils;*
 - *preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and*
 - *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.*
111. *Planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value. Local planning authorities may continue to consider the case for setting a locally appropriate target for the use of brownfield land.*
120. *To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.*
121. *Planning policies and decisions should also ensure that:*
- *the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;*
 - *after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and*
 - *adequate site investigation information*, prepared by a competent person**, is presented.*

For a site undergoing development or redevelopment it should be the case that upon completion of that work the site should sit within Category 4 in respect of all receptors.

**Site investigation information:* Includes a risk assessment of land potentially affected by contamination, or ground stability and slope stability reports, as appropriate. All investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 (2011) Code of Practice for the Investigation of Potentially Contaminated Sites). The minimum information that should be provided by an applicant is the report of a desk study and site reconnaissance.

***Competent person (to prepare site investigation information):* A person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land stability, and membership of a relevant professional organisation.

Appendix F Risk Assessment

Classification of Consequence

The classifications of consequence (severity) are taken from R&D Publication 66 (NHBC and Environment Agency, 2008). AECOM has chosen to apply the classifications to a broad range of development scenarios.

It should be noted that the categories of pollution incident have no relation to the categories of significant possibility of significant harm to human health or significant possibility of significant pollution of controlled waters in respect of the Part 2A Statutory Guidance.

Classification	Definition
Severe	Highly elevated concentrations likely to result in “significant harm” to human health as defined by the EPA 1990, Part 2A, if exposure occurs. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Catastrophic damage to crops, buildings or property.
Medium	Elevated concentrations which could result in “significant harm” to human health as defined by the EPA 1990, Part 2A if exposure occurs. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.
Mild	Exposure to human health unlikely to lead to “significant harm”. Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce. Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population. Minor damage to crops, buildings or property.
Minor	No measurable effect on humans. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structure and services.

Classification of Probability

The classifications of probability are taken from R&D Publication 66 (NHBC and Environment Agency, 2008). AECOM has chosen to apply the classifications to a broad range of development scenarios.

It should be noted that the categories of pollution incident have no relation to the categories of significant possibility of significant harm to human health or significant possibility of significant pollution of controlled waters in respect of the Part 2A Statutory Guidance (Appendix D). Also, in the Part 2A Statutory Guidance "pollutant linkage" is now termed "contaminant linkage", although it is noted that the terms are effectively synonymous.

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

Categorisation of Risk

		Consequence (Severity)			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low Likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Description of Risk Levels and Likely Action Required

Term	Description
Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action <u>or</u> there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to be site owner or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.
High risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action. Realisation of the risk is likely to present a substantial liability to the site owner or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term.
Moderate risk	It is possible that without appropriate remediation action, harm would arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term.
Low risk	It is possible that harm could arise to a designated receptor from identified hazard. It is likely that, at worst, if any harm was realised any effects would be mild. It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.
Very low risk	It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.
No potential risk	There is no potential risk if no pollutant linkage has been established.

Summary of Definitions

Term	Description
Hazard	A property or situation which in certain circumstances could lead to harm. (The properties of different hazards must be assessed in relation to their potential to affect the various different receptors).
Consequences	The adverse effects (or harm) arising from a defined hazard which impairs the quality of the environment or human health in the short or longer term.
Probability	The mathematical expression of the chance of a particular event in a given period of time (e.g. probability of 0.2 is equivalent to 20% or a 1 in 5 chance).
Likelihood	Probability; the state of face of being likely.
Risk	A combination of the probability or frequency of the occurrences of a defined hazard AND the magnitude of the consequences of that occurrence.
Contaminant linkage	An identified pathway is capable of exposing a receptor to a contaminant and that contaminant is capable of harming the receptor. In the Part 2A Statutory Guidance the terms "contaminant", "pollutant" and "substance" have the same meaning, and some non-statutory technical guidance relevant to land contamination uses alternative terms such as "pollutant", "substance" and associated terms in effect to mean the same thing.

