Report No. 9642/1
Date: April 2009

GEOENVIRONMENTAL APPRAISAL

of land at

YEWS PLACE, KENDRAY

Prepared for

KEEPMOAT HOMES

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YEWS PLACE, KENDRAY (KEEPMOAT) - SUMMARY OF GEOENVIRONMENTAL ISSUES

The site is located off Yews Place, Kendray, approximately 2km south-east of Barnsley town centre (NGR SE 358 053). The site occupies an area of approximately 0.25 hectares (0.6 acres).

The site currently comprises a temporary office compound and storage yard, associated with adjacent residential development by Keepmoat. Historically the site was occupied by housing.

Encia were commissioned by Keepmoat to provide a geoenvironmental appraisal of the site. It is understood that the site is to be redeveloped with ten semi-detached two storey dwellings; a proposed sketch layout is available. Encia's investigation included a review of geological & historical plans together information from the Coal Authority, Environment Agency and Local Authority and a ground investigation comprising ten window sample borehole.

A summary of salient geoenvironmental issues is provided in the Table below.

Issue	Remarks
Made Ground	A veneer of made ground comprising granular Sub-base identified up to 0.4m depth, underlain by Relict Subsoil with occasional gravel of brick and concrete up to 0.9m depth, typically <0.5m.
Natural Ground	Generally comprised Weathered Sandstone recovered as sandy gravel and cobbles, encountered between 0.35m and 1.3m depth, typically <1m. Locally, Completely Weathered, recovered as clayey sand and sandy clay.
Contamination	No visual or olfactory signs of gross organic contamination. No significant contamination identified during laboratory testing (one outlier of elevated arsenic identified in one sample of Sub-base).
Hazardous Gas	Site is not located in a radon affected area. No significant sources of hazardous gas within 210m of the site and no significant putrescibles identified at the site. Site not underlain by shallow underground mine workings. Therefore no hazardous gas protection measures considered necessary although information from the EA and Barnsley Council still awaited.
Mining & Quarrying	The surface stability of the site is unlikely to be affected by shallow underground coal mining. There are no active of former quarries at or adjacent to the site.
Preparatory Works	Likely to comprise redistribution of granular Sub-base beneath areas of proposed hardstand. Import of Subsoil/Topsoil to act as a suitable growing medium in garden areas.
Foundations	Conventional strip footings founded in the sandstone strata from around 0.45m to 1.3m depth. Locally overdeepend to found entirely in rock.
Groundwater & Excavations	Groundwater was not encountered and is likely to lie at depth within the sandstone strata. During the window sampling several of the window sample holes 'refused' within the sandstone. Given the relatively small diameter of the window sample holes assessment of the ease of excavation at the site is not possible. However, an allowance should be made for the excavation of rock in any drainage/service trenches greater than around 1.5m depth.
Flooding & Drainage	The site is not located within an indicative flood plain. Soakaways may be a suitable drainage solution for surface water run-off at the site although this is dependant of the nature and openness of the fractures within the sandstone. At this stage no in-situ testing has been undertaken.
Highways	Highways at the site are likely to be constructed on natural sandstone strata which should have a CBR value in excess of 5%. Where made ground is encountered then this should be excavated and replaced with suitable aggregate.

Developer abnormals relating to geoenvironmental issues at the site are:

- Post site vacation trial pitting to confirm ground conditions and allow soakaway testing
- Grubbing up of localised hardstand and granular Sub-base.
- Import and placement of minimum 300mm thickness of subsoil/topsoil for use as a suitable growing medium in garden/landscaped areas

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

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APPENDICES

Appendix A – General Notes

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02	Ground Investigation Fieldwork
03	Geotechnical Testing
04	Contamination Laboratory Analysis & Interpretation (including WAC)

Appendix B – Drawings

Drawing No.	Title
9642/1	Site Location Plan
9642/2	Proposed Site Layout
9642/3	Existing Site Features & Site Photographs
9642/4	Preliminary Conceptual Site Model
9642/5	Exploratory Hole Location Plan
9642/6	Revised Conceptual Site Model

Appendix C – Commission

Appendix D – Historical OS Plans (Some plans only included on accompanying CD)

Appendix E – Search Responses (Some data is only included on accompanying CD)

From	To	Date	Content
Envirocheck	Encia	26th March 2009	Envirocheck Report Extracts
Coal Authority	Encia	27th March 2009	Mining Report
Barnsley Metropolitan Borough Council	Encia	awaited	Environmental Search
Environment Agency	Encia	awaited	Environmental Search

Appendix F – Exploratory Records

Appendix F	WS1 to WS10

Appendix G – Chemical Test Results (Only on accompanying CD)

FOREWORD (Geoenvironmental Investigation Report)

This report has been prepared for the sole internal use and reliance of the Client named on page 1. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Encia Environmental Limited (Encia); such authorisation not to be unreasonably withheld. If any unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill.

The report presents observations and factual data obtained during our site investigation, and provides an assessment of geoenvironmental issues with respect to information provided by the Client regarding the proposed development. Further advice should be sought from Encia prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. Encia cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. However, it should be noted that in order to keep the number of sheets of paper in the hard copy to a minimum, some information (e.g. laboratory test certificates) is only included within the "electronic", PDF Report on the accompanying CD.

The findings and opinions conveyed in this report (including review of any third party reports) are based on information obtained from a variety of sources as detailed within this report, and which Encia believes are reliable. All reasonable care and skill has been applied in examining the information obtained. Nevertheless, Encia cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

The report represents the findings and opinions of experienced geo-environmental consultants. Encia does not provide legal advice and the advice of lawyers may also be required.

Intrusive investigation can only investigate shallow ground beneath a small proportion of the total site area. It is possible therefore that the intrusive investigation undertaken by Encia, whilst fully appropriate, may not have encountered all significant subsurface conditions. Consequently, no liability can be accepted for conditions not revealed by the exploratory holes. Any opinion expressed as to the possible configuration of strata between or below exploratory holes is for guidance only and no responsibility is accepted as to its accuracy

It should be borne in mind that the timescale over which the investigation was undertaken may not allow the establishment of equilibrium groundwater levels. Particularly relevant in this context is that groundwater levels may be artificially low at the site due to existing pumping and abstraction. In addition, groundwater levels are susceptible to seasonal and other variations and may be higher during wetter periods than those encountered during this commission.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

Encia Environmental Limited cannot be responsible for the consequences of changing practices, revisions to waste management legislation etc that may affect the viability of proposed remedial options.

Encia reserve the right to amend their conclusions and recommendations in the light of further information that may become available.

GEOENVIRONMENTAL APPRAISAL

of land at

YEWS PLACE, KENDRAY

1 INTRODUCTION

1.1 The Commission and Brief

1.1.1 Encia Environmental Limited (Encia), were commissioned by Keepmoat Homes (Keepmoat) to carry out a geoenvironmental appraisal of land at Yews Place, Kendray.

1.1.2 Correspondence regarding Encia's appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:

- a site walkover and inspection
- an assessment of the land use history
- determination of the site's environmental setting
- an intrusive ground investigation comprising ten window sample boreholes
- assessment of the geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations
- a qualitative assessment of contamination risks, with respect to potential receptors
- the provision of recommendations with respect to site preparatory and remedial works

1.2 The Proposed Development

1.2.1 It is understood that consideration is being given to redevelopment of the site with two storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. A sketch site layout has been provided by Keepmoat (Yews Place, Kendray) which is reproduced as Drawing No. 9642/2 in Appendix B to this report.

1.3 Report Format and Limitations

1.3.1 All standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on:

- Assessment of the site's environmental setting
- Ground investigation fieldwork (including techniques, in-situ testing and sampling)
- Geotechnical Testing
- Contamination Testing (including current guidance, notes about organics analyses, and WAC)

1.3.2 General notes and limitations relevant to all Encia geoenvironmental investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

1.3.3 Primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to enable the Client to obtain budget costs for the necessary site preparatory and remedial works.

2 SITE DESCRIPTION

2.1 General

2.1.1 The site location is shown on Drawing No. 9642/1 presented in Appendix B to this report. Site details are summarised in the Table below.

Detail	Remarks
Location	2 km south-east of Barnsley town centre
NGR	SE 358 053
Approximate Area	0.25ha
Known services	Underground electric, water & sewer serving existing site cabins.

2.2 Site Features

2.2.1 An Encia engineer completed a walkover survey of the site on 31st March 2009.

2.2.2 The site is currently used as a storage and temporary office compound by Keepmoat, associated with the construction of the neighbouring residential development.

2.2.3 Existing salient features together with a photographic record of the site at the time of the walkover survey are presented on Drawing No. 9642/3 in Appendix B to this report.

Feature	Remarks
Current Access	Off Cedar Crescent to the south and Yews Place to the north
Topography	General slope downwards from west to east
Approximate areas	500m^2 temporary office blocks/storage containers 2,000m^2 tarmac hardstand/granular Sub-base, with approximately 800m^2 covered with building materials
Nature of boundaries	The site is currently enclosed with temporary herras fencing
Surrounding land uses	North & East – new build residential South & West – existing residential

2.3 Site Operations

2.3.1 The site is currently in use as a storage and temporary office compound. Raw materials stored on site comprise building materials such as timber, bricks, sands/gravels and individually bagged cement powder.

2.3.2 Two fuel tanks are located at the site. A bunded fuel tank is located within the office area in the south of the site with a second internally bunded tank stored within a steel container in the north-west of the site.

2.3.3 No visual or olfactory evidence of spillage/leakage was noted at the location of either tank.

2.3.4 The filling of the internally bunded tank in the north-west was observed during the walkover. Filling took place from a tanker using a sealed hose locked to the filler pipe of the tank.

2.4 Japanese Knotweed

2.4.1 During the site walkover, we did not notice the presence of any Japanese Knotweed. However, it should be noted that we are not qualified ecologists and as such cannot guarantee the absence of Knotweed or other invasive vegetation.

3 SITE HISTORY

3.1.1 In order to investigate the development history and previous land uses at the site and immediate surrounding land, site centred extracts from Ordnance Survey (OS) plans dating back to 1892 were examined. These plans are presented in Appendix D to this report.

3.1.2 The Table below provides a summary of the salient points relating to the history of the site with respect to the proposed end use. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in bold text for ease of reference.

Date(s)	Site	Surrounding Land
1892	Open fields	**Pinder Oaks Colliery** (disused) 250m to north-west
1938	**Buildings** shown in north of site, likely residential	Residential development shown to north of site
1948		Site of former colliery now occupied by a **factory** building
1961		Residential development shown to south, east and west of site
1974	**Buildings** shown in south of site, likely residential	

3.1.3 No further significant changes are shown on subsequent plans although the buildings at the site have recently been demolished.

4 ENVIRONMENTAL SETTING

4.1 General

4.1.1 Notes describing how the site's environmental setting has been assessed are included in Appendix A to this report. The response received from the Coal Authority together with extracts from the Landmark report are presented in Appendix E.

Issue	Data reviewed	Summary
Geology	1:50,000 BGS map (Sheet 87 - Barnsley) 1:10,000 BGS map (Sheet SE 34 NE)	Drift – None shown. Solid – Oaks Rock Sandstone (Coal Measures). Shallowest coal seam – Newhill Coal (0.61m to 1.37m) below at least 20m depth. Strata Dip – to south-east, no dip angle shown. Faults – none at or adjacent to the site.
Mining	Coal Authority Report BGS maps	Past and present workings – Property is within the likely zone of physical influence from workings in 12 seams of coal at 150m to 560m depth, last worked in 1974. Any ground movement from these coal workings should have stopped by now. Mine entries – None at or within 20m of the site. Opencast – None at the site.
Quarrying	Local Authority search Historical OS Plans	No quarrying is shown at or near to the site.
Radon	BRE Report BR211	Not located in a radon affected area, no protection measures required.
Hydrogeology	Environment Agency Groundwater Vulnerability map (Sheet 11 South Pennines)	Source Protection Zone - None. Aquifer – Minor Aquifer (Solid). Soil leaching potential – High (Unclassified). Groundwater abstractions – None within 1km of the site. Pollution incidents – None at or relating to the site.
Hydrology	Environment Agency Landmark Report	Nearest watercourse(s) – Measborough Dike flowing south to north approximately 170m to west. Water quality – not provided. Pollution incidents – None at or relating to the site. Abstractions – None within 1km of the site. Discharge consents – Nearest located approximately 700m to north-east, discharge of sewage/storm effluent.
Flood Risk	Environment Agency	Site not located within a flood plain

4.1.2 The responses from Barnsley Metropolitan Borough Council and the Environment Agency are still awaited at the time of writing and will be forwarded upon receipt.

4.2 Landfills

4.2.1 Known or suspected areas of landfill in the vicinity of the proposed development site are summarised below:

Landfill Sites

Location	NGR (proximity to site)	Remarks	Source of data
Cemetery Road	SE 356 055 (210m north-west)	Nature & depth of waste; date of filling; monitoring results etc not provided. Site currently forms part of a cemetery.	Landmark
Highfield Farm	SE 356 048 (470m south)	Less than 250,000 tonnes per year, licence ref WD20 B 311, lapsed/cancelled/surrended since 1st January 1981. Waste types – construction & demolition waste.	Landmark
Monument Field	SE 362 058 (640m north-east)	Less than 250,000 tonnes per year, licence ref WD20 B 37, lapsed/cancelled/surrended since 1st September 1977. Waste types – construction & demolition waste, inert/non hazardous/non toxic.	Landmark

4.2.2 The northern extent of the landfill at Cemetery Road has been occupied by a cemetery since 1931, with the cemetery extending over the southern extent on the 1961 OS Plan.

4.2.3 No evidence of landfilling is shown on geological or historical OS Plans, the area of the landfill is shown as occupied partly by the former Pinder Oaks Colliery, a factory and Barnsley cemetery. It is possible that the landfilling refers to deposits of colliery spoil from the colliery which are unlikely to generate significant quantities of hazardous gas.

4.2.4 Further details may be provided by Barnsley Metropolitan Borough Council and the Environment Agency in their responses which are currently awaited. Further assessment of the significance of the Cemetery Road landfill will be made on receipt of such additional information.

4.2.5 The former landfills at Highfield Farm and Monument Field are not considered a significant risk given the nature of the wastes deposited, dates of closure/licence surrender and distances from the development site.

5 GROUND INVESTIGATION DESIGN

5.1 Anticipated Ground Conditions & Potential Issues

5.1.1 Based on the data reviewed in Section 4 (Environmental Setting), anticipated ground conditions are expected to comprise:-

Anticipated Condition	Remarks
Made Ground	Shallow granular made ground associated with the storage compound surfacing. Possible relict foundations from former housing
Natural Soils	Completely Weathered Oaks Rock Sandstone at shallow depth
Bedrock	Oaks Rock Sandstone at shallow depth
Mineworkings	No shallow underground workings anticipated
Groundwater	Likely to lie at depth within the sandstone strata

5.1.2 Based on the data above and that in Sections 2 (Site Description) and 3 (History), potential ground-related issues associated with this site are likely to include:

Type of Issue	Specific Issue	Remarks
Potential on-site contamination sources	1. fuel storage tank in south of site 2. fuel storage tank in north-west of site 3. made ground	1. possible spillage/leakage 2. possible spillage/leakage 3. granular site surfacing
Potential off-site contamination sources	1. none anticipated	
Potential geotechnical hazards	1. relict buried obstructions 2. deep Made Ground	1. from former buildings 2. possible backfilled basements
Other potential constraints	1. none anticipated	

5.2 Preliminary Conceptual Site Model

5.2.1 A preliminary conceptual site model, presented as Drawing No 9642/4 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 5.1 inclusive, of this report.

5.2.2 Potential pollutant linkages are shown on the preliminary conceptual site model.

5.2.3 The most significant receptors at the site include:

- Human Health (end-users)
- The Environment (Groundwater – minor aquifer, vegetation)

5.2.4 The most significant pathways at the site include:

- Direct contact, inhalation and ingestion
- Leaching of mobile contaminants
- Volatilisation of organic contaminants

5.3 Ground Investigation Design & Strategy

5.3.1 The preliminary conceptual site model was used as a basis for design of an appropriate ground investigation, the scope of which is summarised below.

Initial Ground Investigation Strategy

Exploratory Holes	Purpose
WSs 1 to 10	To determine the general nature of soils underlying the site, including the: • nature, distribution and thickness of made ground • nature, degree and extent of contamination • proportion of undesirable elements eg biodegradable matter, foundations etc • suitability of the ground for founding structures and highways
WS 10	To idntify potential hydrocarbon contamination around the fuel storage tank in the south of the site

5.3.2 Proposed exploratory hole locations have been selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 5.1 above. A nominal 30m grid spacing is proposed. Additional exploratory locations will probably be scheduled by the site engineer in light of the ground conditions actually encountered.

5.3.3 The number of representative samples taken will be reflective of the geological complexity actually encountered. However, in general about 3 samples will be taken from most trial pits.

5.3.4 An assessment of potential contaminants associated with the former uses has been undertaken. As a consequence of this assessment, anticipated potential contaminants, within soil and/or groundwater include:

- Metals within the made ground
- Organics adjacent to the fuel storage tanks

6 FIELDWORK

6.1 Objectives

6.1.1 The original investigation strategy is outlined in Section 5.2 above.

6.2 Exploratory Hole Location Constraints

6.2.1 Access was limited across the site due to office cabins, storage containers, services, site operations and storage of building materials. Window sampling was the only practical investigation at the site.

6.2.2 No access was available adjacent to the fuel storage tank n the north-west of the site as the tank is located inside a steel lockable storage container.

6.2.3 It should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material). Furthermore, assessment of the strength of cohesive soils, via hand vane tests, is difficult due to disturbance caused by drilling.

6.3 Scope of Works

6.3.1 Fieldwork was supervised by Encia on 31st March 2009 and comprised the exploratory holes listed below.

Scope of Ground Investigation Works

Technique	Exploratory holes	Final depth(s)	Remarks
Window Sample boreholes	WSs 1 to 10	1.0m to 2.7m	Monitoring wells installed in WSs 2, 5 & 9

6.3.2 Notes describing ground investigation techniques, in-situ testing and sampling are included in Appendix A to this report.

6.3.3 Exploratory hole logs are presented in Appendix F to this Report. These logs include details of the:

- Samples taken
- Descriptions of the solid strata, and any groundwater encountered.
- The monitoring wells installed

6.3.4 Exploratory hole locations are shown on Drawing No. 9642/5 presented in Appendix B.

7 GROUND CONDITIONS

7.1 General

7.1.1 A complete record of strata encountered beneath the proposed development site is given on the various exploratory hole records, presented in Appendix F. However, a summary of the ground conditions is provided below.

7.1.2 Typical ground conditions encountered at the site are described below in Sections 7.2 (made ground) and 7.4 (natural ground) with a summary provided in the Table on page 9.

7.2 Made Ground

7.2.1 The made ground on site is a heterogeneous mixture of materials and it is unlikely, even with a huge amount of sampling, that it could be accurately characterised. Nonetheless, the bulk of the made ground can be categorised as one of two broad types as summarised in the Table on page 8.

Strata	Typical Composition	Typical Distribution
Sub-Base	Sandy gravel of brick, concrete and sandstone	Identified across the majority of the site up to 0.4m depth. Placed as a running/surface layer within the compound to facilitate access
Relict Subsoil	Stiff (friable) clay with occasional gravel of brick, concrete etc	Identified underlying the Sub-Base across the majority of the site up to 0.9m depth, typically less than 0.5m

7.2.2 Within the office/storage compound in the south of the site Tarmac up to 0.1m thick was encountered.

7.3 Obstructions

7.3.1 It is apparent from a review of historical OS Plans (see Section 3) that buildings have been present on about 30% of the site area.

7.3.2 Constraints associated with the existing operation of the site have prevented trenching to identify and assess the nature/extent of buried obstructions. However, although no significant obstructions were encountered within any of the window sample holes it is possible that due to the relatively small diameter of the holes relict foundations were not identified. Such obstructions may remain at the site.

7.4 Natural Ground

7.4.1 Natural ground was encountered in the majority of the exploratory holes, and typically comprised:

Strata	Typical Composition	Typical Distribution
Completely Weathered Sandstone	Sandy gravelly clay/clayey sand	Identified locally up to 1.3m depth
Weathered Sandstone	Strong sandstone. Recovered as sandy gravelly cobbles	Identified in all of the exploratory holes from 0.55m to 1.3m depth.

7.4.2 The window sample holes were driven in to the sandstone strata until refusal, typically at <2m depth.

Summary of Ground Conditions

Hole ID	Final Depth (m)	Depth to Base of Made Ground (m)	Depth to Base of Made Ground (m)			Depth to Base of Natural Ground (m)		Depth to Rockhead (m)	
			Tarmac	Sub-Base	Relict Subsoil	Completely Weathered Sandstone		Weathered Sandstone	Penetration (m)
						gravelly CLAY	clayey SAND		
WS1	1.40	0.35		0.20	0.35			0.35	1.05
WS2	2.00	0.40		0.20	0.40		1.10	1.10	0.90
WS3	1.40	0.70						0.70	0.70
WS4	1.50	0.50		0.15	0.50			0.50	1.00
WS5	1.00	0.30		0.30		0.60		0.60	0.40
WS6	2.70	0.70	0.05	0.35	0.70		1.30	1.30	1.40
WS7	1.90	0.55		0.35	0.55			0.55	1.35
WS8	1.90	0.50	0.10	0.30	0.50		1.10	1.10	0.80
WS9	1.60	0.50		0.40	0.50			0.50	1.10
WS10	1.60	0.90	0.10	0.30	0.90			0.90	0.70

7.5 Visual & Olfactory Evidence of Organic Contamination

7.5.1 During the investigation no visual or olfactory evidence of gross organic contamination were noted in any of the exploratory holes.

7.6 Groundwater

7.6.1 No significant inflows of groundwater were encountered during the investigation, although given the relatively small diameter of the window sample holes, groundwater seepages are difficult to observe.

7.6.2 However, given the geology and topography, groundwater is likely to lie at depth within the sandstone strata underlying the site.

7.7 Stability & Ease of Excavation

7.7.1 Give the relatively small diameter of the window sample holes it is not possible to assess the stability of foundation and service trenches.

7.7.2 However, given the geology encountered at the site excavations within both the Relict Subsoil and natural ground are likely to be stable.

7.7.3 Some overbreak within the Weathered Sandstone strata should be anticipated in foundation and service trenches. Locally, breaking out of rock is likely to be required for deep excavations, greater than around 1.5m depth, although this will be dependent on the excavator size and bucket type used and should be confirmed prior to redevelopment.

7.8 Revised Conceptual Ground Model (Ground Conditions)

7.8.1 The Preliminary Conceptual Site Model has been revised in light of data obtained during the ground investigation, most notably with respect to:

- the nature and distribution of made ground, including the presence of significant buried obstructions
- the strength, nature and depth of underlying natural strata
- the nature and distribution of contamination (based on visual/olfactory evidence only)

7.8.2 The revised Conceptual Site Model is presented in Appendix B, as Drawing No. 9642/6.

7.8.3 Further refinement of the Conceptual Site Model is presented in Section 9 where the results of laboratory testing for contaminants have been considered.

8 CONTAMINATION (ANALYSIS)

8.1 General

8.1.1 Notes outlining current guidance with respect to the interpretation of analytical data are included in Appendix A to this report.

8.1.2 The site has been formerly occupied by several buildings, most likely residential. Existing use comprises an office and storage compound.

8.1.3 Raw materials stored and used on site include building materials and diesel fuel for plant.

8.1.4 The site's usage may have given rise to some minor ground contamination. Furthermore, made ground was encountered in all of the exploratory locations during the ground investigation.

8.1.5 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 5.2.

8.2 Testing Scheduled

8.2.1 Based on the above assessment, an Encia Engineer submitted a test schedule (summarised in the table below) to a UKAS accredited laboratory.

Type of Sample	No. of Samples	Determinands
Made Ground	12	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
	10	water soluble sulphate, chloride, nitrate & magnesium
	6	leachable metals: arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc
	1	speciated PAH, speciated TPH, TOC
Natural Soil	7	pH & water soluble sulphate, chloride, nitrate & magnesium

8.2.2 Notes describing the various organics analyses are included in Appendix A to this report.

8.3 Soil Contamination Results

8.3.1 The soil contamination test results are summarised in the Tables on pages 12 to 14.

8.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix G to this report.

Inorganic Determinands

8.3.3 Of the twelve samples of made ground analysed for inorganic parameters, eleven of the samples can be classified as uncontaminated and one could be classified as contaminated.

8.3.4 These samples are classified by comparison of parameters concentrations with the relevant current UK guidance threshold value for an end use including domestic gardens and any area where plants are to be grown (the most sensitive of the proposed end-uses).

8.3.5 The only contaminant identified was arsenic in one sample of Sub-base.

8.3.6 Statistical analysis of the Sub-base results has been carried out in general accordance with the methods outlined in CLR7 (see comments in Appendix A, Contamination Testing) and the results are summarised below.

8.3.7 Two of the arsenic results failed the outlier test in the Sub-base samples. An outlier may indicate a localised area of contamination (quite possibly associated with an isolated fragment), or simply be the result of a measurement or recording error; but in any event, CLR 7 suggests it flags up the need for further investigation.

Results of Statistical Analysis of Soil Contamination Data

Stratum	US_{95} Values for Contaminants that have yielded one or more Tier 1 exceedances for a given made ground type
	Arsenic (20)
Sub-base	7 (20)

Notes: Values in brackets are US_{95} values inclusive of any outliers.

Summary of Degree of Ground Contamination (Inorganics) at Yews Place, Kendray.

Hole ID	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are Shown in Brackets and assume a **residential with gardens** end-use.											
			pH[#]	As (20)[$]	Cd ♣ $	Cr (130)[$]	Pb (450)[$]	Hg (8)[$]	Se (35)[$]	B (3)*	Cu ♣ x	Ni (50)[$]	Zn ♣ x	Sol SO_4 (0.5 g/l) ◊
WS1	0.00 – 0.20	Sub-Base	9.8	-	-	-	-	-	-	-	-	-	-	-
WS2	0.00 – 0.20	Sub-Base	10.0	-	-	-	-	-	-	-	-	-	-	-
WS4	0.00 – 0.15	Sub-Base	7.9	-	-	-	-	-	-	-	-	-	-	-
WS6	0.05 – 0.35	Sub-Base	9.4	-	-	-	-	-	-	-	-	-	-	-
WS7	0.00 – 0.35	Sub-Base	9.6	-	-	-	-	-	-	-	-	-	-	
WS9	0.25 – 0.40	Sub-Base	8.3	32	-	-	-	-	-	-	-	-	-	-
WS1	0.20 – 0.35	Relict Subsoil	7.7	-	-	-	-	-	-	-	-	-	-	-
WS2	0.20 – 0.40	Relict Subsoil	7.8	-	-	-	-	-	-	-	-	-	-	
WS3	0.40 – 0.70	Relict Subsoil	7.7	-	-	-	-	-	-	-	-	-	-	-
WS4	0.15 – 0.50	Relict Subsoil	6.9	-	-	-	-	-	-	-	-	-	-	-
WS7	0.35 – 0.55	Relict Subsoil	7.7	-	-	-	-	-	-	-	-	-	-	-
WS8	0.30 – 0.50	Relict Subsoil	7.5	-	-	-	-	-	-	-	-	-	-	-
WS2	0.40 – 1.00	Comp Weath SSt (Sand)	7.9											-
WS5	0.30 – 0.60	Comp Weath SSt (Clay)	7.0											-
WS6	0.70 – 1.00	Comp Weath SSt (Sand)	5.3											-
WS1	0.35 – 0.80	Weathered Sandstone	5.6											-
WS2	1.10 – 1.50	Weathered Sandstone	7.8											-
WS4	1.00 – 1.20	Weathered Sandstone	5.9											-
WS8	1.10 – 1.50	Weathered Sandstone	7.6											-

Key		Source of Guidance Trigger Level	
-	Parameter tested for but not found to be in excess of trigger concentration	$	DEFRA and the EA Contaminated Land Exposure Assessment (CLEA) – March '02
	Parameter not tested for	x	MAFF – The Soil Code (Rev. 1998)
		◊	BRE Special Digest 1, Concrete in aggressive ground (2005)
#	All pH results listed to confirm which soil guideline values are to be used in CLEA assessment	0	Dutch Intervention Levels
♣	Tier 1 Value is pH dependent	*	ICRCL Guidance Note 59/83, Second Edition (1987) – (Boron Phytotoxic only)

Summary of the Leachability Testing on samples at Yews Place, Kendray.

Hole ID	Depth (m)	Material	Concentration in μg/litre unless otherwise Shown. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are Shown in Brackets.										
			pH	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Se	B
				(10)*	(5)*	(50)*	(2000)*	(25)*	(1)*	(20)*	(5,000)*	(10)*	(1000)*
WS1	0.20 – 0.35	Relict Subsoil	7.6	-	-	-	-	-	-	-	-	-	-
WS2	0.00 – 0.20	Sub-Base	10.3	-	-	-	-	-	-	-	-	-	-
WS3	0.40 – 0.70	Relict Subsoil	8.5	-	-	-	-	-	-	-	-	-	-
WS4	0.00 – 0.15	Sub-Base	8.3	-	-	-	-	-	-	-	-	-	-
WS7	0.35 – 0.55	Relict Subsoil	8.3	-	-	-	-	-	-	-	-	-	-
WS9	0.25 – 0.40	Sub-Base	8.6	-	-	-	-	-	-	-	-	-	-

Key		**Source of Guidance Trigger Level**	
-	Parameter tested for but not found to be in excess of trigger concentration	*	Water Supply (Water Quality) Regulations 1989, as amended in 2000
	Parameter not tested for		

Summary of Degree of Ground Contamination (Organics) at Yews Place, Kendray.

Hole ID	Depth (m)	Material	Concentrations in mg/kg. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in brackets and assume a **residential with gardens** end use									
			TOC	Benzene	Toluene	Ethyl Benzene	Xylenes	PAH		TPH - C_6 to C_{40}		
			%	(0.3) ~	(38) ~	(78) ~	(6)~	total	Benzo(a) pyrene	GRO C_5 to C_{10}	DRO C_{10} to C_{21}	LRO C_{21} to C_{35}
								(5)~ ◇	(5)~	(0.3)~ ◇	(330)~	(580)~
WS10	0.30 – 0.50	Sub-Base	1.5	-	-	-	-	-	-	-	-	-

Summary of Degree of Ground Contamination (Speciated Organics) at Yews Place, Kendray.

Hole ID	Depth (m)	Material	Concentrations in mg/kg. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in brackets and assume a **residential with gardens** end use												
			Aliphatic							Aromatic						
			5-6	6-8	8-10	10-12	12-16	16-21	21-35	5-7	7-8	8-10	10-12	12-16	16-21	21-35
			(92) ~	(500) ~	(40) ~	(1000) ~	(1,000) ~	(1,000) ~	(5,000) ~	(16) ~	(36) ~	(63) ~	(330) ~	(620) ~	(540) ~	(580) ~
WS10	0.30 – 0.50	Sub-Base	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Key	
-	Parameter tested for but not found to be in excess of trigger concentration
	Contaminant not tested for

Source of Guidance Trigger Level	
♣	CLEA SGV is dependent on Soil Organic Matter content. The Tier 1 values used here are the most conservative, and in the event of exceedances, reference should be made to TOC analysis.
~	Encia risk-derived Tier 1 screening values. (Assumes the residential development has **no cover in gardens** and contamination is at surface)
◇	Conservative value – assumes all C_6 to C_{10} is benzene, or all PAH is Benzo(a)pyrene.

8.3.8 This statistical analysis indicates that the upper 95th percentile bound values (US_{95}) for arsenic in Sub-base are not elevated in comparison with the relevant current UK guidance threshold value for residential with gardens end use; however, the maximum is an outlier and therefore would require further inestigation.

Leachables

8.3.9 Of the leachability tests conducted on six samples of made ground, none had concentrations of leachable contaminants above the maximum permissible concentrations as defined in the Water Supply (Water Quality) Regulations 1989, as amended in 2000.

8.4 Soluble Sulphate and pH

8.4.1 In accordance with BRE Special Digest 1:2005, this site has been classified as brownfield with a mobile groundwater regime.

8.4.2 It is envisaged foundations will extend to depths of about 1m through made ground and natural strata and samples taken from this depth range have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).

8.4.3 The concentrations of sulphate in the aqueous natural soil extracts of seven samples of natural ground and ten samples of made ground were tested using ion chromatography as part of the contamination suite. The pH value of each sample was determined by the electrometric method with the pH values of an additional two samples of made ground also determined.

8.4.4 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the Table below. Typically, the average values of pH were all above 5.5, therefore concentrations of chloride and nitrate are considered insignificant.

Summary of Sulphate and pH results

Soil type	Lowest pH values	Highest Soluble Sulphate Concentration (g/l)
Sub-Base	7.9	0.2
Relict Subsoil	6.9	0.2
Completely Weathered Sandstone	5.3	<0.1
Weathered Sandstone	5.9	<0.1

8.4.5 One sample of Completeley Weathered Sandstone had a pH value of 5.3, although typically pH values of the Completeley Weathered Sandstone and Weathered Sandstone are >5.5. Therefore, in accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-2z.

Organic Determinands

8.4.6 In the absence of UK guidance values for many organic determinands, samples have been classified by comparison with Encia risk-derived Tier 1 screening values (see Generic Notes 04 in Appendix A).

Total Petroleum Hydrocarbons (TPH)

8.4.7 With respect to aliphatic and aromatic TPH fractions (C_6 to C_{35}), Encia have derived risk based screening values in accordance with the methodology detailed by the TPHCWG, and recently reviewed by a UK workshop of experts in respect to UK adoption of the method. All default parameters and conclusions are detailed in Appendix A.

8.4.8 These "Tier 1" TPH screening concentrations have been derived using the RISC model adapted to reflect current UK scenarios and assumptions. With respect to remediation, a higher "target" concentration might be acceptable, but this would normally be subject to the results of a Quantitative Risk Assessment (QRA).

8.4.9 The concentrations of GRO/DRO/LRO do not exceed their respective Tier 1 values presented in the Table on page 14, therefore further assessment (a 3-step approach, outlined in Generic Notes 04 in Appendix A) has been undertaken.

8.4.10 The first two steps involve review of speciated results. The third step assesses cumulative effects.

8.4.11 As TPH fractions are made up of a range of different substances it is possible that a number of these can affect the same 'target organ' (i.e. cause skin irritation or affect the liver), resulting in cumulative effects.

8.4.12 The cumulative effect, associated with each source material, has been assessed via calculation of a Hazard Index (HI); HI < 1 indicates no cumulative effects; HI > 1, cumulative risk requires further consideration via a detailed QRA.

8.4.13 The HI calculation for this site is contained in Appendix G. The HI is < 1, therefore cumulative risks need not be considered further.

Polycyclic Aromatic Hydrocarbons (PAH)

8.4.14 The concentration of total PAH in one sample of Completely Weathered Sandstone recovered from adjacent to the fuel storage tank is below the Trigger Level concentration for a residential with gardens end use.

8.4.15 Speciated analysis has also confirmed the absence of Benzo(a)pyrene, the most problematic PAH, in the soils beneath this site.

8.4.16 No elevated concentrations of the remaining most toxic PAH compounds, namely Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, Indeno(1,2,3,c,d)pyrene and Dibenz(a,h)anthracene were identified.

9 CONTAMINATION (QUALITATIVE RISK ASSESSMENT & REMEDIATION)

9.1 Assessment of Contamination Test Results

9.1.1 Notes outlining current guidance with respect to the interpretation of analytical data are included in Appendix A to this report.

9.1.2 No existing topsoil suitable for use in garden/landscaped areas was noted at the time of the investigation.

9.1.3 A veneer of made ground up to 0.4 m thick underlies the majority of the site which comprises gravel of brick, concrete etc (Sub-base). The Sub-base is generally underlain by Relict Topsoil which occasionally contains anthropogenic material such as brick to around 0.5m depth, maximum 0.9m.

9.1.4 No significant elevated concentrations of inorganic determinands were identified in the made ground. However, the Sub-base strata contains an outlier of arsenic together with materials (eg brick, concrete etc), which would generally be considered undesirable as a near-surface material in garden areas.

9.1.5 No organic (hydrocarbon) contamination has been identified at the site based on observations made during Encia's ground investigation and Encia's laboratory test results.

9.2 Revised Conceptual Ground Model (Contamination)

9.2.1 The Preliminary Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably with respect to the distribution of made ground and contaminants.

9.2.2 A revised Conceptual Site Model is presented as Drawing No. 9642/6 in Appendix B. The Model includes the contaminant sources described in Section 9.1 above, and potential pollutant linkages (summarised below in Section 9.3) to receptors.

9.3 Environmental Setting & End Use

9.3.1 As discussed in Section 9.1 above, no significant contamination exists in the soil beneath this site.

9.3.2 The underlying strata is classified as a minor aquifer. The nearest surface watercourse is Measeborough Dike, which flows in a south to north direction, approximately 170m beyond the site's western boundary. Therefore, the site's environmental setting is considered to be of low sensitivity.

9.3.3 With respect to human health, the proposed end use (residential) is considered sensitive. Transient risks to construction workers can be addressed by the adoption of appropriate health and safety measures, see Section 12.3.

9.4 Pollutant Linkages

9.4.1 In terms of a proposed redevelopment of this site, plausible pollutant linkages can be summarised as follows.

Sources

9.4.2 No contaminant sources have been identified as summarised in Section 9.1 above.

Pathways

9.4.3 Potential contaminant pathways include:

- ingestion
- dermal contact
- inhalation of contaminated particulates
- surface water run-off, including existing drainage infrastructure
- downward infiltration of leachable/mobile contaminants to groundwater

Receptors

9.4.4 Potential contaminant receptors include:

- the environment – minor aquifer, vegetation
- end users of the site (residents)

9.4.5 It can be concluded that there are plausible pathways to potential receptors.

9.5 Potential Remedial Options

General

9.5.1 Approval of the recommendations given below should be sought from the appropriate regulatory authorities prior to commencement of site redevelopment.

Inorganic contamination

9.5.2 No significant inorganic contamination has been identified at the site. One slightly elevated concentration of arsenic was identified in the Sub-base although statistical analysis has shown this result to be an outlier.

9.5.3 However, the Sub-base contains materials (brick etc) considered undesireable near surface in garden and landscaped areas. Consequently it is recommended that the Sub-base be excavated and redistributed beneath concrete oversite or areas of hardstanding, where it would be satisfactorily isolated from end users.

9.5.4 It is recommended that a 300mm thick surface cover of "clean" soil comprising 150mm subsoil and 150mm topsoil be placed in garden and landscaped areas to act as a suitable growing medium.

Organic Contamination

9.5.5 No areas of gross organic contamination were encountered during the site works. However, localised areas of more onerous contamination than that identified to date may be present on site. If any buried drums, "oily", odorous, brightly coloured etc. materials are encountered further, advice should be sought from Encia.

Waste Classification

9.5.6 Disposal of the made ground off site is not considered appropriate, economically viable, nor in line with current Government philosophy regarding sustainable development. However, some excess arisings may be generated by excavations for foundations, sewers etc. Disposal to landfill may be the most practical solution, if redistribution and retention on site is not feasible.

Notes outlining the interpretation of analytical data with respect to waste classification are included in Appendix A to this report, together with notes about Waste Acceptance Criteria (WAC).

9.5.7 All soil arisings generated by excavations at this site are likely to be classified as inert waste.

10 HAZARDOUS GAS

10.1.1 The site is not in an area susceptible to radon emissions and as such no radon protection measures are required for new dwellings at the site.

10.1.2 Information from the Landmark Information Group indicates that there is one former landfill site located 210m to the north-west of the site although no further details regarding the landfill are available.

10.1.3 The site is neither underlain by shallow mineworkings nor located in an area considered susceptible to mines gas emissions.

10.1.4 As such it is unlikely that the site will be affected by landfill gas although this will be reviewed upon receipt of information from the Environment Agency and Barnsley Metropolitan Borough Council.

11 GEOTECHNICAL ISSUES

11.1 Conceptual site Model

11.1.1 A revised Conceptual Site Model is presented as Drawing No. 9642/6 in Appendix B to this report.

11.2 Mining & Quarrying

11.2.1 The surface stability of the site is not considered to be at risk from shallow underground coal mining.

11.2.2 There are no known quarries at or adjacent to the site.

11.3 Foundation Recommendations

General

11.3.1 It is understood that consideration is being given to redevelopment of the site with two storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. A sketch site layout has been provided by Keepmoat (reference Yews Place, Kendray) which is reproduced as Drawing No. 9642/2 in Appendix B to this report.

11.3.2 Foundation recommendations assume that development will be two storey and that line loads will not exceed 60kN/m run. If this is not the case significant alteration to these recommendations will be required.

11.3.3 We have also assumed that final development levels will not differ significantly from ground levels existing at the time of investigation. Any digital terrain modelling undertaken, or commissioned by Keepmoat should consider implications for the foundation recommendations outlined below.

11.3.4 A veneer of made ground comprising granular Sub-base up to 0.4m depth was identified across the site, underlain by Relict Subsoil with occasional gravel of brick and concrete up to 0.9m depth, typically 0.5m.

11.3.5 Made ground is not considered a suitable foundation material and foundations should therefore be taken through these materials into underlying strata of adequate bearing capacity.

11.3.6 A suspended floor construction should be used wherever the depth of made ground or infill beneath a plot exceeds 600mm. Based on current site levels this is likely to affect Plots 3, 4, 6, 7 & 8 although this should be confirmed on completion of any site re-grade given that made ground is typically around 0.5m thickness.

11.3.7 Natural ground generally comprised Weathered Sandstone recovered as sandy gravel and cobbles, encountered between 0.35m and 1.3m depth, typically <1m.

11.3.8 Locally, Completely Weathered Sandstone recovered as clayey sand and sandy clay was encountered.

11.3.9 Assuming a strip foundation of 10m length and 0.6m width, founding at 0.6m depth, the Weathered Sandstone is generally considered to have a safe bearing capacity in excess of 200kN/m^2.

11.3.10 With respect to the above foundation geometry and a maximum line load of 60kN/m run, settlements of less than 25mm would be anticipated. This is considered likely to be acceptable; however, further advice should be sought from the Structural Engineer responsible for design.

11.3.11 Excavation using a backhoe excavator of around the upper 1m thickness of the Weathered Sandstone at the site is considered likely, which will be recovered as tabular gravels/cobbles. Where in-situ sandstone is encountered at founding depth (minimum of 450mm), it will provide a suitable founding stratum for two storey dwellings, and need only be penetrated by the proposed foundation thickness.

11.3.12 Keepmoat or their groundworker should seek further advice from Encia if unexpected ground conditions are encountered in foundation or sewer excavations, including any conflict between soft ground associated with a backfilled trial pit excavation and the line of a proposed footing.

11.3.13 Sub-surface concrete in contact with the made and natural ground should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-2z.

11.3.14 No relict foundations of former buildings were encountered during the investigation. However, should relict foundations be identified then these could probably be left in-situ and an allowance made for local breaking out where these conflict with new foundations.

11.3.15 Foundations of plots placed over relict foundations should be taken to greater depth than the relict foundations and into natural ground of adequate bearing capacity.

11.3.16 Overdeepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.4.

11.3.17 Foundations will be required to be placed below a line drawn up at 45^{o} from the base of any service or similar excavation.

11.3.18 Conventional reinforced strip foundations are considered the most suitable founding option for two storey residential properties constructed on this site and these are discussed below.

Reinforced Strip Footings

11.3.19 Conventional reinforced strip footings are viable where the made ground is less than about 2.5m thick, and competent rock is the founding material.

11.3.20 Where the ground is found to comprise varying and significant amounts of coarse granular (cobbly/bouldery) weathered rock or varying soil types, reinforcement of footings is recommended as a precaution against differential settlement. Reinforcement is likely to be required for all of the plots at the site.

11.3.21 For a standard 600mm wide, 225mm thick footing, a suitable reinforcement would be one layer of A393 mesh placed 75mm above the base of the footing. For other footing dimensions further advice should be sought from Encia. Reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata.

11.3.22 Foundations on rock should be placed entirely on rock and not partially on rock and partially on residual soil. This may, depending on surface gradient, necessitate significant overdeepening of foundations. Residual soils (gravelly clays and clayey sands) were only encountered locally at the site to shallow depth (maximum 1.3m depth).

11.3.23 Founding depths are from original or finished ground level, whichever is the lower, to the underside of the footing.

11.3.24 Whilst strip or trench fill footings generally represent a simple and inexpensive foundation solution, there are a number of potential disadvantages associated with their use on this site:

- Disposal of arisings will be required
- Foundation and drainage excavations may encounter significant obstructions resulting in significant overbreak within the sandstone
- Breaking out of rock may be required locally

11.3.25 In addition to the above, Keepmoat should review proposed plot designs and layouts, since deeper excavations for trench fill are likely to be unstable where the centre-lines of parallel trenches are closer than about 2m (assuming 600mm widths). Keepmoat should supervise their groundworker to ensure footings are excavated in a controlled and safe manner.

Summary of Foundation Recommendations

11.3.26 In summary, the following foundation solutions are likely to be most appropriate (subject to Client preferences regarding site preparatory works, final levels & costs associated with each foundation option).

Plot Nos	Foundation Solution(s)	Remarks (influencing factors)
1 & 2	Reinforced Strips (approx 1.0m depth)	Sandstone at approximately 1m depth. Clayey sand in north of plots to around 1.1m depth, footings overdeepend to found entirely in rock.
3 & 4	Reinforced Strips (approx 0.5 m depth)	Sandstone at approximately 0.5m depth
5 & 6	Reinforced Strips (approx 0.6m to 1.3m)	Sandstone from approximately 0.6m depth. Sand/gravelly clay locally to around 1.3m depth, footings overdeepend to found entirely in rock.
7 & 8	Reinforced Strips (approx 0.45m to 0.7m)	Sandstone from approximately 0.35m to 0.7m depth, footings overdeepend to found entirely in rock.
9 & 10	Reinforced Strips (approx 0.5m to 1.1m)	Sandstone from approximately 0.5m to 1.1m depth. Clayey sand locally to around 1.1m depth, footings overdeepend to found entirely in rock.

11.3.27 The foundation solutions outlined in the above table assume that ground levels will not change significantly from those existing at present. If this is not to be the case, further advice should be sought from Encia Environmental.

11.4 Designated Concrete Mixes

11.4.1 The following designated mixes in accordance with BRE Special Digest SD1 and BS 8500: Part 1: 2006 will be suitable for use on this site.

Application	DS-1 conditions ACEC Class AC-2z
Unreinforced strip/trench fill footings	FND2Z
Reinforced strip/ trench fill footings (mesh reinforcement)	FND2Z
Reinforced strip/ trench fill footings (rebar etc)	FND2Z
Unreinforced concrete floor slabs	GEN2
In situ reinforced concrete floor slabs	RC28/35

Note: The use of an FND mix imposes a strength class of C28/35 on the structural designer; if this is not acceptable a designed mix in accordance with BS8500-1:2006 should be specified.

The specification of concrete to floors in AC-2s conditions and above assumes the concrete is isolated from the ground via a damp proof membrane and blinding.

11.5 Excavations

11.5.1 Given the relatively small diameter of the window sample holes it is not possible to accurately assess the stability or ease of excavation of foundation and service trenches.

11.5.2 However, given the geology encountered at the site excavations within both the Relict Subsoil and natural ground are likely to be stable.

11.5.3 Some overbreak within the Weathered Sandstone strata should be anticipated in foundation and service trenches. Locally, breaking out of rock is likely to be required for deep excavations, greater than around 1.5m depth, although this will be dependent on the excavator size and bucket type used and should be confirmed prior to redevelopment.

11.6 Drainage

11.6.1 Based on the results of the investigation it is unlikely that major groundwater flows will be encountered in shallow excavations. Groundwater is likely to lie at depth within the sandstone strata underlying the site.

11.6.2 The site slopes gently down from west to east.

11.6.3 Soakaways may be a suitable drainage solution for surface water run-off at the site although this is dependant of the nature and openness of the fractures within the sandstone. At this stage no in-situ testing has been undertaken.

11.6.4 Any damage to the existing land drainage system caused by foundation or sewer excavations should be made good; this may require diversion and re-connection.

11.6.5 It is recommended that the developer contact Yorkshire Water Services with respect to capacity in existing foul and surface water sewers in the vicinity of the development area.

11.7 Highways

11.7.1 Based on visual inspection of the natural materials at the site, published tables (Design Manual for Roads and Bridges – Volume 7, Section 2 – January 1999) indicate that the Completely Weathered Sandstone will have a CBR value of at least 5%. These values should be verified prior to or during construction.

11.7.2 Where shallow made ground remains below highways it is strongly recommended that consultation regarding the specification of the highways should be made with the adopting authority.

11.7.3 However, it is considered that the following options would be suitable to enable the construction of the highways. Excavation of the full thickness (up to a maximum of 2m) of made ground and either:

a) replacement with suitable aggregate in accordance with Series 600 (Earthworks) of The Highways Agency (HA) "Specification for Highway Works" 1998, or

b) screening, selection and replacement of suitable materials (in accordance with Series 600) of suitable material in engineered layers. Unsuitable materials include any soft or wet materials, biodegradables including topsoil, wood, scrap metal, frozen material and oversize.

11.7.4 Where the made ground is re-engineered it is considered that a CBR value of 5% should be achievable, however, this should be verified by field trials.

11.7.5 Grubbing up of existing tarmac and the granular Sub-base covering the site will generate aggregate, which (subject to confirmatory testing) may be suitable for use as unbound pavement materials within the highways.

11.7.6 It is likely that prior to redevelopment of the site the surface covering of Tarmac and Sub-base is stripped and stockpiled separately for re-use beneath highways and areas of hardstand.

11.8 External Works

11.8.1 Any digital terrain modelling undertaken, or commissioned by Keepmoat should be made available to their Engineering Designer prior to issue of an External Works Drawing.

12 REDEVELOPMENT ISSUES

12.1 General

12.1.1 This report has presented options with respect to foundation solutions etc that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (NHBC & Local Authority) for their comment/approval.

12.2 Remedial Strategy

12.2.1 Remediation of the site beyond the scope of grubbing up of existing granular Sub-base/localised tarmac for re-use on site beneath highways and proposed hardstand with import of clean soils for use in garden/landscaped areas is not anticipated.

12.2.2 Consequently a detailed site specific Remedial Strategy report is not considered necessary.

12.2.3 The anticipated remediation works are summarised below:

- General site clearance
- Import of suitable 'clean' soils for use in garden and landscaped areas

12.3 Health & Safety Issues - Construction Workers

12.3.1 No significant elevated concentrations of contaminants were identified at the site; however, as a good practice simple precautionary measures should be followed, i.e. good personal hygiene and basic personnel protective equipment.

12.3.2 General guidance on the protection of the health and safety of site personnel is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land".

12.3.3 Access into excavations etc. must be controlled. The atmosphere in shored trenches in excess of 1.2m should be monitored for oxygen and hazardous gas (methane & carbon dioxide), prior to personnel entering such excavations. Monitoring should continue whilst personnel are working in deep excavations.

12.3.4 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.

12.4 Control of Excavation Arisings

12.4.1 The granular Sub-base and tarmac hardstand at the site are not considered suitable near surface in garden and landscaped areas. The groundworker should carefully segregate (and stockpile separately) Sub-base/hardstand arisings from arisings of suitable soils, in order that an excessive volume of unsuitable material is not generated.

12.4.2 Sub-base/hardstand arisings could be:

- redistributed beneath concrete oversite, or areas of hardstanding, where they would be satisfactorily isolated from end users.
- exported from site to a suitably licensed landfill facility

12.5 New Utilities

12.5.1 Any deep service trenches are likely to encounter Sandstone rockhead which is likely to prove difficult to excavate from greater than around 1.5m depth (although this will be dependent on the excavator size and bucket type used and should be confirmed prior to redevelopment) with some overbreak occuring.

12.5.2 It is strongly recommended that all statutory service bodies are consulted at an early stage with respect to the ground conditions within which they will lay services in order to enable them to assess at an early stage any potential abnormal costs.

13 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

13.1 General

13.1.1 It is understood that consideration is being given to redevelopment of the site with two storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. A sketch site layout has been provided by Keepmoat (reference Yews Place, Kendray) which is reproduced as Drawing No. 9642/2 in Appendix B to this report.

13.1.2 A veneer of made ground comprising granular Sub-base identified up to 0.4m depth has been identified across the majority of the site, underlain by Relict Subsoil with occasional gravel of brick and concrete up to 0.9m depth, typically 0.5m.

13.1.3 Natural ground generally comprised Weathered Sandstone recovered as sandy gravel and cobbles, encountered between 0.35m and 1.3m depth, typically <1m.

13.1.4 Locally Completely Weathered Sandstone recovered as clayey sand and sandy clay was encountered.

13.2 Hazardous Gas

13.2.1 The site is not in an area susceptible to radon emissions and as such no radon protection measures are required for new dwellings at the site.

13.2.2 Thee nearest known former landfill site is located 210m to the north-west of the site although no detailed information is available.

13.2.3 The site is neither underlain by shallow mineworkings nor located in an area considered susceptible to mines gas emissions.

13.2.4 As such it is unlikely that the site will be affected by landfill gas although this will be confirmed upon receipt of further information from the Environment Agency and Barnsley Metropolitan Borough Council which is still awaited at the time of writing.

13.3 Mining

13.3.1 The surface stability of the site is not considered to be at risk from shallow underground coal mining.

13.3.2 There are no known quarries at or adjacent to the site.

13.4 Contamination & Remediation

13.4.1 No significant concentrations of inorganic or organic contaminants have been identified at the site.

13.4.2 However, the Sub-base strata and localised tarmac hardstand covering the site are considered undesireable near surface in garden and landscaped areas and as such should be excavated and stockpiled separately. Such materials could be redistributed beneath proposed areas of hardstand where they will satisfactorily be isolated from end-users of the site

13.4.3 Some import of subsoil and topsoil will be required for garden/landscaped areas to act as a suitable growing medium (minimum 300mm thickness).

13.5 Foundations

13.5.1 Conventional reinforced strip foundations placed in Weathered Sandstone from 0.45m to 1.3m depth are considered the most suitable founding option for two storey residential properties constructed on this site.

13.5.2 Footings should be placed entirely in rock and not partially in rock and partially in residual soil. This may necessitate local overdeepening of foundations.

13.5.3 Localised breaking out of rock may be required where sandstone is encountered at shallow depth although no excavation has been carried out at the site to date so this should be confirmed.

13.6 Flooding

13.6.1 The EA indicate that the site is not located within an indicative floodplain.

13.7 Drainage

13.7.1 The site slopes gently down from west to east. Groundwater is likely to lie at depth within the sandstone strata underlying the site.

13.7.2 Soakaways may be a suitable drainage solution for surface water run-off at the site although this is dependant of the nature and openness of the fractures within the sandstone. At this stage no in-situ testing has been undertaken.

13.7.3 It is recommended that the developer contact Yorkshire Water Services with respect to capacity in existing foul and surface water sewers in the vicinity of the development area.

13.8 Highways

13.8.1 Based on visual inspection of the natural materials at the site, published tables (Design Manual for Roads and Bridges – Volume 7, Section 2 – January 1999) indicate that the Completely Weathered Sandstone will have a CBR value of at least 5%. These values should be verified prior to or during construction.

13.8.2 Where shallow made ground remains below highways the following options would be suitable to enable the construction of the highways. Excavation of the full thickness (up to a maximum of 2m) of made ground and either:

replacement with suitable aggregate in accordance with Series 600 (Earthworks) of The Highways Agency (HA) "Specification for Highway Works" 1998, or

screening, selection and replacement of suitable materials (in accordance with Series 600) of suitable material in engineered layers. Unsuitable materials include any soft or wet materials, biodegradables including topsoil, wood, scrap metal, frozen material and oversize.

13.8.3 Where the made ground is re-engineered it is considered that a CBR value of 5% should be achievable, however, this should be verified by field trials.

13.9 Further Works

13.9.1 Given the restricted access at the site, post site vacation trial pitting is recommended to confirm the ground conditions at the site and, if necessary, allow soakaway testing.

13.9.2 Further sampling and testing of the Sub-base in the area of the arsenic outlier in WS9.

APPENDIX A
GENERAL NOTES

Generic Notes – Encia Geoenvironmental Investigations

Environmental Setting

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority, the Local Authority etc is presented in the Correspondence Appendix of this Geoenvironmental Report.

Geology, Mining & Quarrying

In order to establish the geological setting of a site, Encia refer to BGS maps for the area, and the relevant geological memoir.

A coal mining report is obtained from the Coal Authority. Further information is sourced from the Local Authority and by reference to current and historical OS plans.

Landfills

Encia obtain data from the Landmark Information Group, the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite), and can move though fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

In order to assess potential risks associated with radon gas, Encia refer to BRE Report BR211, 2007: "*Radon: guidance on protective measures for new buildings*".

The level of protection needed is site-specific and is determined by reference to the maps contained in Annex A of BR211. These maps are derived from the Radon Atlas of England and Wales (2007), and indicate the highest radon potential within each 1km grid square.

If the site falls within a light grey square on the relevant map in Annex A then basic radon protection should be installed in new buildings; if the site falls within a dark grey square then full radon protection should be installed. **If the site is in an un-shaded square then no radon protection is needed.**

BR211 provides a preliminary indication of the measures required for a particular site, but it is also often beneficial to request a BR211 Radon Report from the BGS. The Annex A maps indicate the highest geological radon potential within each 1km grid square, but in many cases the radon potential varies considerably within the grid square. The BR211 Radon Report gives definitive guidance on the requirement for radon protective measures, and therefore may allow the adoption of a lower level of protection than that indicated in the Annex A maps.

Encia typically obtain a BR211 Radon Report for all sites that fall within a shaded square on the relevant Annex A map.

When requesting a BR211 Radon Report from the BGS Encia select the search radius carefully, since too large a search radius may result in the inclusion of areas of higher geological radon potential, and therefore in the recommendation of too high a level of protection.

Further details of the protective measures required, if appropriate, are provided in the Hazardous Gas section of this Geoenvironmental Report.

Hydrogeology

Encia obtain information from the Environment Agency (EA) and the Landmark Information Group with respect to:

- groundwater quality
- recorded pollution incidents
- licensed groundwater abstractions

Reference is also made to the EA document "*Policy and Practice for the Protection of Groundwater*" (1998) and the relevant Groundwater Vulnerability Map.

Bedrock and any overlying granular Drift deposits are classified by the EA:-

- **Major aquifers:** *"Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public water supply and other purposes".*

- **Minor aquifers**: *"Fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Although these aquifers will seldom produce large quantities of water for abstractions, they are important both for local supplies and in supplying base flow to rivers".*
- **Non-aquifers**: *"Formations which are generally regarded as containing insignificant quantities of groundwater. However groundwater flow through such rocks, although imperceptible, does take place and needs to be considered in assessing the risk associated with persistent pollutants. Some non-aquifers can yield water in sufficient quantities for domestic use".*

Groundwater vulnerability is determined by 4 variables:

1. The presence and nature of overlying soil (the weathered zone affected by living organisms; soil in the UK can extend up to 2m in depth). Physical properties of the soil affect the downward passage of water and it's ability to attenuate pollutants. The EA make reference to a three-fold classification of soil types:-

    - Soils of **low** leaching potential are defined as *"soils in which the pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants".*
    - Soils of **intermediate** leaching potential are defined as *"soils which have a moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer".*
    - Soils of **high** leaching potential are defined as *"soils with little ability to attenuate diffuse source pollutants and in which non-adsorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater".*

In urban areas and restored mineral workings the soil information is based on fewer observations than elsewhere. A worst-case vulnerability (H) is therefore assumed for these areas and for current mineral workings by the EA. All are given a designation of **HU** unless proved otherwise.

2. The presence and nature of Drift, which often overlies bedrock. Where Drift is of substantial thickness and low permeability, it can provide an effective barrier to surface pollutant migration. Permeable Drift is classified as a Minor Aquifer except where it is in probable hydraulic continuity with a Major Aquifer, where it is regarded as part of the Major Aquifer unless proven otherwise by site investigation.

3. The nature of the geological strata (bedrock). Rocks that contain groundwater in exploitable quantities are called aquifers.

4. The depth of the unsaturated zone; ie that part of the aquifer which lies above the water table

The EA have also designated Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone is a function of the aquifer, volume of groundwater abstracted and the effective rainfall, and may vary from tens to several thousand hectares.

Hydrology

Encia obtain information from the Environment Agency and the Landmark Information Group with respect to:

- surface water quality
- recorded pollution incidents
- licensed abstractions (groundwater & surface waters)
- licensed discharge consents
- site susceptibility to flooding

The EA have set **water quality** targets for all rivers. These targets are known as River Quality Objectives (RQOs). The water quality classification scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are six GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to **flooding** is assessed by reference to a Flood Map on the Environment Agency's website. These maps provide show natural floodplains - areas potentially at risk of flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

There are two different kinds of area shown on the Flood Map:

1. Dark blue areas could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year

2. Light blue areas show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year (or 1 in 200 year as appropriate), areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year flood). Also, parts of the areas shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley, the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist consultant who can advise on appropriate mitigating measures; ie raising slab levels, provision of storage etc.

COMAH & Explosive Sites

Encia obtain information from the Landmark Information Group with respect to COMAH or explosive sites within 1km of the proposed development site. Encia's report refers to any that are present, and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise it's emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say, and they are likely to place more weight on advice from the HSE).

Preliminary Conceptual Ground Model

The site's environmental setting (and proposed end use) is used by Encia to assess the significance of any contamination encountered during the subsequent ground investigation

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential targets.

Potential pollutant linkages are shown on a preliminary conceptual site model, presented as a Drawing in an Appendix to this Geoenvironmental Report. The preliminary model is revised in light of data arising from the subsequent ground investigation.

Generic Notes – Encia Geoenvironmental Investigations

2. Ground Investigation Fieldwork

General

Encia Ground Investigations are undertaken in accordance with current UK guidance including:

- BS5930:1999 "*Code of practice for site investigation*"
- BS10175:2001 "*Code of practice for the identification of potentially contaminated sites*".
- "*Technical Aspects of Site Investigation*" – EA R&D Technical Report P5-065/TR (2000)
- "*Development of appropriate soil sampling strategies for land contamination*" – EA R&D Technical Report P5-066/TR (2001)
- Contaminated Land Reports 1 to 6, most notably CLR Report No. 4 "*Sampling strategies for contaminated land*"
- "*Guidance on the protection of housing on contaminated land*" – NHBC & EA R&D Publication 66 (2000)
- AGS: 1996 "*Guide to the selection of Geotechnical Soil Laboratory Testing*"

Exploratory hole logs are presented in Appendices to this Geoenvironmental Report. These logs include details of the:

- Investigation technique adopted
- Samples taken
- Descriptions of the solid strata, and any groundwater encountered.
- Results of any in-situ testing
- Any gas\groundwater monitoring well installed

Exploratory Hole Locations

Exploratory hole locations are selected by Encia, prior to commencement of fieldwork, to provide a representative view of the strata beneath the site and to target potential contaminant sources identified during the preliminary investigation (desk study). Additional exploratory locations are often determined by the site engineer in light of the ground conditions actually encountered; this enables better delineation of the depth and lateral extent of organic contamination, poor ground, relict structures etc.

Investigation Techniques

Ground conditions can be investigated by a number of techniques; the procedures used are in general accordance with BS5930: 1999 and BS1377: 1990. Techniques most commonly used by Encia include:

- Machine excavated trial pits, usually equipped with a backactor and a 0.6m wide bucket.
- Cable percussive (Shell & Auger) boreholes, typically using 150mm diameter tools and casing.
- Window or Windowless Sampling boreholes. Constraints associated with existing buildings, operations and underground service runs can render some sites partly or wholly inaccessible to a mechanical excavator. In such circumstances, window sampling is often

the most appropriate technique. A window sampling drilling rig can be manoeuvred in areas of restricted access and results in minimal disturbance of the ground (a 150mm diameter tarmac/concrete core can be lifted and put to one side). However, it should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material).

- Rotary percussive open-hole probeholes are typically drilled using a tricone rock roller bit with air as the flushing medium. Probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse.

Where installed, gas\groundwater monitoring wells typically comprise a lower slotted section, surrounded by a filter pack of 10 mm non-calcareous gravel and an upper plain section surrounded in part by a bentonite seal and in part by gravel or arisings. The top of the plain pipe is cut off below ground level and the monitoring well protected by a square, stopcock type manhole cover set in concrete, or the plain pipe is cut off just above ground level and the well protected by 100mm diameter steel borehole helmet set in concrete.

Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

In-situ Testing

Where relative densities of granular materials given on the trial pit and window sample logs are based on visual inspection only, they do not relate to any specific bearing capacities. However, wherever possible Encia employ a Mackintosh probe to assess relative density. Mackintosh probe results can be related to approximate allowable bearing capacities.

The relative densities of granular materials encountered in cable percussive boreholes are based on Standard Penetration Test (SPT) results. SPTs are carried out boreholes, in accordance with BS 1377 1990, Part 9 Section 3.3. Where full penetration (600mm) is not possible, N values are calculated by linear extrapolation and are shown on the logs as N* = x.

The strength of cohesive deposits is determined using a hand shear vane.

Shear strength test results reported on trial pit logs are considered to be more reliable than those reported on window sample logs. Significant sample disturbance occurs during window sampling and consequently shear strength results on disturbed window samples are generally lower than results obtained during trial pitting, in-situ or in large excavated blocks.

Sampling

Representative soil/fill samples are taken at regular intervals from the exploratory holes to assist in description of the ground and to allow selected laboratory testing to be performed. The type of sample taken is dependent on the nature of the stratum and the purpose of the analysis.

Where the soils encountered contain a significant proportion of coarse grained material, truly representative samples are not typically obtained - only the finer fraction is placed in sample containers. However, a visual estimate of the amount of coarse material is made on site.

NB: Coarse constituents not sampled are defined as: coarse gravel, cobble and boulder. (i.e. any 'particles' with an average diameter greater than 20mm).

Occasionally, unrepresentative 'spot' samples are also taken from some exploratory locations for contaminant analysis, typically where unusual, localised pockets of materials are encountered.

Samples of soil for chemical testing are placed into 1 litre plastic tubs prior to delivery to the selected laboratory. Samples of water are taken in one litre, brown glass bottles and stored in cool boxes, at a temperature of approximately 4ºC, until delivery to the selected laboratory. Soil\fill samples for organic analysis are also stored in cool boxes.

Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork.

It should be borne in mind that the rapid excavation rates used during a ground investigation may not allow the establishment of equilibrium water levels. Water levels are likely to fluctuate with season/rainfall and could be substantially higher at wetter times of the year than those found during this investigation.

Long-term monitoring of standpipes or piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

Description of Strata

The soils encountered during an Encia ground investigation are described (logged) in general accordance with BS 5930. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section within the main body of text.

The materials encountered in the trial pits are logged, samples taken, and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

Key to Exploratory Hole Logs

Keys to logs are presented in the Appendix(ces) containing the logs. There are two Keys – Symbols & Legends and Terms & Definitions.

3. Geotechnical Laboratory Tests

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by Encia. All tests are carried out in accordance with BS 1377:1990.

The test results are presented as received in an Appendix to this Geoenvironmental Report.

The following laboratory testing are routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

The additional tests are typically only scheduled where significant earthworks regrade is anticipated:

- Grading.
- Compaction tests
- Particle density.

Atterberg Limits & Moisture Content

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. Encia typically only consider a soil to be shrinkable if the proportion finer than 63μm is >35%.

PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003), which advocates the use of modified Plasticity Index (I'p), defined as:

I'p = Ip * (%< 425μm/100)

ie if PI is 30%, but the soil contains 80% < 425μm, then: I'p = 30 * 80/100 = 24%.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425μm sieve is routinely reported by testing labs.

Encia apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to:

- the average values for each particular soil type (ie differentiate between residual soil and alluvium),
- the number of results in each class and
- the actual values.

Unless the judgment strongly indicates otherwise, Encia typically adopt a conservative approach and recommend assumption of the higher classification.

Soluble Sulphate and pH

Sulphates in soil and groundwater are the chemical agents most likely to attack sub-surface concrete, resulting in expansion and softening of the concrete to a mush. Another common cause of concrete deterioration is groundwater acidity.

The rate of chemical attack depends on the concentration of aggressive ions and their replenishment at the reaction surface. The rate of replenishment is related to the presence and mobility of groundwater.

Encia refer to BRE Special Digest 1 (SD1) "Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment" (2005). SD 1 provides definitions of:

- the nature of the site (greenfield, brownfield or pyritic)
- the groundwater regime (static, mobile or highly mobile)
- the Design Sulphate Class (DC Class) and
- the Aggressive Chemical Environment for Concrete (ACEC Class)

Encia reports clearly state each of the above for the site being considered.

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO_4 for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

SD1 also discusses determination of "representative" sulphate concentration from a number of tests. Essentially if <10 samples of a given soil-type have been tested, the highest measured sulphate concentration should be taken. If >10 samples have been tested, the mean of the highest 20% of the sulphate test results can be taken. With respect to groundwater, the highest sulphate concentration should always be taken.

With respect to pH (soil & groundwater) the value used is the lowest value if <10 samples have been tested and the mean of the lowest 20% if >10 samples have been tested.

4A. Contamination Laboratory Analysis & Interpretation (including WAC)

Waste Classification & WAC

In the context of waste soils generated by remediation and\or groundworks activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated 'natural' soil, bricks, concrete, tiles & ceramics).
- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds).
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds).

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

From 16th July 2005, landfill operators will require Waste Acceptance Criteria (WAC) laboratory data, if soil waste is classified as **hazardous**, and such waste must have been subjected to pre-treatment. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

Encia typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated, for example where redevelopment proposals include basement construction etc.

If off-site disposal of soils classified as hazardous waste were undertaken during redevelopment, then WAC analysis should be scheduled at an early stage in the remediation programme.

However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous. These contaminants can often be dealt with by alternative technologies (eg by bioremediation or stabilisation) and consequently retention on site is often possible.

It should be noted that **non-hazardous** soil waste can go to a non-hazardous landfill facility; no further testing (eg WAC) is required.

Contamination Laboratory Analysis & Interpretation

An assessment of potential contaminants associated with the former usages of the site is undertaken with reference to CLR 8 "*Potential contaminants for the assessment of land*" and the relevant DETR Industry Profile(s).

Common Inorganic Contaminants

These include:

- metals, most notably cadmium, copper, chromium, mercury, lead, nickel, and zinc.
- semi-metals, most notably arsenic, selenium, and (water soluble) boron
- non-metals, most notably sulphur
- inorganic anions, most notably cyanides (free & complex), sulphates, sulphides, and nitrates.

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

Total cyanide (CN) is determined by acid extraction; whereas free cyanide is the water soluble fraction.

Complex cyanide is "bound" in compounds and is hard to breakdown. Laboratory determination of complex CN involves subjecting the sample to uv digestion for determination of both free and total CN.

Thiocyanate (SCN) is a different species combined with sulphur.

Elemental sulphur (S) and free sulphur are the same. Total sulphur is all forms, including that present in sulphates (SO_4), sulphides etc

There are 2 forms of chromium (Cr), chromium VI and chromium III. Chromium VI is the more toxic of these. In soils, total chromium is determined by a strong aqua regia acid digestion. Chromium VI is an empirical method based on a water extract test.

Common Organic Contaminants

Petroleum hydrocarbons are a mixture of hydrocarbons produced from the distillation of crude oil. They include aliphatics (alkanes, alkenes and cycloalkanes), aromatics (single or multi benzene ringed compounds) and hydrocarbon-like compounds containing minor amounts of oxygen, sulphur or nitrogen.

Petroleum hydrocarbons can be grouped based on the carbon number range:-

GRO – Gasoline Range Organics (typically C_6 to C_{10}). Also referred to as PRO – Petroleum Range Organics
DRO – Diesel Range Organics (typically C_{10} to C_{28})
LRO - Lubricating Oil Range Organics (typically C_{28} to C_{40})
MRO – Mineral Oil Range Organics (typically C_{18} to C_{44})

However, it should be borne in mind that the terms "GRO" and "DRO" analysis are purely descriptive terms, the exact definition of which varies.

Total Petroleum Hydrocarbons (TPH) is also a poorly defined term; some testing laboratories regard TPH as hydrocarbons ranging from C_5-C_{40}, whereas other define TPH as C_{10}-C_{30}.

The composition of a TPH plume migrating through the ground can vary significantly; this is primarily dictated by the nature of the source (eg petrol, diesel, engine oil etc). Furthermore, different hydrocarbons are affected differently by weathering processes, and this can result in further variation in the chemical composition of the TPH.

Gasoline contains light aliphatic hydrocarbons (especially within the C4 to C5 range) that will rapidly evaporate. The aromatic hydrocarbons in gasoline are primarily benzene, toluene, ethylbenzene and xylenes, referred to as BTEX. Small amounts of polyaromatic hydrocarbons (PAHs) such as benzo(a)pyrene may also be present.

Diesel and light fuel oils have higher molecular weights than gasoline. Consequently, they are less volatile and less water soluble. About 25 to 35% is composed of aromatic hydrocarbons. BTEX concentrations are generally low.

Heavy Fuel Oils are typically dark in colour and considerably more viscous than water. They contain 15 to 40% aromatic hydrocarbons. Polar nitrogen, sulphur and oxygen-containing compounds (NSO) compounds are also present.

Lubricating Oils are relatively viscous and insoluble in groundwater. They may contain 10 to 30% aromatics, including the heavier PAHs. NSO compounds are also common.

Polycyclic Aromatic Hydrocarbons (PAHs) have more than two fused benzene rings as a structural characteristic. PAH compounds are present in both petrol and diesel, although in significantly lower concentrations than in coal tars. Certain PAH compounds are carcinogenic (Benzo(a)pyrene) and\or mobile in the environment (naphthalene).

Semi-Volatile Organic Compounds (sVOCs) include a variety of compounds, which as the names suggest have relatively low boiling points; however, VOC's are much more volatile than SVOC's. Examples of VOC's include benzene, chloroform and toluene; SVOC's include phenol, fluorene. Both groups of chemicals are readily absorbed through skin and some, such as benzene, are believed to be linked to tumour growth.

Phenols are compounds that have a hydroxyl group attached to an aromatic ring (ie include a benzene ring and an –OH group). Most are colourless solids. A solution of phenol in water is known as carbolic acid, and is a powerful antiseptic. However, phenol vapour is toxic, and skin contact can result in burns.

Polychlorinated Biphenyls (PCBs) were used in pre-1974 transformers as dielectric fluids. PCB's are of increasing toxicity relative to the degree of chlorination. Acute symptoms of PCB poisoning are irritation of the respiratory tract leading to coughing and shortness of breath. Nausea, vomiting and abdominal pain are caused by ingestion of PCB's.

Dioxins and furans (polychlorinated dibenzodioxins and polychlorinated dibenzofurans) are some of the most toxic chemicals known. In the environment, they tend to bio-accumulate in the food chain. Dioxin is a general term that describes a group of hundreds of chemicals that are highly persistent in the environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD.

Dioxin is formed by burning chlorine-based chemical compounds with hydrocarbons. The major source of dioxin in the environment comes from waste-burning incinerators and also from backyard burn-barrels. Dioxin pollution is also affiliated with paper mills which use chlorine bleaching in their process and with the production of Polyvinyl Chloride (PVC) plastics and with the production of certain chlorinated chemicals (like many pesticides).

Methods of Analysis (Organic Compounds)

TPH by GC-FID is a more refined analytical technique which only detects hydrocarbons (aliphatic and aromatic) in the range C_{10} to C_{40} (volatiles, heavy tars, humic material and sulphur are not detected). The laboratory can provide a breakdown of the TPH results into diesel range organics (**DRO**) and heavier lubricating oil range organics (**LRO**).

GRO (PRO) by GC-FID analysis detects the more volatile C_6-C_9 hydrocarbons (aliphatic and aromatic), including those organic compounds present in petrol.

Speciated VOC (by GC-MS) analysis quantifies the concentrations of 30 USA-EPA priority compounds. These include chlorinated alkanes and alkenes (in the molecular weight range chloroethane to tetrachloroethane); trimethylbenzenes; dichlorobenzenes; and the 4 BTEX compounds (benzene, ethyl-benzene, toluene & xylene).

Speciated sVOC by (GC-MS) analysis quantifies the concentrations of a variety of organic compounds, including the 16 USA-EPA priority PAHs, phenols, 7 USA EPA priority PCB congeners, herbicides & pesticides.

Note: PAHs are hydrocarbons and consequently (where present) will be picked-up when scheduling TPH. by GC-FID. Naphthalene (the lightest PAH) is also one of the 58 US EPA VOCs.

Speciated TPH by GC-FID provides a "banded" TPH, initially split into aromatic and aliphatic fractions and then further divided into fraction specific carbon bandings based upon behavioural characteristics.

Note: Risk assessment models require physiochemical properties (solubilities, toxicities etc) of compounds in order to model their behaviour in the environment. These physiochemical properties cannot be derived from a single "TPH", "GRO" or "DRO" value. However, the carbon banded fractions can be used in risk assessment models.

Current UK Guidance

The UK approach to contaminated land is set out in Contaminated Land Report No. 11 (2004) "*Model Procedures for the Management of Land Contamination*". The approach is based upon risk assessment, where risk is defined as the combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

In the context of land contamination, there are three essential elements to any risk: (1) a contaminant source, (2) a receptor (eg controlled water or people) and (3) a pathway linking the (1) and (2). Risk can only exist where all three elements combine to create a pollutant linkage. Risk assessment requires the formulation of a conceptual model which supports the identification and assessment of pollutant linkages.

Encia adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. The initial step of such a risk assessment (or Tier 1) is the comparison of site data with appropriate UK guidance levels, Encia risk-derived screening values, or remedial targets.

Tier 1 **groundwater** risk assessments are undertaken by comparing leachate or groundwater concentrations with the appropriate water quality standard. Depending upon the specific characteristics and environmental setting of the site the appropriate standard is likely to be one of the following:

- Water Supply (Water Quality) Regulations 1989
- Environmental Quality Standards (for Freshwater)
- The Surface Waters (Abstraction for Drinking Water) Regulations

The tier 1 risk assessment of **landfill gas** is undertaken through reference to the following documents:

- Approved Document C, Building Regulations 1991
- CIRIA Report 149, "Protecting Development from Methane", 1995

Further information is presented in Generic Note No. 5 – Hazardous Gas.

In March 2002 DEFRA and the Environment Agency published a series of technical research papers (R & D Publications CLR 7, 8, 9 and 10) introducing the UK approach to the assessment of risk to **human health** from land contamination. This methodology and approach represents current scientific knowledge and thinking. The overall methodology also included the Contaminated Land Exposure Model (CLEA) and some Soil Guideline Values (SGV's).

At the time of writing this report, SGV's were only available for a limited number of contaminants, the development of both the CLEA model and additional SGV's is ongoing. Where published, SGV's have been utilised as intervention values for the purpose of an initial Tier 1 assessment.

It should be noted that exceedance of Tier 1 does not necessarily mean that remedial action will be required.

With respect to the assessment of potential **phytotoxic effects** of contaminants, Encia refer to "*The Soil Code*" (MAFF, 1998) for copper and zinc. The CLEA SGV is adopted for nickel due to its human health effects.

The potential risk to **building materials** is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, 'Concrete in aggressive ground', 2005.

With respect to the interpretation of the **calorific values**, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRCL Note 61/84 "Notes on the fire hazards of contaminated land" which states that:

"*In general……it seems likely that materials whose CV's exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn".*

Current Guidance derived by Encia

In the absence of UK SGVs for a number of "common" organic compounds, Encia have derived generic screening values for use as "Tier 1" values. These values have been derived using the RISC model, and taking account of UK policy decisions, Health Criteria Values and CLEA defaults.

PAH cannot be assessed as a single "total" value, as each individual PAH compound has different toxicity and mobility in the environment. Speciated analysis is required to determine the concentrations of the various compounds, most notably the key PAHs: Benzo(a)Pyrene (considered the most toxic of the PAHs); and Naphthalene (the most mobile and volatile of the PAHs).

Similarly, TPH cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "*The UK approach for evaluating human health risks from petroleum hydrocarbons in soils*". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG).

The TPHCWG have broken down “TPH” into thirteen representative constituent fractions or “EC Bandings”. EC Bandings are based around Equivalent Carbon numbers and the TPHCWG have derived a series of physiochemical and toxicological parameters for each of the thirteen EC bandings. The methodology for the derivation of these banding-specific properties is outlined in the TPHCWG series volumes 1-4.

Encia have calculated a screening value for each of the thirteen constituent fractions. These fractions have then been considered in terms of GRO, DRO and LRO to provide simpler, conservative initial Tier 1 screening values.

Encia’s derivation of Tier 1 values is based on a number of assumptions, most notably:

a. The site’s environmental setting, in terms of proximity to **Controlled Waters**, is not sensitive. It is not possible to derive generic Tier 1 values for waters, because distance and ground permeability are key factors, and both are extremely site-specific. Consequently, detailed quantitative risk assessment is required.

b. Contamination identified is located in the top 0.5m of soil on site. The CLEA model assumes that all exposure pathways are relevant within 0.5m of ground level.

c. A conservative **Soil Organic Matter** of 1%.

   (Note: TOC = SOM x 0.58; and FOC = TOC/100).

   Hydrocarbons tend to be “bind” with SOM, and therefore become less mobile. Consequently, Tier 1 values can be revised if the amount of organic matter within the soil exceeds 1%.

d. Some determinands reach **residual saturation** before a vapour risk is predicted to occur. Prior to residual saturation, as the concentration of a contaminant in soil increases, so does the concentration of the same contaminant in the associated vapour phase. However, once saturation is reached, the concentration of contaminant in the vapour phase remains constant (for any given atmospheric conditions – temperature and pressure).

   However, Encia recognise that it is unacceptable to leave free product in the ground and therefore arbitrary Tier 1 values have been ascribed to such contaminants. These values have been selected on the basis that they are below the limit of olfactory detection (ie at concentrations below Tier 1, odours are not readily identified).

Table 1 - Encia Tier 1 values

Contaminant	Tier 1 Value (mg/kg)	Comments/Notes
PCB	1.2	Based on PCB EU Seven
Benzene	0.3	
Xylene	6	
Benzo(a)pyrene	1.4	This value should also be used for the other most toxic PAHs, namely: Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, Indeno(1,2,3,c,d)pyrene & Dibenz(a,h)anthracene.
Naphthalene	22	Risk at surface driven by direct ingestion pathway
total PAH	1.4	The higher toxicity of Benzo(a)pyrene makes it the most problematic PAH in near surface soils. Consequently, Encia have adopted the Tier 1 value for Benzo(a)pyrene (1.4mg/kg) as an initial Tier 1 screening value for total PAH, on the conservative assumption that all the PAH is Benzo(a)pyrene.
TPH $<C_{10}$ Gasoline range organics (GRO)	0.3	Based on conservative assumption that all TPH$<C_{10}$ is benzene. If concentrations >0.3 mg/kg are recorded, but no benzene present, a Tier 1 value of 16mg/kg could be adopted for the gasoline range or reference can be made to Refined Tier 1 Values for speciated TPH (see below).
TPH $C_{10} – C_{20}$ Diesel range organics (DRO)	330	If DRO above tier 1 value and speciated fraction bandings are available, refer to Refined Tier 1 Values for speciated TPH (see below).
TPH $C_{21} – C_{40}$ Lubricating range organics (LRO)	580	Risk at surface driven by direct ingestion/dermal contact/veg uptake pathway of heavy aromatic fractions, if speciated fraction bandings are available, refer to Refined Tier 1 Values for speciated TPH (see below).

If site concentrations of any of the three broad TPH bandings (GRO, DRO or LRO) exceed the Tier 1 values quoted in Table 1 above, further assessment, with reference to speciated TPH results, will be required:

Table 2 - Refined Tier 1 values (TPH Bands)

Contaminant	Refined Tier 1 values (mg/kg)	Comments/notes
Aliphatic C5-C6	92	
Aliphatic C6-C8	500	Residual saturation reached due to lower toxicity of aliphatic compounds (cf aromatics), therefore no inhalation or ingestion risk. Tier 1 value selected on the basis that a concentration of 500 mg/kg is well below the limit of olfactory detection.
Aliphatic C8-C10	40	
Aliphatic C10-C12	1,000	Risk at surface driven by direct ingestion pathway, but (more conservatives value) adopted based on odour threshold
Aliphatic C12-C16	1,000	
Aliphatic C16-C21	1,000	
Aliphatic C21-C34	5,000	Residual saturation reached via inhalation; 5,000 selected based on direct contact.
Aromatic C5-C7	16	
Aromatic C7-C8	36	
Aromatic C8-C10	63	
Aromatic C10-12	330	
Aromatic C12-16	620	Driven by direct contact and vegetable uptake
Aromatic C16-C21	540	Driven by direct contact and vegetable uptake
Aromatic C21-35	580	Driven by direct contact and vegetable uptake

The significance of speciated TPH results can be assessed by following the 3 steps outlined in Table 3 below.

Note: This 3-step assessment is **not** required if concentrations of GRO, DRO & LRO are all above their respective Tier 1 values (see Table 1).

Table 3 – Assessment of TPH

Step	Result	Action
1 – Consider indicator compounds: Are BTEX, Naphthalene, Benzo(a)pyrene (and the other toxic PAHs) above their respective screening values (refer to Table 1 above)?	Yes	Detailed Quantitative Risk Assessment (DQRA) required
	No	Proceed to Step 2
2 – Consider individual TPH fractions: Are they above respective screening values (refer to Table 2 above)?	Yes	DQRA required
	No	Proceed to Step 3
3 – Assess Cumulative effects (use the equation below): Is the calculated Hazard Index for each source >1	Yes	DQRA required
	No	TPH compounds pose no significant risk.

Equation used to determine Hazard Index (Step 3).

$$HI = \sum_{F_i=1}^{16} HQ\ F_i = \frac{Measured\ concentration\ F_i\ (mg\,kg^{-1})}{SGV\ F_i\ (mg\,kg^{-1})}$$

where HI = Hazard Index
HQ = Hazard Quotient
F_i = Fraction $_i$
SGV = Soil Guideline Value

UK physiochemical properties, environmental properties, receptor and pathway parameters assumed within the assessment are detailed in the table below.

Table 4 - RISC amended parameters to reflect UK position and data source.

Parameter	Data Source
Chemicals of concern	- Individual chemical SGV and Tox reports
	- Environment Agency Publication - Review of the Fate
	and Transport of Selected Contaminants in the Soil
	Environment. Technical Report P5-079/TR1
	- TPH Criteria Working Group Vol 1-4
Surface soil and pathways selection	assumed direct ingestion of soil and dust, dermal contact, vegetable uptake
	and consumption and inhalation pathways.
Vapour Inhalation and pathways selection	Johnson and Ettinger model used as default in RISC model considering vapours
	from a contaminated soil. Default model acceptable as is also UK adopted
	model for inhalation
Determine receptor point concentration	
Indoor Air – Building parameters (residential house)	Environment Agency and Defra Publication CLR 10
	'Technical basis and algorithms', CLEA briefing notes
Cross-sect. area of basement = 40m2	CLEA Briefing note 3
Volume of building = 196.6m3	CLEA Briefing note 3
No. air changes per day = 12	CLEA Briefing note 3
Foundation thickness = 0.15m	CLEA Briefing note 3
Fraction of cracks = 0.001	CLEA Briefing note 3
Porosity of cracks = 0.25	CLEA Briefing note 3
Water content in cracks = 0	Assume 0 – no moisture restriction to vapour migration
Flow rate of soil gas into building = 0	CLEA Briefing note 3
Length of foundation perimeter = 34.4m	CLEA Briefing note 3
Depth of foundation = 0.15m	CLEA Briefing note 3
Pressure difference = 30g/cm-s2	CLEA Briefing note 3
Permeability of soils = 1x10-9cm2	Representative of current UK house building practice
Lens - material above source	Scenario specific
Thickness: 'clean' cover in garden areas assumed = 0mm	
Porosity = 0.46	CLEA Briefing note 2 and CLR 10
Water content = 0.15	CLEA Briefing note 2 and CLR 10
Source data –data regarding material contamination located in	
Porosity of source material = 0.46	CLEA Briefing note 2 and CLR 10
Water content of source material = 0.15	CLEA Briefing note 2 and CLR 10
Fraction organic carbon = 0.006	CLR 10
Bulk density = 1.6	CLEA Briefing note 2 and CLR 10
Unsaturated zone – data regarding material surrounding source	
Distance to building from source or groundwater = 0.15	Scenario specific
Total porosity = 0.46	CLEA Briefing note 2 and CLR 10
Water content = 0.15	CLEA Briefing note 2 and CLR 10
Source concentration – maximum recorded site concentrations	Site Specific (assumed 100 for all single compounds and 10,000 for all TPH fractions)
Describe receptor	
Receptor and analysis type	
Deterministic analysis, one receptor of a child resident (RME)	CLR 10 default parameter for a residential development
Exposure Data	
Based on a female child of 0-6 years.	
Averaging time/lifetime = 6yrs	CLR10
Body weight = 14.5kg	CLR 10 Table 5.6
Exposure Frequency = 365days/yr	CLR 10
Exposure duration = 6yrs	CLR 10
Soil ingestion rate = 100mg/day	CLR 10 Table 6.1
Total skin surface area = 6166cm^2	CLR 10 Table 5.8
Fraction skin exposed = 0.265	CLEA Briefing Note 1
Soil/skin adhesion factor = 1	CLEA Briefing Note 1 and SGV reports
Exposure frequency for veg uptake = 365days	CLR 10
Exposure duration for veg uptake = 6yrs	CLR 10

Parameter	Data Source
Root Veg ingestion rate = 103.6g/day	CLR 10 Table 6.3
Above ground veg ingestion rate = 38.5g/day	CLR 10 Table 6.3
Fraction of home grown veg = 0.28	CLR 10 Table 6.4
Fraction organic carbon in soil = 0.006	Site Specific
Exp. Frequency indoor air = 365 days	CLR 10
Exp. Duration = 6yrs	CLR 10
Lung retention factor = 1	Assumed
Inhalation rate = 0.43m3/hr	CLR 10 Table 5.9
Time indoors = 20.6hr/day	Sniffer Framework Table 10.3

Note: The information contained within the table above reflects all parameters within the RISC model that were amended to reflect current UK guidance and scenarios. The model summary is not included with this text but is available upon request.

Possible Action in event of Tier 1 exceedance

Should any of the Tier 1 criteria detailed above be exceeded, then three potential courses of action are available. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

- Undertake further statistical analysis following the approach set out in Appendix A of CLR 7 in order to determine whether contaminant concentrations of inorganic contaminants within soil\fill actually present a risk (only applicable to assessing the risk to human health).
- Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.
- Based on a qualitative risk assessment, advocate an appropriate level of remediation to "break" the pollutant linkage - for example the removal of the contaminated materials or the provision of a clean cover.

Prior to undertaking any statistical analysis (as set out in Appendix A of CLR 7) the issue of the **averaging area** requires further consideration. CLR 7 suggests the averaging area should be representative of the receptors behaviour, such as a single garden or an open area used by the local community as a play area. This approach to averaging areas is considered applicable within the context of Part IIA of the Environmental Protection Act (EPA) 1990, in terms of an existing residential development.

However, Encia consider the concept of a single garden as an averaging area to be inappropriate with respect to brownfield redevelopment, which is regulated by the planning regime. In this context, contamination across the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Encia gather and analyse sample results by fill type, and\or by former use in a given sub-area of the site, before undertaking statistical analysis; ie the averaging area is associated with the extent of a particular fill type, or an area affected by spillage\leakage.

In terms of brownfield redevelopment, this is considered a more appropriate methodology which provides a more representative sample population for statistical analysis. As such the entire site is considered in terms of the proposed end use, be this residential with, or without gardens.

Analysis by soil\fill type is appropriate for essentially immobile contaminants associated with a particular fill type, for example arsenic in colliery spoil, metals in ash & clinker, sulphate in plaster-rich demolition rubble etc.

Analysis by former use is appropriate where more mobile contaminants have entered the ground, for example diesel associated with leakage from a former fuel tank, downward migration of leachable metals through granular materials, various soluble contaminants present in a wastewater leaking into the ground via a fractured sewer etc. In these

circumstances, it may be appropriate to undertake statistical analysis of sample results from a variety of different soil\fill types. However, consideration would have to be given to factors such as porosity which might influence impregnation of a mobile contaminant into the soil mass; ie contamination would normally be more pervasive and significant in granular soils than cohesive soils.

APPENDIX B
DRAWINGS

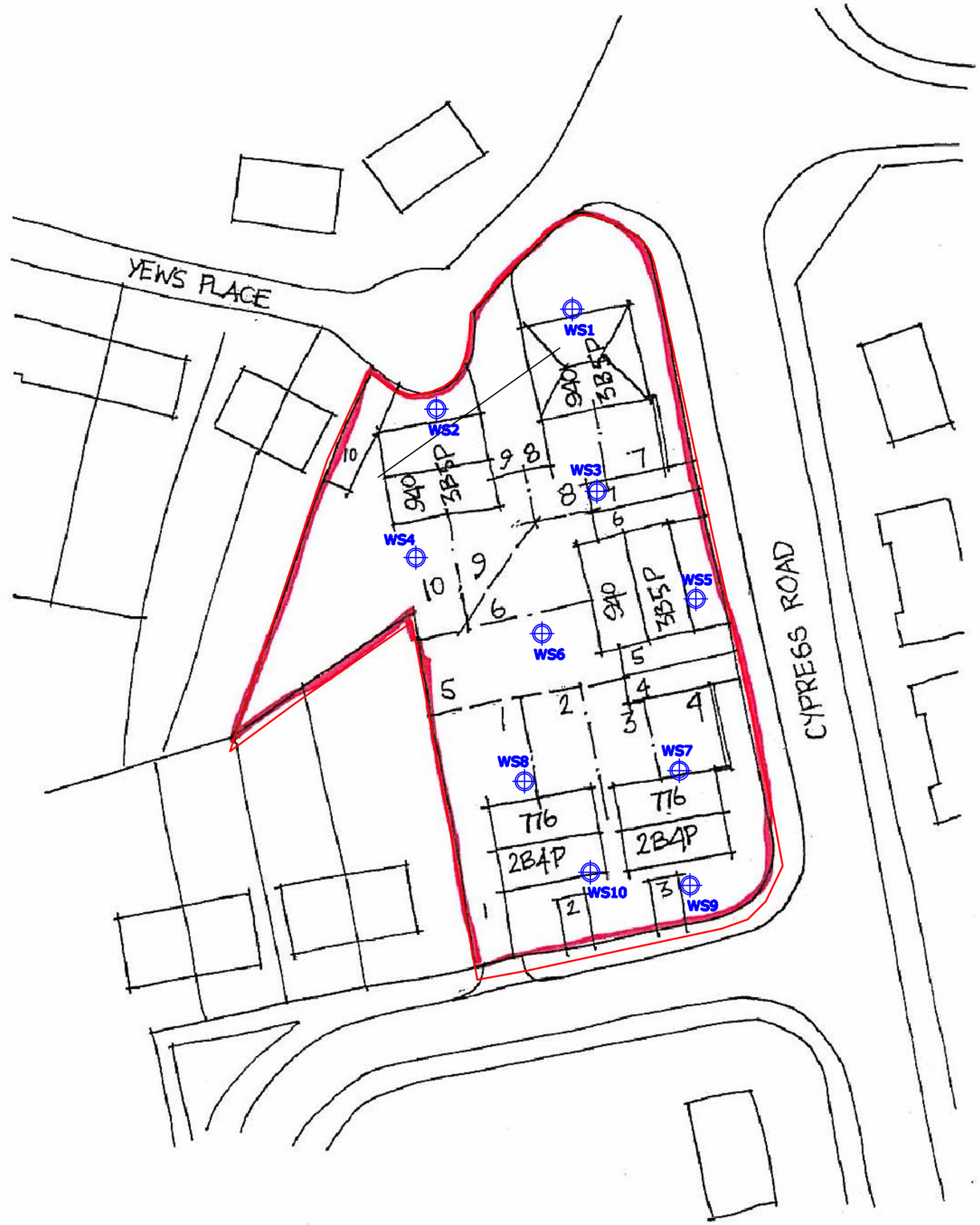


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ENCIA Environmental

ENCIA HOUSE
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WETHERBY
LS22 7RD
TEL: 01937 589955
FAX: 01937 589944

CLIENT	KEEPMOAT HOMES
JOB TITLE	YEWS PLACE, KENDRAY
DRAWING TITLE	SITE LOCATION PLAN
DRAWN	ASw
DATE	01 04 09
CHECKED	RJH
DATE	01 04 09
STATUS	FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☐ FINAL ☑
SCALE	1:25,000
SHEET	A4
DRAWING NO.	9642/1
REVISION	A



NOTES

= Window Sample Location (WS1 to WS10)

= Approximate Site Boundary

Reproduced from Keepmoat Homes Sketch Layout (Yews Place, Kendray)

REV.	DESCRIPTION	DATE

ENCIA Environmental

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FAX: 01937 589944

E-Mail: info@enciagroup.co.uk
Web: www.enciagroup.co.uk

CLIENT: KEEPMOAT HOMES

JOB TITLE: YEWS PLACE, KENDRAY

DRAWING TITLE: PROPOSED SITE LAYOUT

DRAWN	DATE	STATUS
ASw	31 03 09	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
RJH	31 03 09	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:500	A3	9642/2	A

















N

W E

S

NOTES

= Cabin/Office/Yard Area

= Fuel Storage Tanks

= Approximate Site Boundary

= Location And Orientation of Photograph

REV.	DESCRIPTION	DATE

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CLIENT

KEEPMOAT HOMES

JOB TITLE

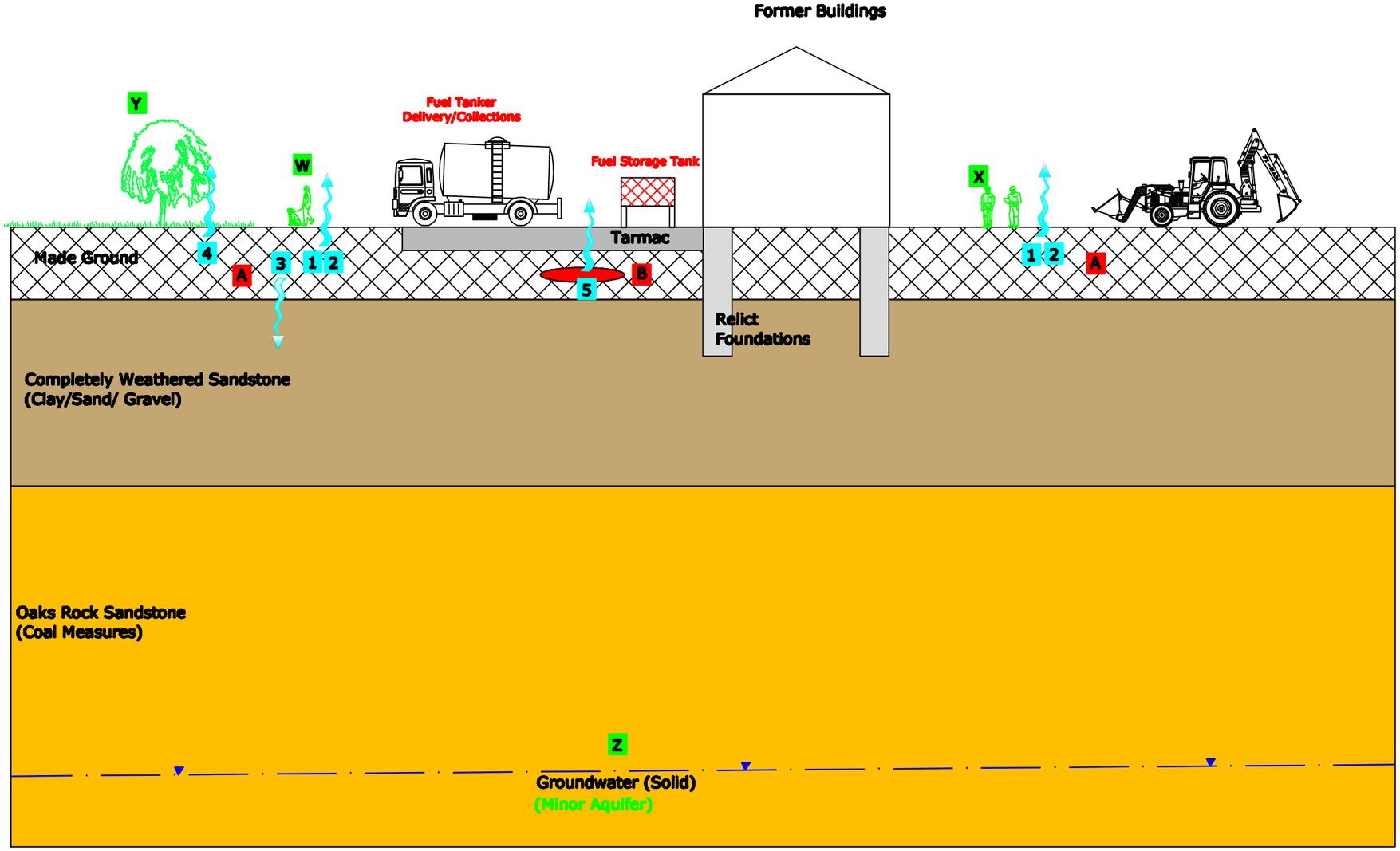
YEWS PLACE, KENDRAY

DRAWING TITLE

EXISTING SITE FEATURES & PHOTOGRAPHS

DRAWN	DATE	STATUS
ASw	31 03 09	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
RJH	31 03 09	DRAFT ☐
		FINAL ☑

SCALE	SHEET SIZE	DRAWING NO.	REVISION
1:500	A2	9642/3	A



KEY	SOURCES	PATHWAYS	RECEPTORS
Made Ground	A Made Ground (metals)	1 Dermal Contact	W End Users (Residents)
Completely Weathered Sandstone (Clay/Sand/Gravel)	B Leakage/Spillage (Fuel/Oil)	2 Ingestion/Inhalation	X Site Workers
Oaks Rock Sandstone		3 Leaching of Mobile Contaminants	Y Vegetation
		4 Uptake by Plants	Z Controlled Waters (Ground)
		5 Volatilisation of Organic Contaminants	

NOTES

REV.	DESCRIPTION	DATE

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CLIENT
KEEPMOAT HOMES

JOB TITLE
YEWS PLACE, KENDRAY

DRAWING TITLE
PRELIMINARY CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
ASw	30 03 09	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
RJH	30 03 09	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	9642/4	A



NOTES

= Window Sample Location (WS1 to WS10)

= Approximate Site Boundary

REV.	DESCRIPTION	DATE

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CLIENT

KEEPMOAT HOMES

JOB TITLE

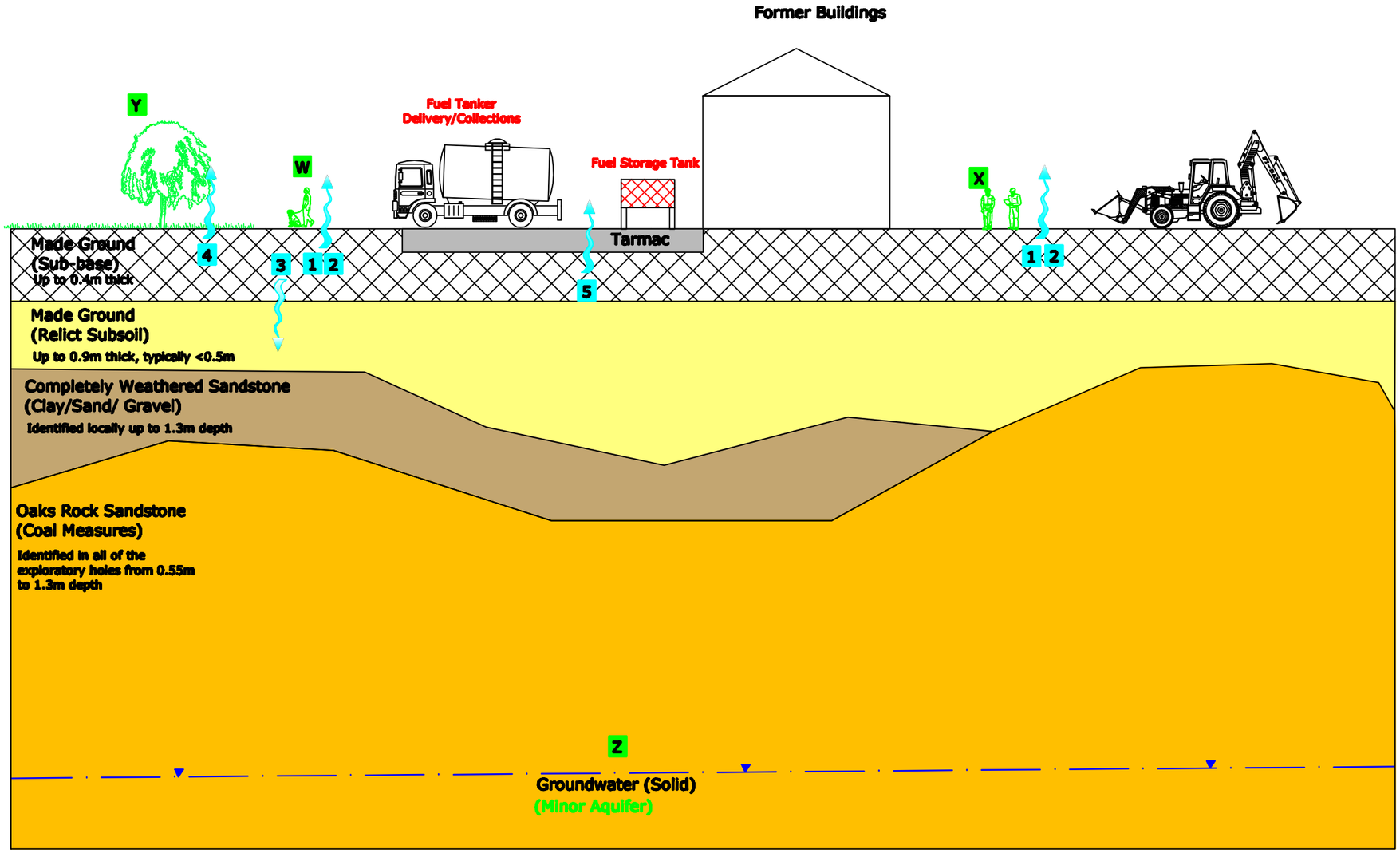
YEWS PLACE, KENDRAY

DRAWING TITLE

EXPLORATORY HOLE LOCATION PLAN

DRAWN	DATE	STATUS
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CHECKED	DATE	FOR APPROVAL ☐
RJH	31 03 09	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:500	A3	9642/5	A



KEY
Made Ground (Sub-base)
Made Ground (Relict Topsoil)
Completely Weathered Sandstone (Clay/Sand/Gravel)
Oaks Rock Sandstone

SOURCES
No significant sources of contamination identified

PATHWAYS	
1	Dermal Contact
2	Ingestion/Inhalation
3	Leaching of Mobile Contaminants
4	Uptake by Plants
5	Volatilisation of Organic Contaminants

RECEPTORS	
W	End Users (Residents)
X	Site Workers
Y	Vegetation
Z	Controlled Waters (Ground)

NOTES

REV.	DESCRIPTION	DATE

ENCIA Environmental
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CLIENT
KEEPMOAT HOMES

JOB TITLE
YEWS PLACE, KENDRAY

DRAWING TITLE
REVISED CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
ASw	20 04 09	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
RJH	20 04 09	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	9642/6	A

APPENDIX C
COMMISSION

9642/002/RJH/rjh

20th March 2009

Please reply to:

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Midlands
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T 0800 169 2238 F 01942 824030

Mr K Owen
Keepmoat Homes Limited
The Waterfront
Lakeside Boulvard
Doncaster
South Yorkshire
DN4 5PL

Dear Keith

Kendray, Barnsley

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that your proposed development will include ten traditional two and three storey domestic dwellings (detached, semi-detached and terraced) with associated gardens and adoptable roads and sewers; an unreferenced sketch layout has been provided.

The site is currently occupied by the temporary offices and storage yard of the adjacent construction site. The offices comprise approximately 20% of the site area with the remainder roughly surfaced and used for storage of loose and palletised materials. Approximately 50% of the area is open.

Given the current operational use of the site we have offered two alternatives to completing the fieldwork element of the project.

- Trial pitting using a mechanical excavator. This is the ideal form of investigation; however, it would require the movement of some of the materials and would leave mounds of spoil at each location. It would also restrict use of the yard for one day.
- Window sampling that would not be restricted by site operations but would provide less ground related information.

Our historical knowledge of the area suggests that the site was undeveloped until the late 1950's when probable housing was constructed on site as part of a much large residential development. No former structures remain on site.

Brief examination of the relevant geological map suggests the site is underlain by Oaks Rock (sandstone). The shallowest coal seam beneath the site is the Newhill Coal (0.61m to 1.37m thick in the area); however, at a minimum depth of 20m below the site it is unlikely to affect its surface stability.

Our site investigation proposal allows for the following works:

Desk Study: An examination of historical Ordnance Survey plans will be made to determine whether any past land uses have had any effect on the proposed development. Additionally, published geological plans of the area will be examined and enquiries will be made of the Environment Agency, Coal Authority and the Local Authority.

Fieldwork: At this stage we have allowed for either one day's trial pitting or one day's window sampling. With the likely ground conditions on site (weathered sandstone) soakaways may be possible; however, given the access restrictions at this time it may not be practical to carry insitu testing. We would suggest you allow a contingency of £[redacted] in your budget to carryout the testing at a later date if ground conditions prove favourable. All trial pits or boreholes will be supervised and logged by an experienced geoenvironmental engineer.

Representative soil samples of natural and man-made ground, including any contaminated samples, will be taken during the works. In-situ shear strengths of any cohesive soils encountered will be determined by the use of a hand-held shear vane. Mackintosh probing will be undertaken within and adjacent to pits in order to determine the in-situ density of any granular soils.

We will make every effort to compact arisings and 'sweep' them over each trial pit. However, you should be aware that on completion of the investigation, "graves" of spoil (each about 3m long by 1m wide) unsuitable for trafficking, will be left at each trial pit location. At this stage, no allowance has been made for reinstatement of the hardstanding.

If the pitting/window sampling encounters significant thicknesses of made ground or very soft/loose deposits (neither considered likely), boreholes may be required to obtain geotechnical data from greater depth. We will advise you of any need for boreholes within three days of completion of the pitting.

The desk study may highlight other potential problems with the site such as landfill gas, quarrying, shallow mining or soil contamination. It may therefore be necessary to carry out additional works, but we will inform you prior to undertaking any such work and provide revised a cost estimate.

Soils Testing: This will comprise routine geotechnical soils analysis, typical of that normally required for greenfield sites. Although no allowance has been for in-situ or laboratory CBR testing, CBR values will be estimated from the strata descriptions and classification test results, where appropriate (i.e. if no significant regrading or reworking of made ground is proposed).

Appropriate chemical analyses, based on our knowledge of the site's history (former housing and construction yard), have been allowed for. In the event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.

Reporting & Timescales: In order to provide you with sufficient information to enable assessment of abnormal costs at the earliest opportunity we will issue a concise overview report within three days of fieldwork completion.

On completion of the desk study, fieldwork and laboratory testing a comprehensive bound, factual and interpretative report will be issued. This will contain detailed engineering records, laboratory test results, copies of all relevant correspondence and drawings of the site. The report will include qualitative risk assessment with respect to both controlled waters and human health.

The report will also provide technically feasible options for redevelopment of the site with housing, including consideration of foundation types and treatment\removal of contamination.

Allowing for receipt of statutory search information, the preliminary investigation will require up to four weeks and fieldwork would take one day. However, fieldwork could be commenced prior to completion of the preliminary investigation, within tow weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report (1 bound hard copy, and 1 electronic PDF on CD) will be issued within four weeks of fieldwork completion.

Given previous usage of this land, it is considered unlikely that significant contamination will be encountered, consequently at this stage we have made no allowance for production of a Remedial Strategy.

Copies of the final report will be issued to the relevant regulatory authorities on receipt of written instruction from yourselves.

Invoicing: The attached proposals provide a breakdown of the costs associated with this project. This breakdown is for information only and the proposals can be regarded as lump sum prices of

- Trial pitting option - £[redacted] plus VAT.
- Window sampling option - £[redacted] plus VAT.

Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent.

Our proposal allows for submission of the report to the Local Authority and NHBC, and for submission of a single piece of subsequent correspondence with each regulator to address any queries they may have. Any further meetings, correspondence etc, would be chargeable.

We will submit our invoice for this project with the final report.

Underground Services: Utility plans are required in order to protect operatives from the hazards associated with striking buried services and avoid potentially substantial disruption\repair costs. We will obtain the necessary plans (to include electricity, gas, water, drainage & telecom) direct from each of the utility companies and our proposal allows for this.

We will make every effort not to damage any services (including review of utility plans and use of a CAT detector). However, Encia cannot accept liability for damage to any underground services that are not accurately marked on plans made available to us prior to commencement of our field investigation, or have not been accurately marked on the ground by a responsible third party (e.g. utility company, site owner).

Terms & Conditions: This work will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed.

You will note that in the last two columns of our costed proposal we have included an estimate of the proportion of the total cost of the works that could be eligible for Land Remediation Relief.

It is hoped the above is sufficient for your present needs. However, should you require any further information, please contact the undersigned.

Yours sincerely



Richard Hey
for and on behalf of
ENCIA ENVIRONMENTAL LIMITED

enc

Terms and Conditions for the Appointment of Encia Environmental Limited

1 DEFINITIONS AND INTERPRETATION

1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:

"Agreement" shall mean these Terms (entitled "Encia Environmental Terms of Appointment"), the Proposal, any document recording the Client's unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing;

"Client" shall mean the party for whom the Services are being provided by Encia;

"Documents" shall mean all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Quantities, calculations, letters, e-mails, faxes, memoranda, films and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of Encia, and whether in paper form or stored electronically or on disk, or otherwise;

"Encia" shall mean Encia Environmental Limited whose registered office is at Emerald House, Meadowcroft Way, Leigh, WN7 3XZ.

"Intellectual Property" includes all rights to, and any interests in, any patents, designs, trade marks, copyright, know-how, trade secrets and any other proprietary rights or forms of intellectual property (protectable by registration or not) in respect of any technology, concept, idea, data, programme or other software (including source and object codes), specification, plan, drawing, schedule, minutes, correspondence, scheme, formula, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed or produced by any person;

"Parties" shall mean the Client and Encia

"Project" shall mean the project described in the Proposal and any enquiry from the Client on which Encia has based its Proposal;

"Proposal" means the offer document prepared by Encia in response to an enquiry or otherwise, in connection with the proposed provision of the Services;

"Services" means the work and services relating to the Project to be provided by Encia pursuant to the Agreement and as set out in the Proposal and shall include any additions or amendments thereto made in accordance with these Terms;

"Terms" means these terms entitled "Encia Environmental Terms of Appointment";

1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.

1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.

1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.

1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.

1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.

2 APPOINTMENT

2.1 The Client agrees to engage Encia and Encia agrees to provide the Services in accordance with the provisions of the Agreement.

3 OBLIGATIONS OF ENCIA

3.1 Encia shall perform the Services using the reasonable standard of skill and care normally exercised by similar professional Environmental firms in performing similar services under similar conditions.

3.2 Encia shall use all reasonable endeavours to perform the Services in accordance with all relevant environmental and safety legislation.

4 OBLIGATIONS OF THE CLIENT

4.1 Throughout the period of this Agreement the Client shall afford to Encia or procure the affording to Encia of access to any site where access is required for the performance of the Services.

4.2 The Client accepts responsibility for ensuring that Encia is notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards known or suspected by the Client, which the Client shall clearly mark on the ground or identify on accurate location plans supplied to Encia prior to the commencement of the Services. The Client shall also inform Encia in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services. The Client shall indemnify Encia against all costs, claims, demands and expenses arising as a result of any non-disclosure in this respect, including but not limited to indemnification against any action brought by the owner of the land or otherwise.

4.3 If the Client discovers any conflict, defect or other fault in the information or designs provided by Encia pursuant to the Agreement, he will advise Encia in writing of such defect, conflict or other fault and Encia shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant the conflicting, defective or in any other way faulty information or designs.

5 INTELLECTUAL PROPERTY

5.1 The copyright in all Intellectual Property prepared by or on behalf of Encia in connection with the Project for delivery to the Client shall remain vested in Encia.

5.2 The Client shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable the Client to copy and use the Intellectual Property but solely for its own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any license to amend any drawing, design or other Intellectual Property produced by Encia.

5.3 Should the Client wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, it must obtain the prior written consent of Encia. The giving of such consent shall be at the discretion of Encia and shall be upon such terms as may be required by Encia. Encia shall not be liable for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on behalf of Encia.

5.4 Ownership of any proposals submitted to the Client that are not subsequently confirmed as part of the Services to be provided for the Client remain with Encia and such proposals must not be used as the basis for any future work undertaken by the Client or a third party and no liability can be accepted howsoever arising from such proposals.

5.5 In the event of the Client being in default of payment of any fees or other amounts due, Encia may suspend further use of the licence on giving 2 days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts

6 CONFIDENTIALITY

6.1 Encia undertakes not to divulge or disclose to any third party without the written consent of the Client information which is designated confidential by the Client or which can reasonably be considered to be confidential and arises during the performance of the Services unless required to do so by law or necessary in the proper performance of its duties in relation to the Project, or in order to make full frank and proper disclosure to its insurers or intended insurers, or to obtain legal or accounting advice.

6.2 Subject to the above, Encia shall be permitted to use information related to the Services it provides in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

7 THIRD PARTIES

7.1 The Agreement or any part thereof or any benefit or interest thereunder may not be assigned by the Client without the prior written consent of Encia. The giving of such consent shall be at the discretion of Encia and Encia will only agree to an assignment on its terms and in return for payment of a fee by the Client to Encia to cover Encia's legal and other costs associated with any assignment.

7.2 The Agreement shall not confer and shall not purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of the Contracts (Rights of Third Parties) Act 1999 or otherwise.

7.3 Encia will consider and may consent to any request from the Client for Encia to enter a collateral warranty with a third party with regard to the Services provided under the Agreement. The giving of such consent shall be at the discretion of Encia and Encia will only enter a collateral warranty on its terms and in return for payment of a fee by the Client to Encia to cover Encia's legal and other costs associated with any collateral warranty.

8 INSURANCE

8.1 Encia warrants to the Client that there is in force a policy of Professional Indemnity insurance covering its liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) in the aggregate. This policy is annually renewable and whilst renewal is not automatic, Encia agrees to use reasonable endeavours to maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under the Agreement, provided such insurance is available at commercially reasonable rates having regard, inter alia, to premiums required and policy terms obtainable.

8.2 If for any period such insurance is not available at commercially reasonable rates, Encia shall forthwith inform the Client and shall obtain in respect of such period such reduced level of Professional Indemnity insurance as is available and as would be fair and reasonable in the circumstances for Encia to obtain.

9 LIMITATIONS ON LIABILITY

9.1 Unless otherwise agreed in writing, Encia's liability under or in connection with the Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either five million pounds in the aggregate or 10 times the total value of invoices issued to the Client for the consultancy work instructed under the Agreement.

9.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against Encia after the expiry of a period of six years from the date of the completion (or termination) of the Services under the Agreement.

9.3 Whilst Encia will scan all potential exploratory locations with a Cable Avoidance Tool, Encia shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.

9.4 Encia shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by Encia or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless Encia has been advised in writing of the same by the Client and has been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

10 PAYMENT

10.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.

10.2 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.

10.3 If the Client disputes the amount included for payment in an invoice a written notice must be served on Encia by the Client not later than 14 days before the final date for payment. If no notice is given the amount due shall be the amount stated in the invoice.

10.4 In the event of failure on the part of the Client to pay any monies in accordance with the foregoing payment provisions, Encia will be entitled to charge interest on any monies owed to it by the Client, such interest to be at a rate of 8% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis.

11 DELAY

11.1 Encia will comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond its reasonable control and in the event of any such circumstances arising Encia undertakes to complete the Services within a reasonable period, but will not be liable to the Client for any delay as a result.

12 TERMINATION

12.1 The Agreement may be determined by either party in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of determination must be given to the party which is insolvent by the other party.

12.2 If for any reason the performance of the Services by Encia is suspended for a period in excess of three calendar months then Encia shall be entitled to determine its appointment in respect of the Services by seven days written notice to the Client.

12.3 If the Client shall fail to pay in full any sum due under the terms of the Agreement by the final date for payment for that sum and no effective notice of intention to withhold payment has been issued, Encia may serve written notice on the Client demanding payment within 14 days of such notice. If the Client shall fail to comply with such notice, Encia shall be entitled to terminate its employment under the Agreement forthwith.

12.4 Any determination of the appointment of Encia howsoever caused shall be without prejudice to the right of Encia to require payment for all services performed up to the date of such determination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which Encia has started, but not completed.

13 NOTICES

13.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to the address of Encia set out above or to the registered address of the Client.

13.2 Such notice shall be deemed to have been received on the day of delivery if delivered by hand or on the second working day after the day of posting if sent by first class post.

14 ENTIRE AGREEMENT

14.1 The Agreement constitutes the complete and entire agreement between the Client and Encia with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications and representations, whether express or implied and any claim against Encia in respect of the Services can only be made in contract under the provisions of the Agreement and not otherwise under the law or tort or otherwise.

14.2 No amendments, modifications or variation of the Agreement shall be valid unless made in writing and agreed to by both the Client and Encia; such agreement must be recorded in writing by at least one of the Parties.

14.3 Encia will not be bound by any standard or printed terms or conditions furnished by the Client in any of its documents unless Encia specifically states in writing separately from such documents that it intends such terms and conditions to apply.

15 DISPUTES AND GOVERNING LAW

15.1 The Agreement shall be governed by and construed in accordance with English law and the Parties irrevocably and unconditionally submit to the jurisdiction of the English Courts.

15.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between the Parties may be referred to adjudication in accordance with The Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland and Northern Ireland.

keepmoat HOMES

The Waterfront
Lakeside Boulevard
Doncaster
South Yorkshire
DN4 5PL

Telephone 01302 347600
Facsimile 01302 347605

web www.keepmoathomes.co.uk

Our Ref: LKO/MH/2665

23 March 2009

Encia
Encia House
Audby Lane
Wetherby
West Yorkshire
LS22 7RD

RECEIVED 25 MAR 2009
JOB No. 9642 F.A.O. RJH
DISTRIBUTION

For the attention of Mr R Hey

Dear Richard

Re: Yews Place, Kendray

Please accept this letter as our official order to carry out the Site Investigation on the above site. I know it will not be easy to carry out the Site Investigation and I think the best option will be window sampling. This will have less disruption to the compound etc and also allow you to put in your gas monitoring well points.

Will you please liaise with our Construction Director for Yorkshire, Mr Rick Long, on 01302 341005 or mobile 07815 528 913.

Would you please confirm to me when you will be going onto site.

Yours sincerely

L K Owen
Development Director

C.c. David Ward – Keepmoat Homes
Rick Long – Keepmoat Homes
Peter Rice – Keepmoat Homes

APPENDIX D
HISTORICAL OS PLANS
(Some plans only included on accompanying CD)

Historical Mapping Legends

Ordnance Survey County Series 1:10,560

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

Ordnance Survey Plan 1:10,000

Chalk Pit, Clay Pit or Quarry
Gravel Pit
Sand Pit
Disused Pit or Quarry
Refuse or Slag Heap
Lake, Loch or Pond
Dunes
Boulders
Coniferous Trees
Non-Coniferous Trees
Orchard
Scrub
Coppice
Bracken
Heath
Rough Grassland
Marsh
Reeds
Saltings
Building
Direction of Flow of Water
Shingle
Sand
Glasshouse
Pylon
Electricity Transmission Line
Pole
Sloping Masonry
Cutting
Embankment
Standard Gauge Multiple Track
Road Under
Road Over
Level Crossing
Foot Bridge
Standard Gauge Single Track
Siding, Tramway or Mineral Line
Narrow Gauge
Geographical County
Administrative County, County Borough or County of City
Municipal Borough, Urban or Rural District, Burgh or District Council
Borough, Burgh or County Constituency
Shown only when not coincident with other boundaries
Civil Parish
Shown alternately when coincidence of boundaries occurs

BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Convenience
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Call Box
MP	Mile Post	TCP	Telephone Call Post
MS	Mile Stone	W	Well

1:10,000 Raster Mapping

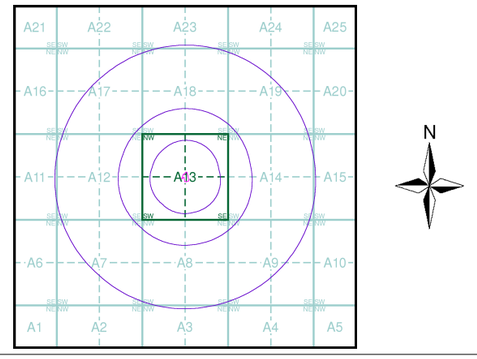
Gravel Pit
Refuse tip or slag heap
Rock
Rock (scattered)
Boulders
Boulders (scattered)
Shingle
Mud
Sand
Sand Pit
Slopes
Top of cliff
General detail
Underground detail
Overhead detail
Narrow gauge railway
Multi-track railway
Single track railway
County boundary (England only)
Civil, parish or community boundary
District, Unitary, Metropolitan, London Borough boundary
Constituency boundary
Area of wooded vegetation
Non-coniferous trees
Non-coniferous trees (scattered)
Coniferous trees
Coniferous trees (scattered)
Positioned tree
Orchard
Coppice or Osiers
Rough Grassland
Heath
Scrub
Marsh, Salt Marsh or Reeds
Water feature
Flow arrows
MHW(S) Mean high water (springs)
MLW(S) Mean low water (springs)
Telephone line (where shown)
Electricity transmission line (with poles)
BM 123.45 m Bench mark (where shown)
Triangulation station
Point feature (e.g. Guide Post or Mile Stone)
Pylon, flare stack or lighting tower
Site of (antiquity)
Glasshouse
General Building
Important Building

ENCIA Environmental

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Yorkshire	1:10,560	1894	2
Yorkshire	1:10,560	1907	3
Yorkshire	1:10,560	1932	4
Yorkshire	1:10,560	1938	5
Yorkshire	1:10,560	1948	6
Ordnance Survey Plan	1:10,000	1955 - 1956	7
Ordnance Survey Plan	1:10,000	1965 - 1966	8
Ordnance Survey Plan	1:10,000	1973 - 1978	9
Ordnance Survey Plan	1:10,000	1980 - 1984	10
Ordnance Survey Plan	1:10,000	1989	11
Ordnance Survey Plan	1:10,000	1993	12
10K Raster Mapping	1:10,000	2000	13
10K Raster Mapping	1:10,000	2008	14

Historical Map - Slice A



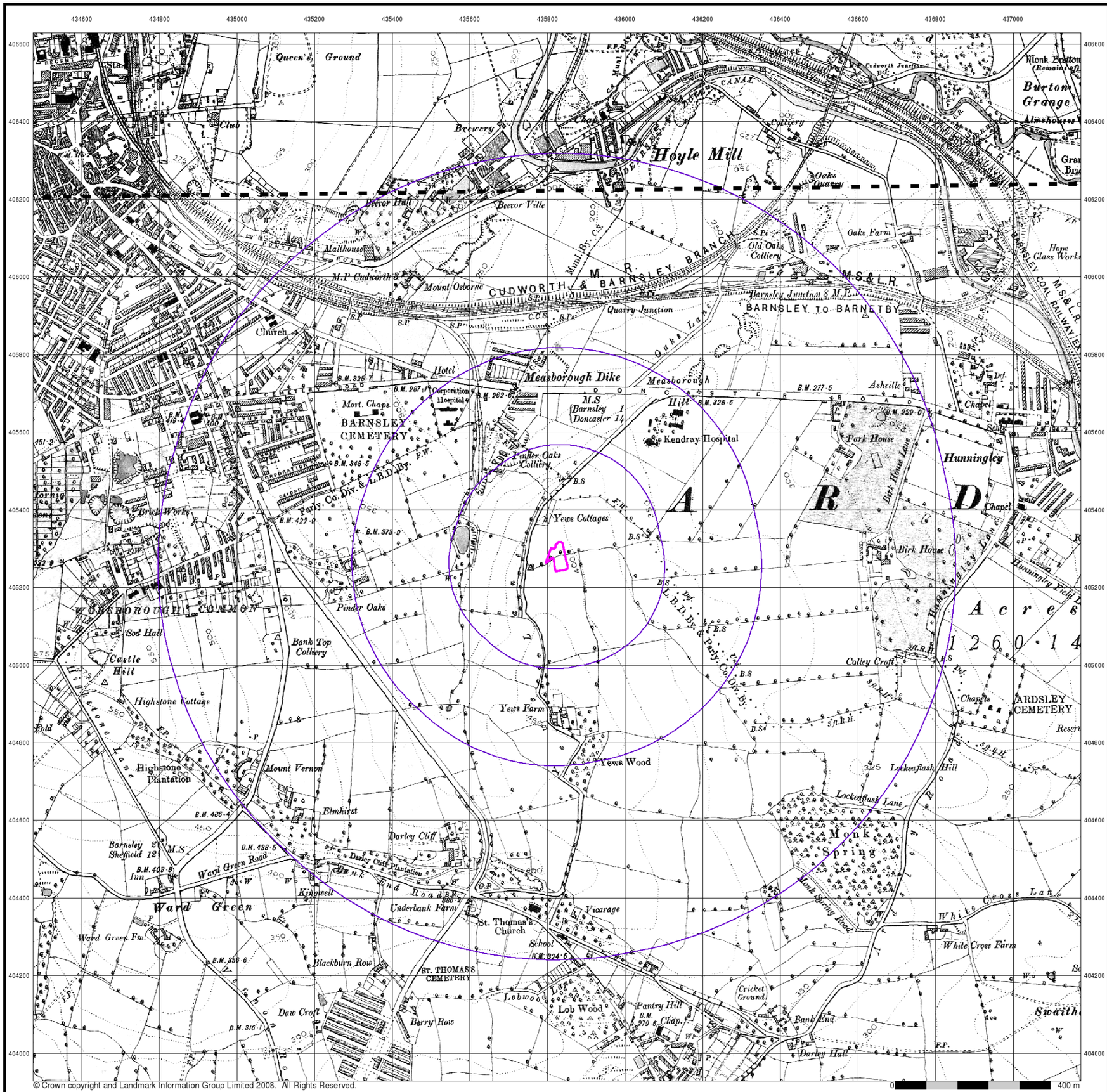
Order Details

Order Number: 27556575_1_1
Customer Ref: 9642 - Yews Place, Kendray
National Grid Reference: 435830, 405280
Slice: A
Site Area (Ha): 0.24
Search Buffer (m): 1000

Site Details

Site at 435800, 405300

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



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ENCIA Environmental

Yorkshire

Published 1894

Source map scale - 1:10,560

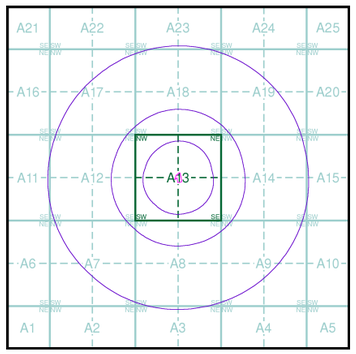
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some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

274NE
1894
1:10,560

274SE
1894
1:10,560

Historical Map - Slice A



Order Details

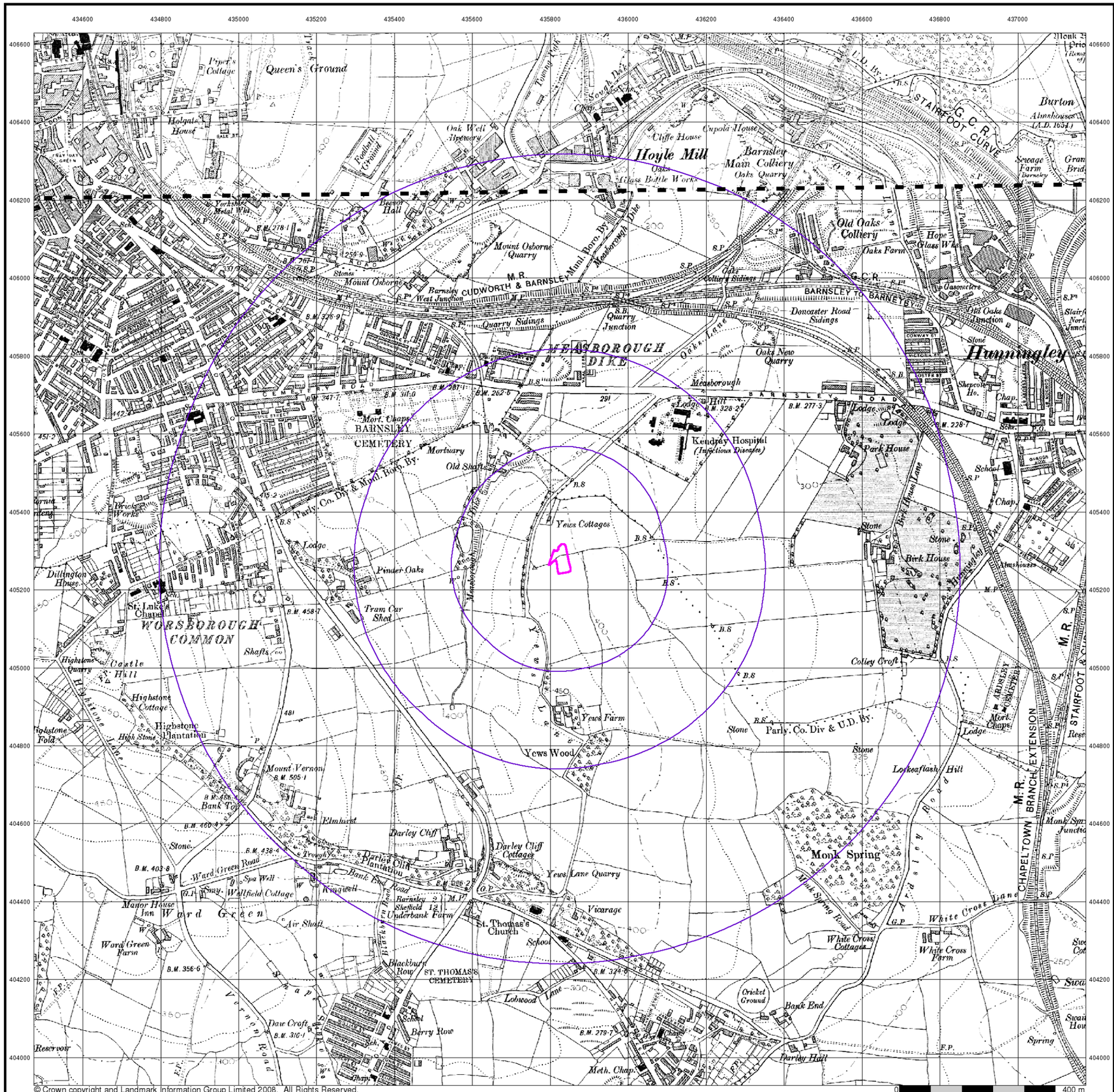
Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

Site Details

Site at 435800, 405300

LANDMARK Information Group

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



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ENCIA Environmental

Yorkshire

Published 1907

Source map scale - 1:10,560

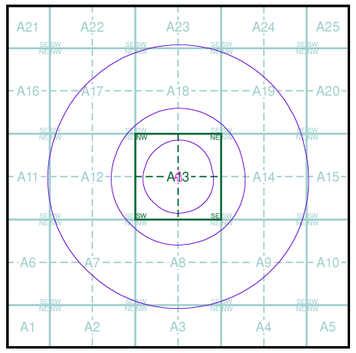
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some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

274NE
1907
1:10,560

274SE
1907
1:10,560

Historical Map - Slice A



Order Details

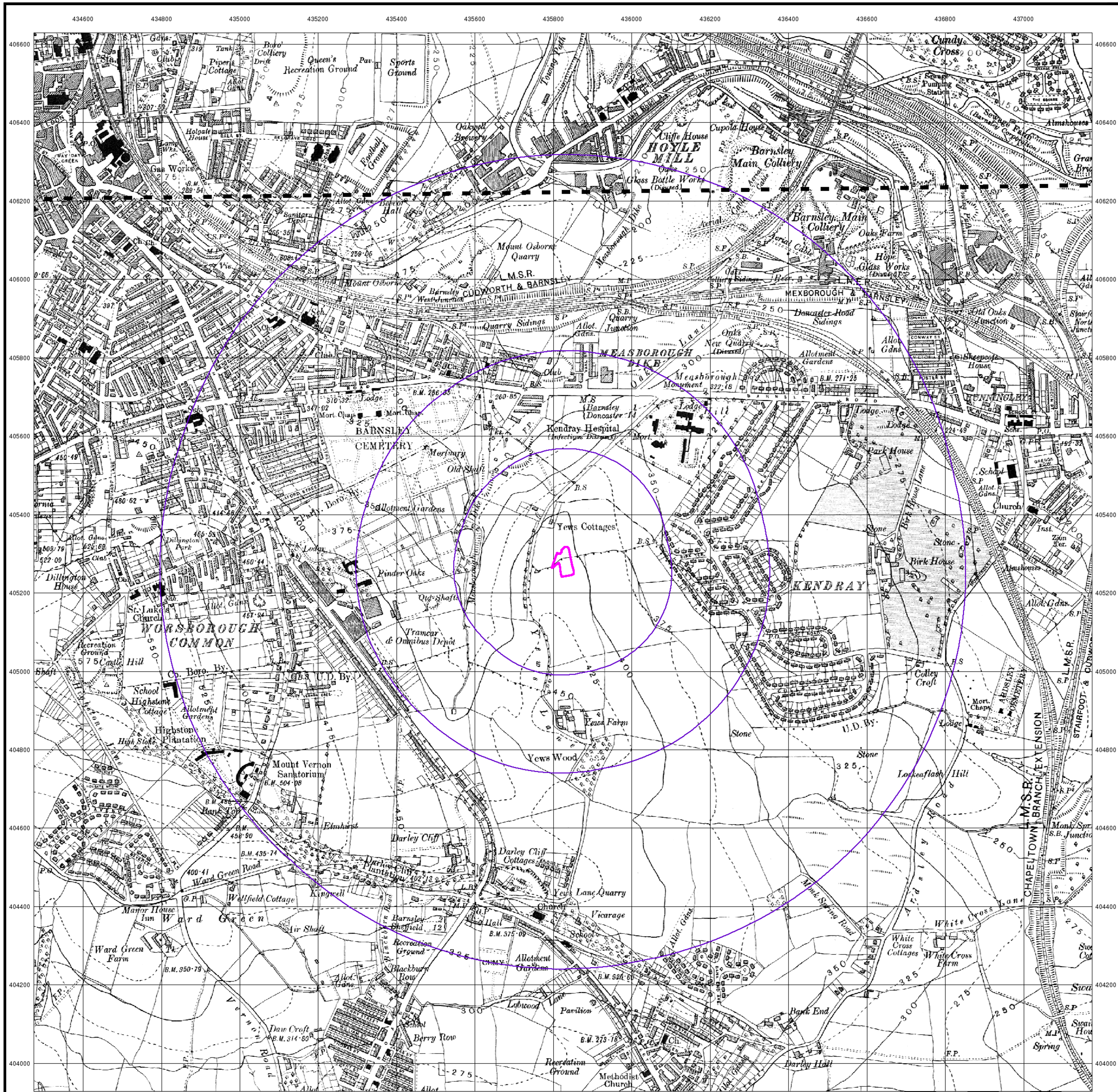
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Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

Site Details

Site at 435800, 405300

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0 400 m

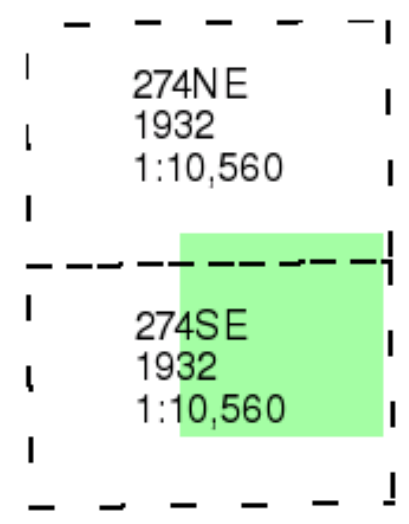
Yorkshire

Published 1932

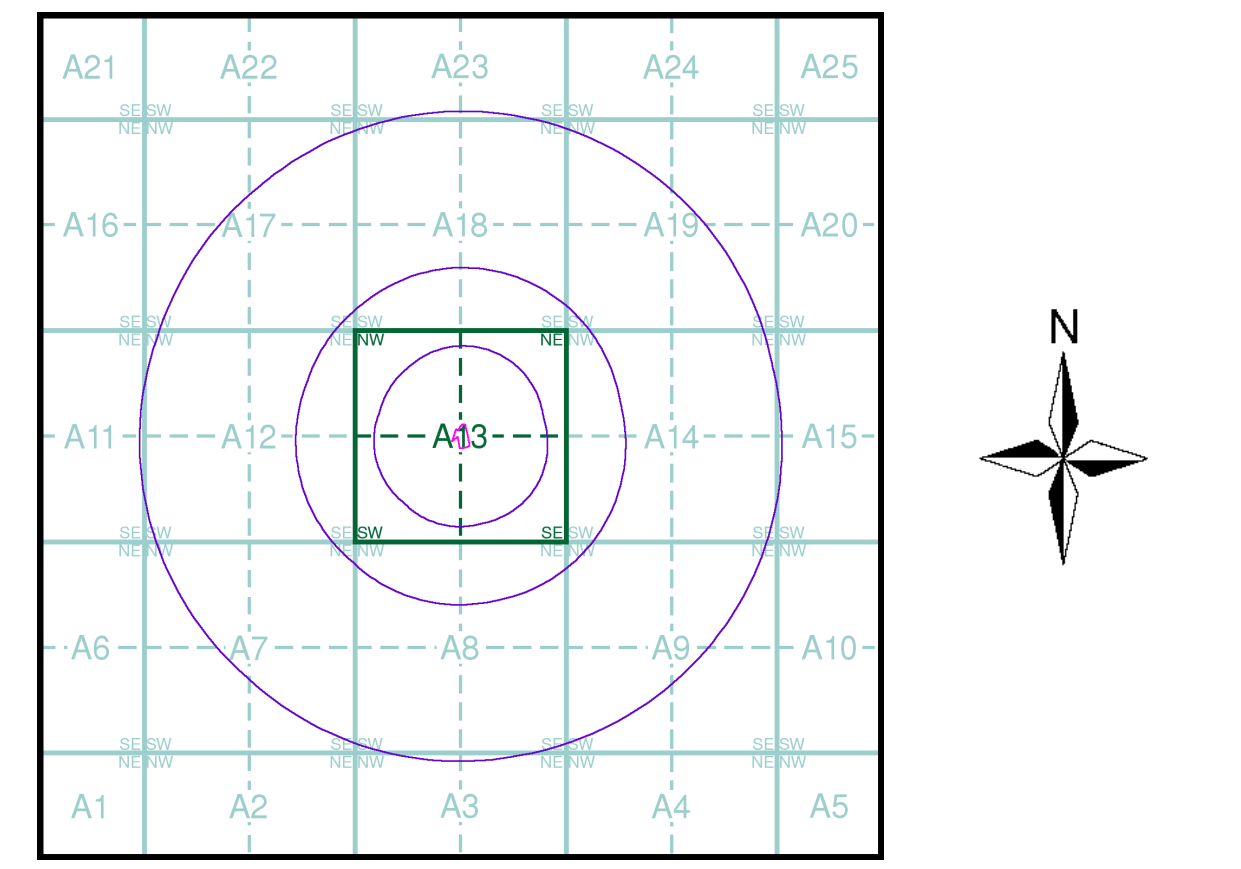
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The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. 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:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
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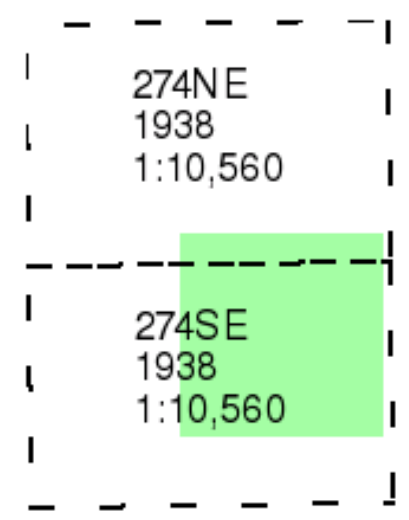
Yorkshire

Published 1938

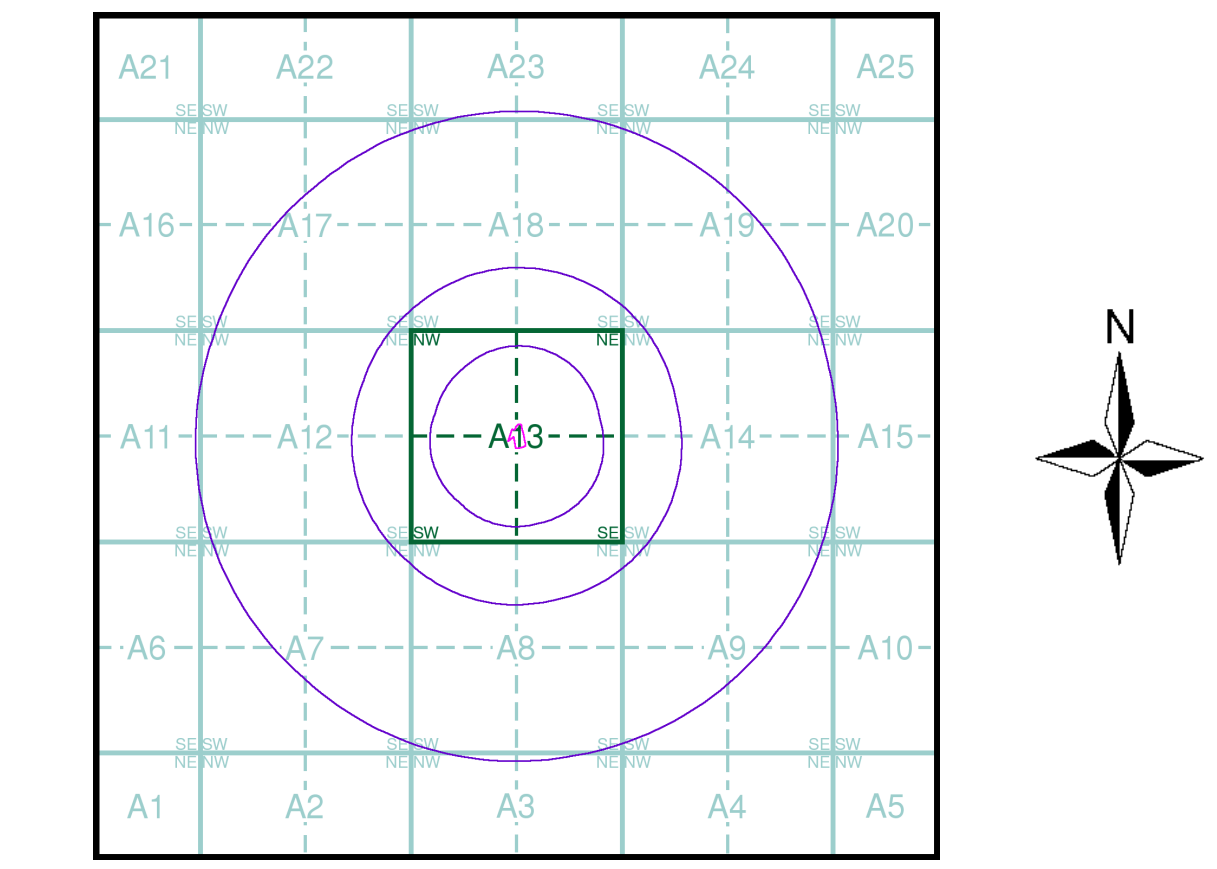
Source map scale - 1:10,560

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



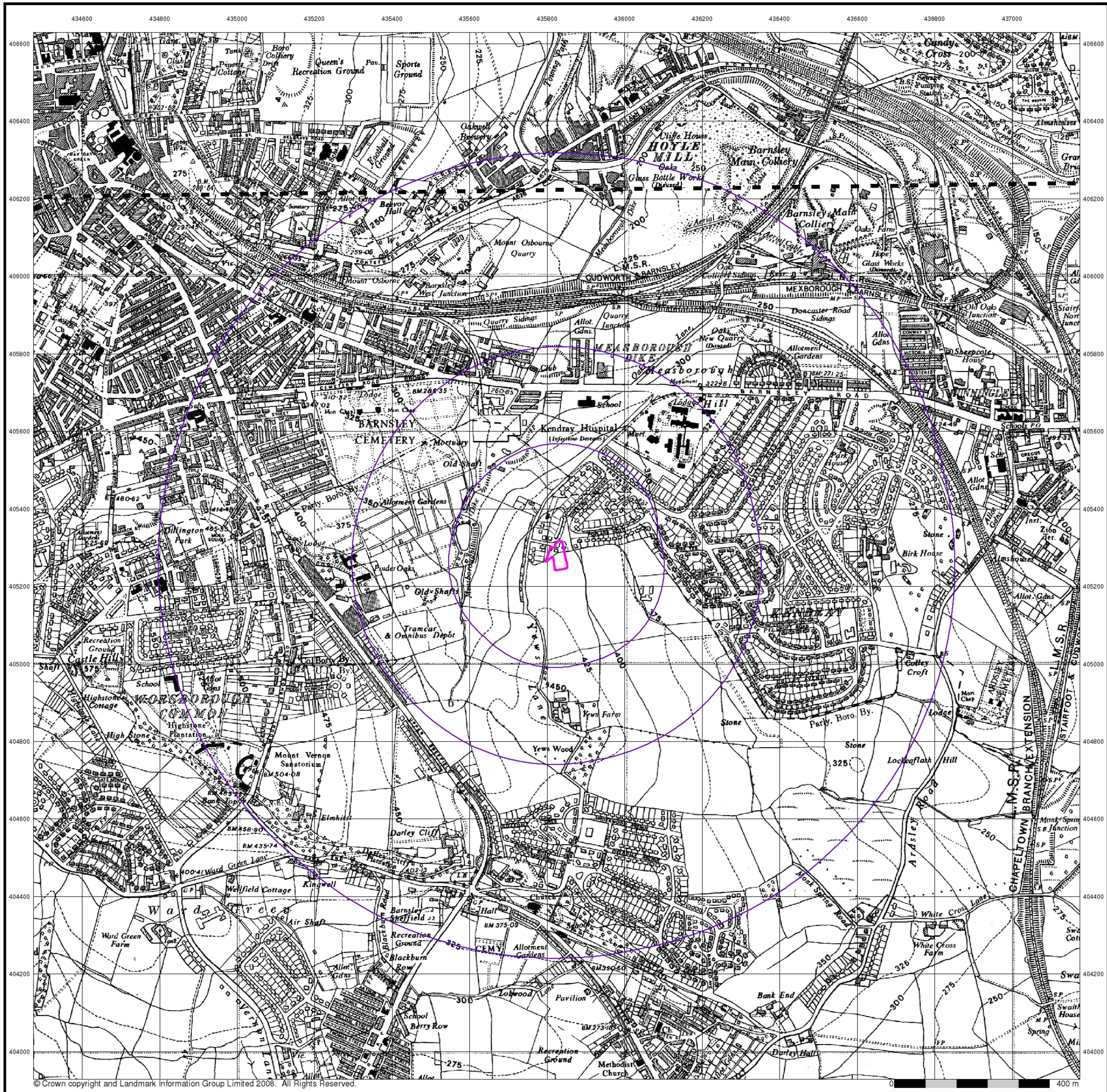
Order Details

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Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

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ENCIA Environmental

Yorkshire

Published 1948

Source map scale - 1:10,560

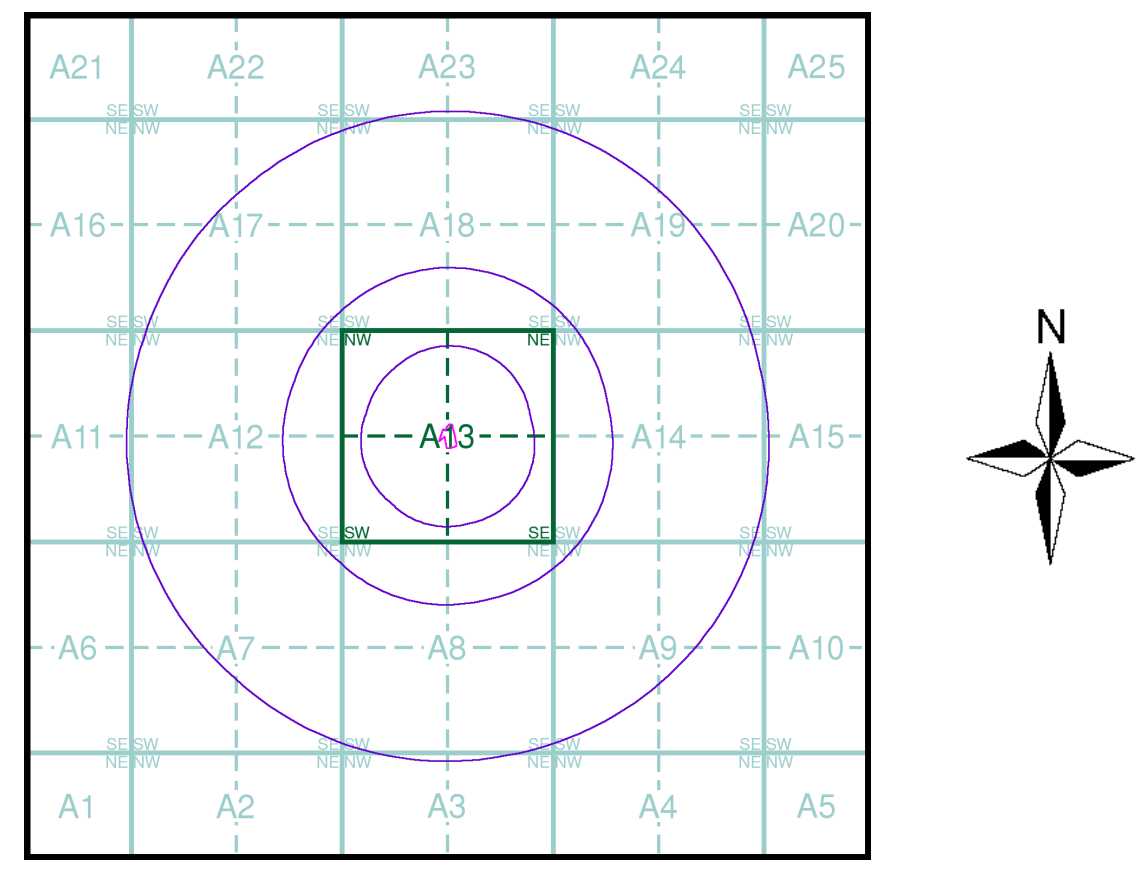
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some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

274NE
1948
1:10,560

274SE
1948
1:10,560

Historical Map - Slice A



Order Details

Order Number: 27556575_1_1
Customer Ref: 9642 - Yews Place, Kendray
National Grid Reference: 435830, 405280
Slice: A
Site Area (Ha): 0.24
Search Buffer (m): 1000

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Ordnance Survey Plan

Published 1955 - 1956

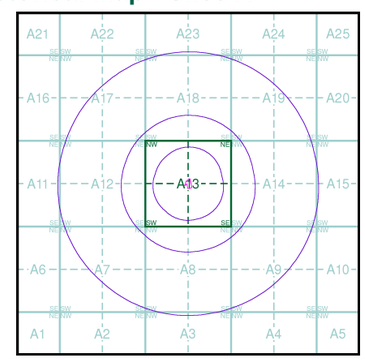
Source map scale - 1:10,000

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)

SE30NW 1956 1:10,560	SE30NE 1955 1:10,560
SE30SW 1956 1:10,560	SE30SE 1956 1:10,560

Historical Map - Slice A



Order Details

Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

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Ordnance Survey Plan

Published 1965 - 1966

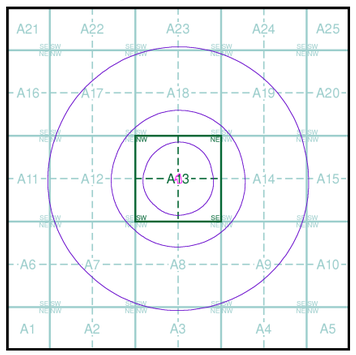
Source map scale - 1:10,000

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Map Name(s) and Date(s)

SE30NW 1966 1:10,560	SE30NE 1966 1:10,560
SE30SW 1965 1:10,560	SE30SE 1966 1:10,560

Historical Map - Slice A



Order Details

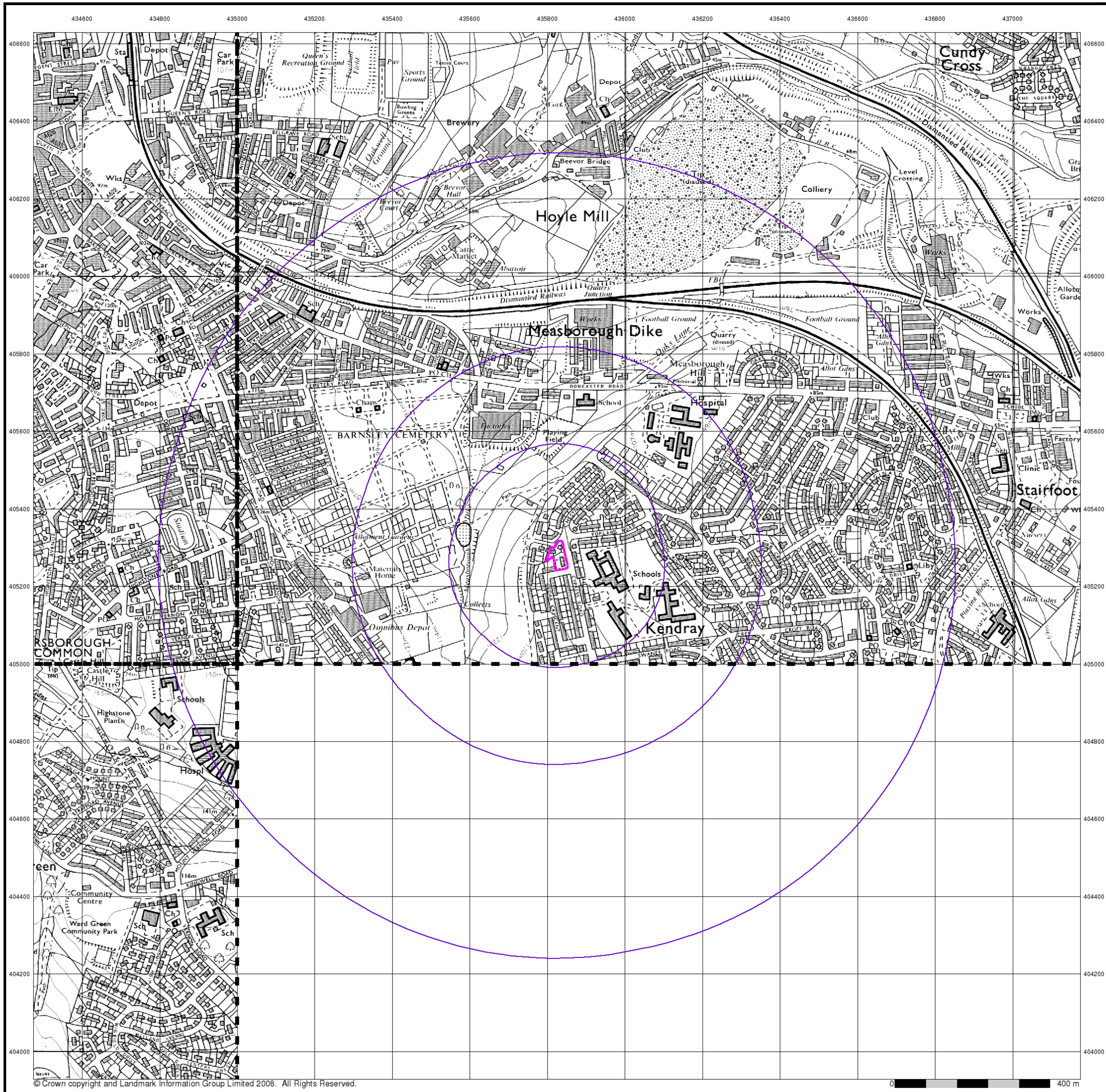
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Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
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Site Area (Ha):	0.24
Search Buffer (m):	1000

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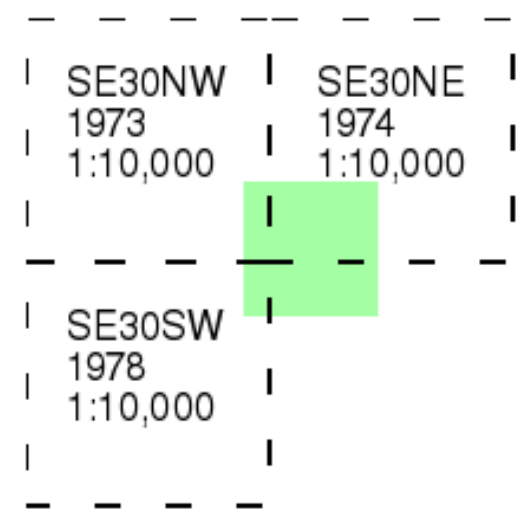
Ordnance Survey Plan

Published 1973 - 1978

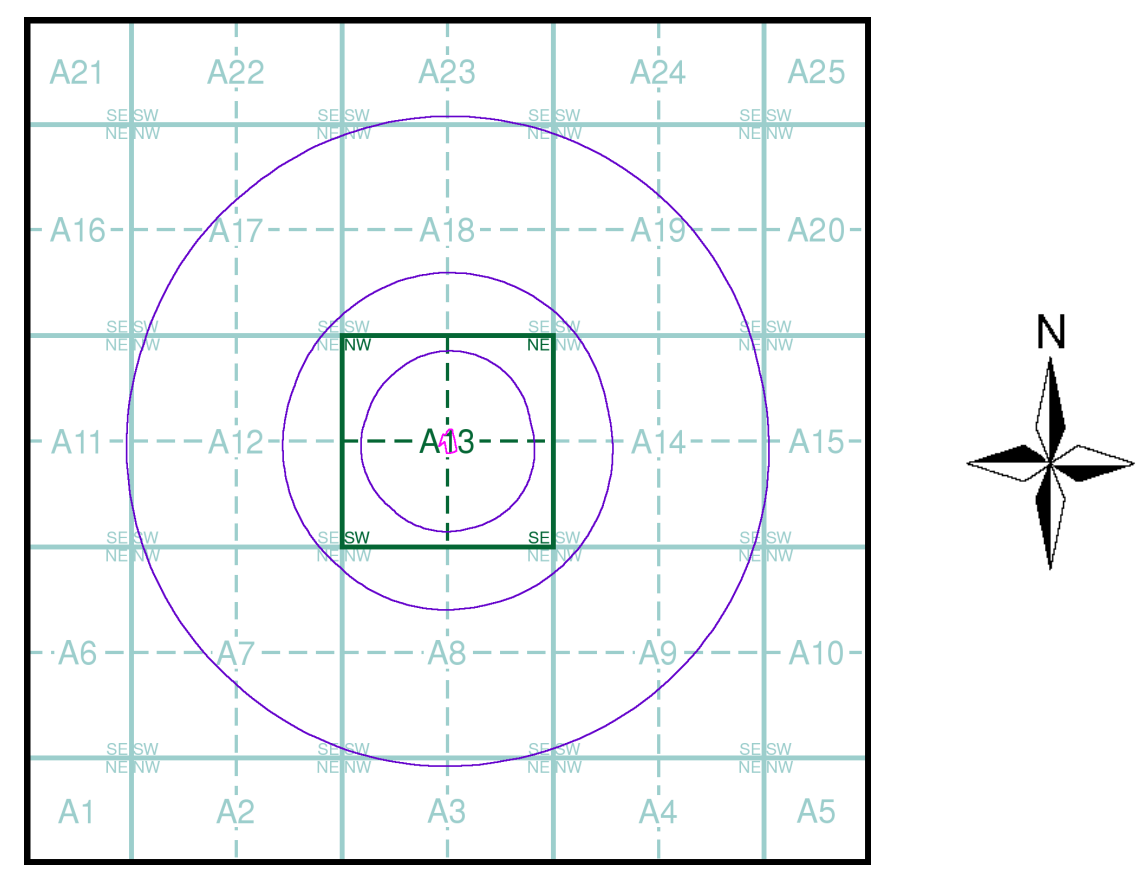
Source map scale - 1:10,000

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: 27556575_1_1
Customer Ref: 9642 - Yews Place, Kendray
National Grid Reference: 435830, 405280
Slice: A
Site Area (Ha): 0.24
Search Buffer (m): 1000

Site Details

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Ordnance Survey Plan

Published 1980 - 1984

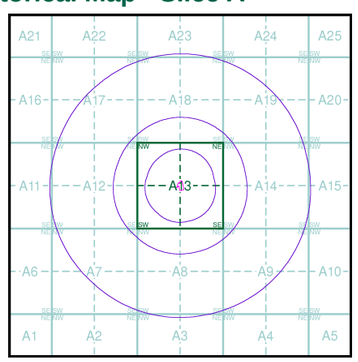
Source map scale - 1:10,000

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)

SE30NW 1983 1:10,000	SE30NE 1984 1:10,000
	SE30SE 1980 1:10,000

Historical Map - Slice A



Order Details

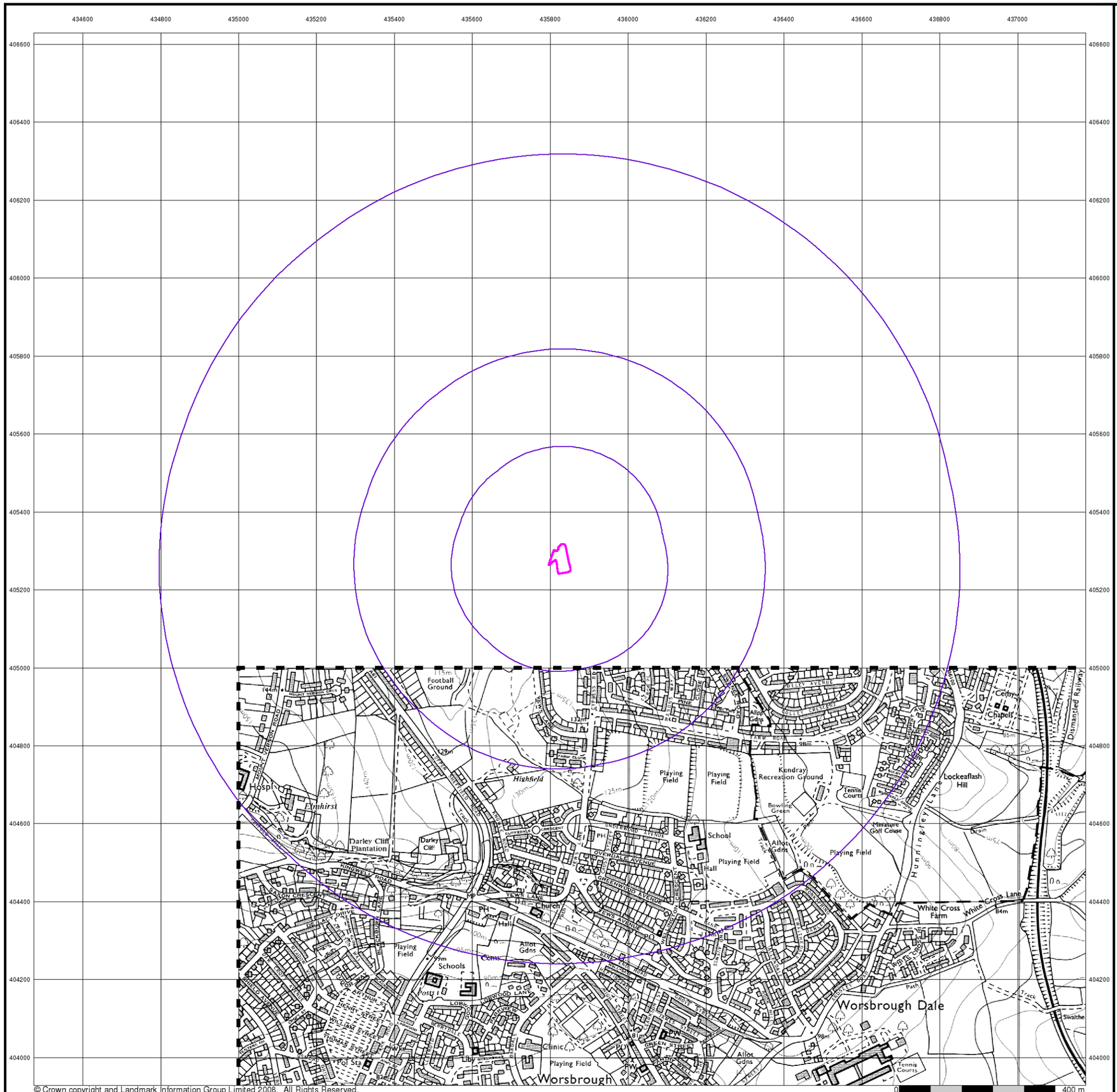
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Slice:	A
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Search Buffer (m):	1000

Site Details

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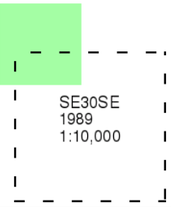
Ordnance Survey Plan

Published 1989

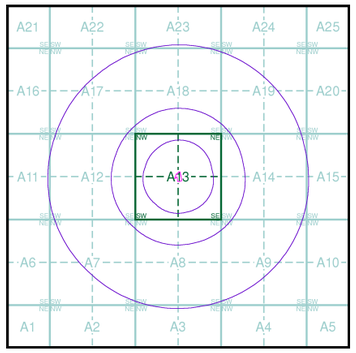
Source map scale - 1:10,000

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

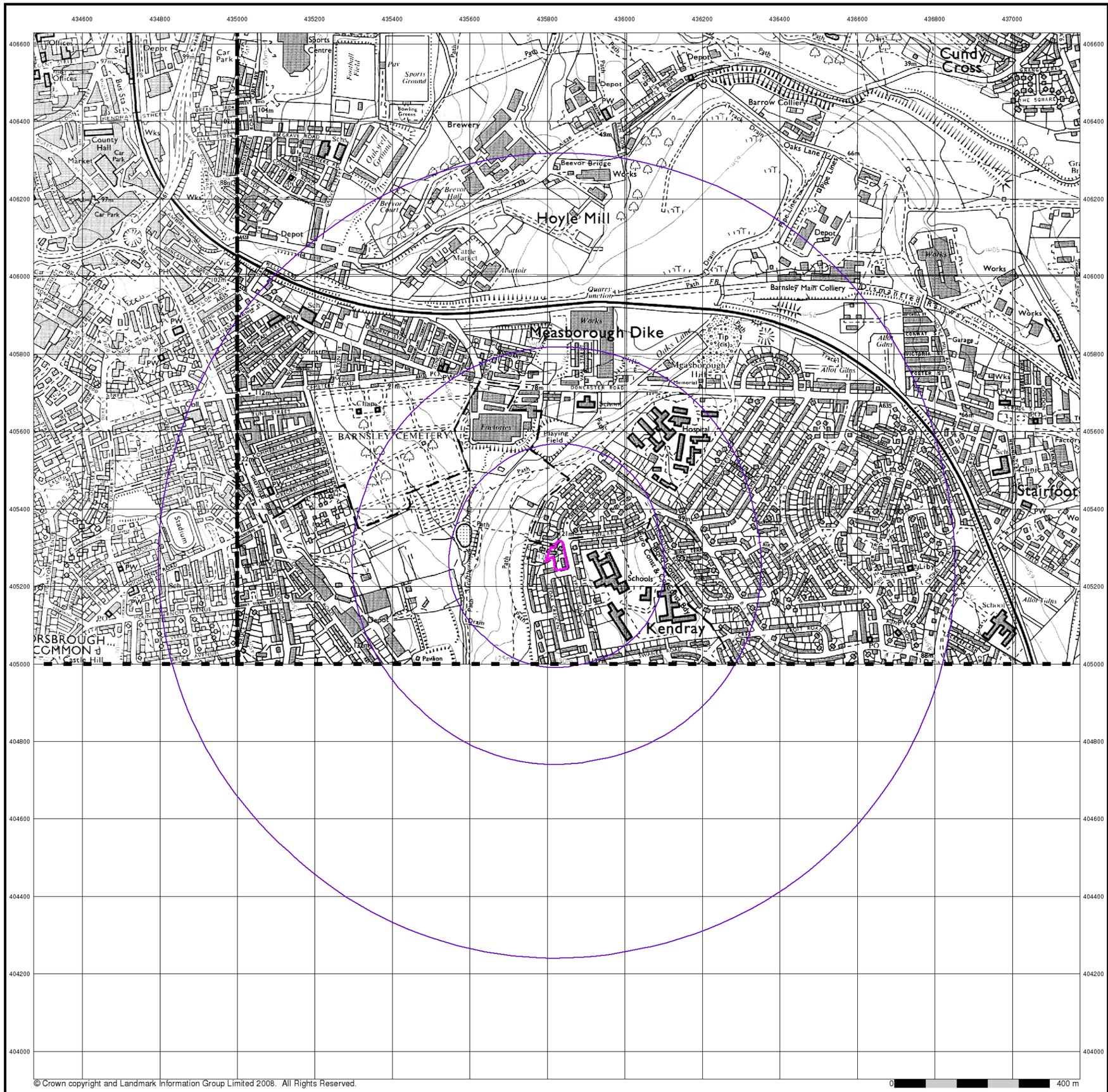
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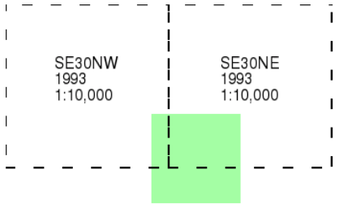
Ordnance Survey Plan

Published 1993

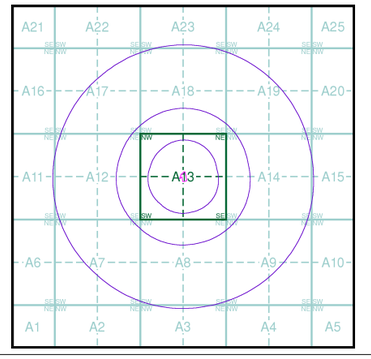
Source map scale - 1:10,000

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Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

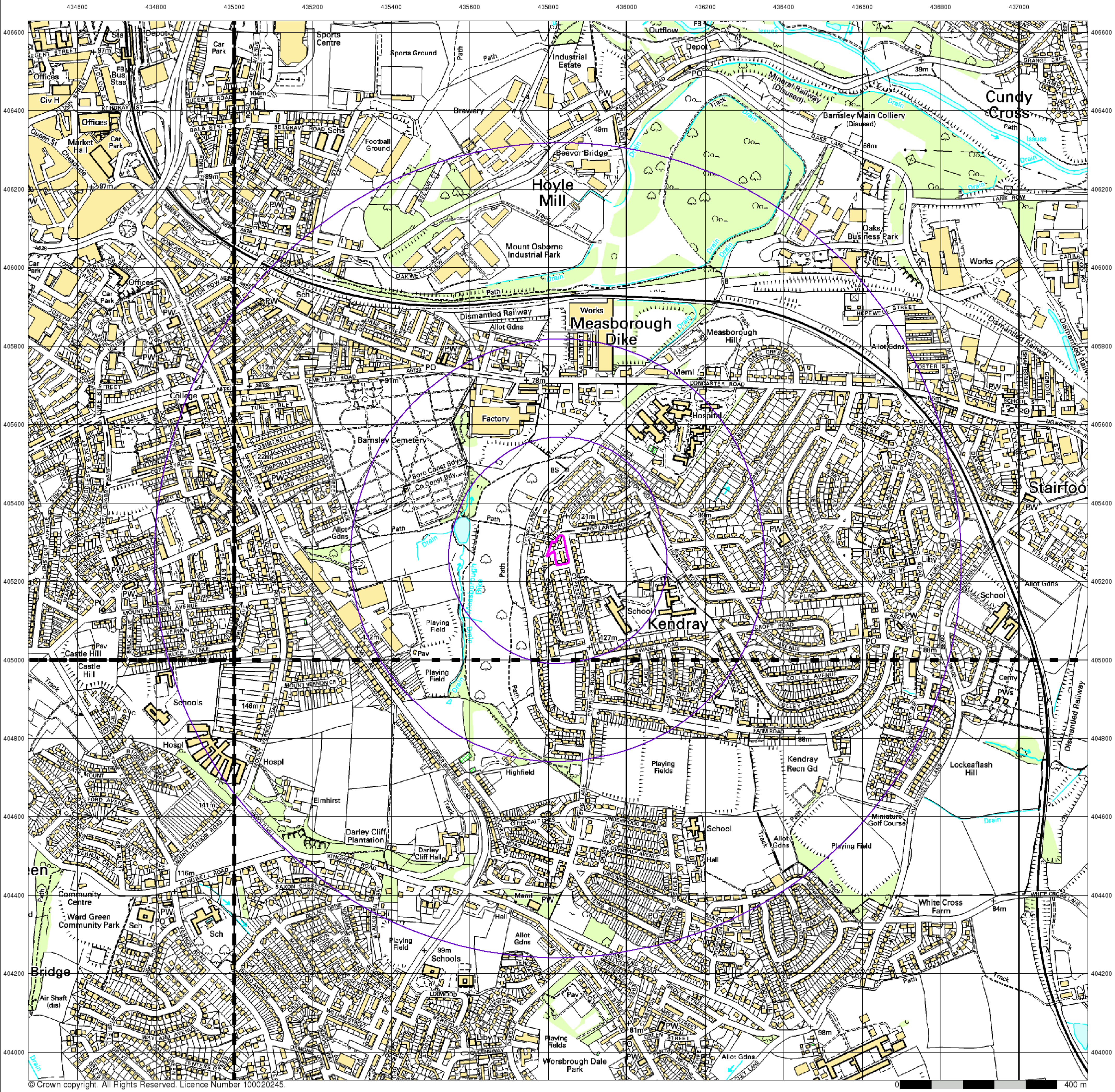
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Site Area (Ha):	0.24
Search Buffer (m):	1000

Site Details

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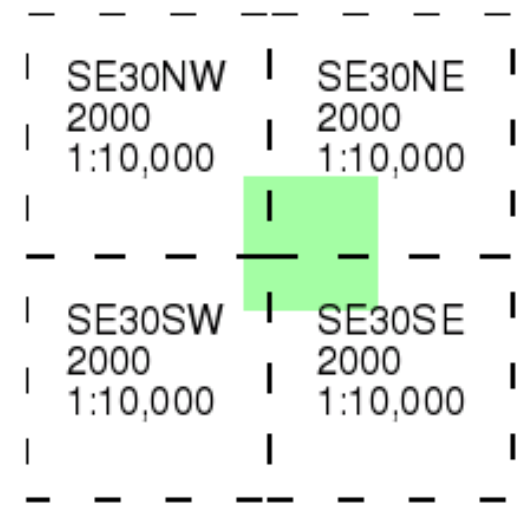
10k Raster Mapping

Published 2000

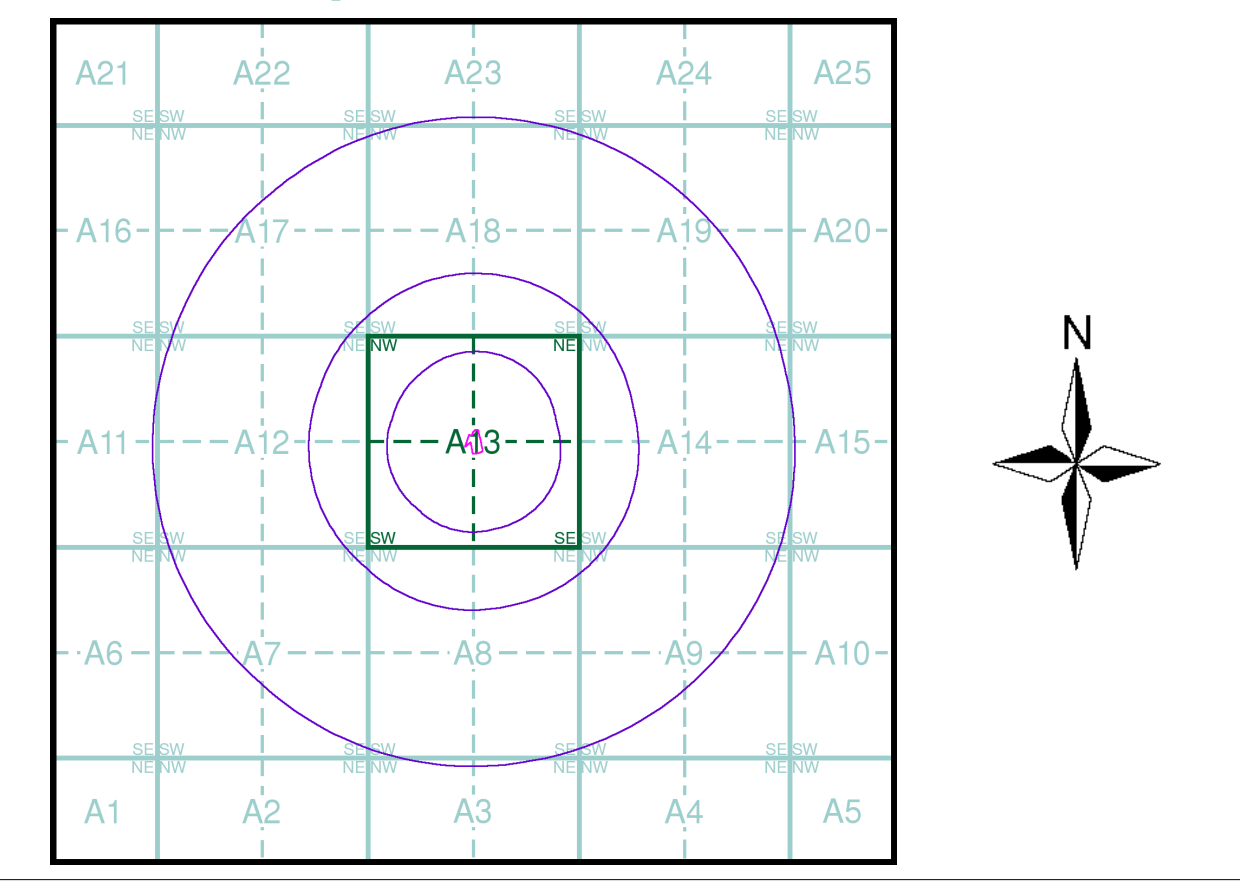
Source map scale - 1:10,000

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

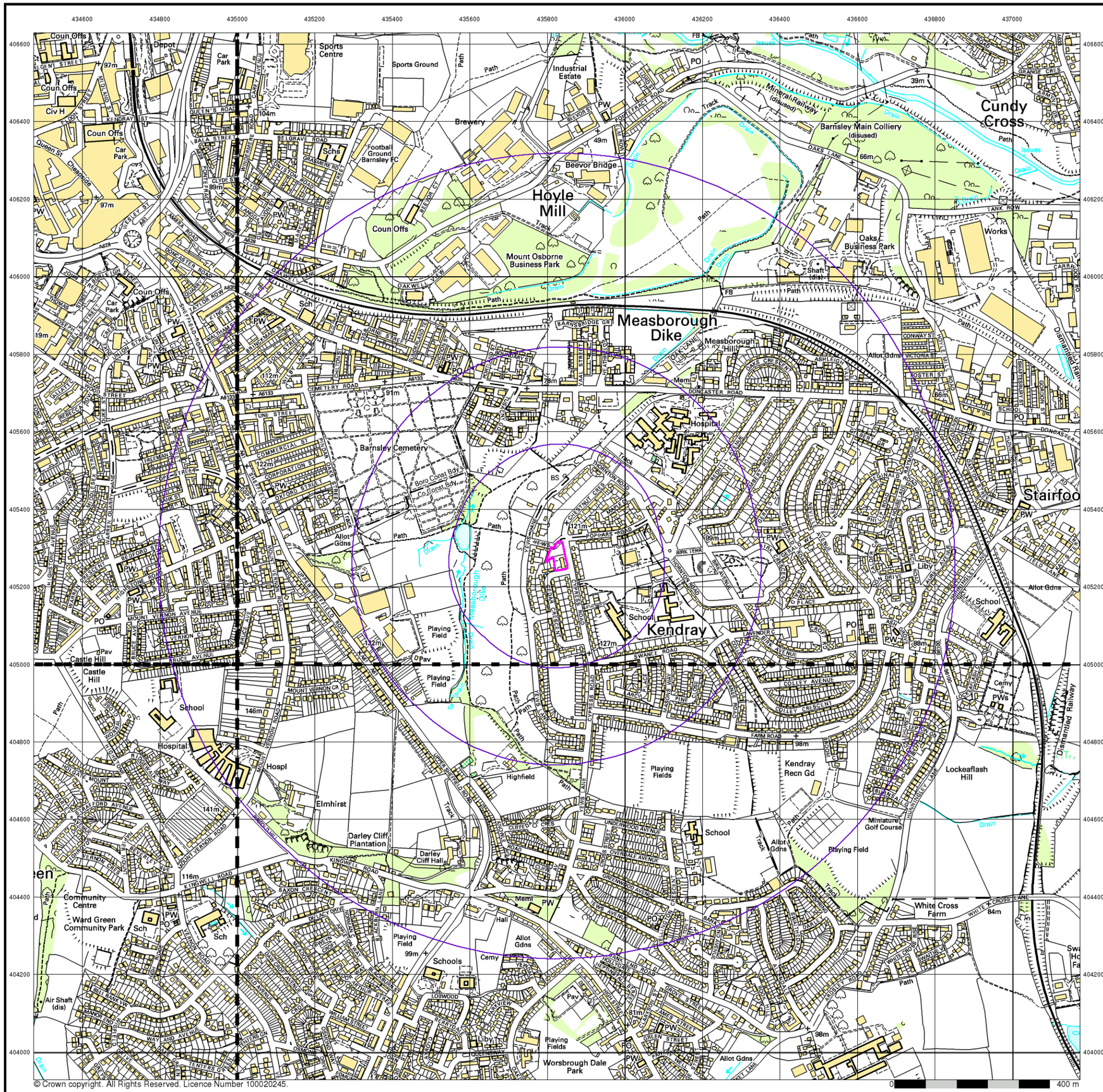
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Customer Ref: 9642 - Yews Place, Kendray
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Slice: A
Site Area (Ha): 0.24
Search Buffer (m): 1000

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10k Raster Mapping

Published 2008

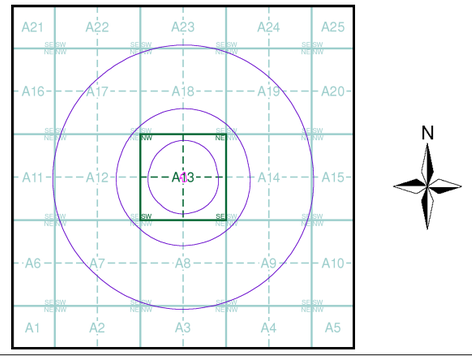
Source map scale - 1:10,000

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)

SE30NW 2008 1:10,000	SE30NE 2008 1:10,000
SE30SW 2008 1:10,000	SE30SE 2008 1:10,000

Historical Map - Slice A



Order Details

Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

Site Details

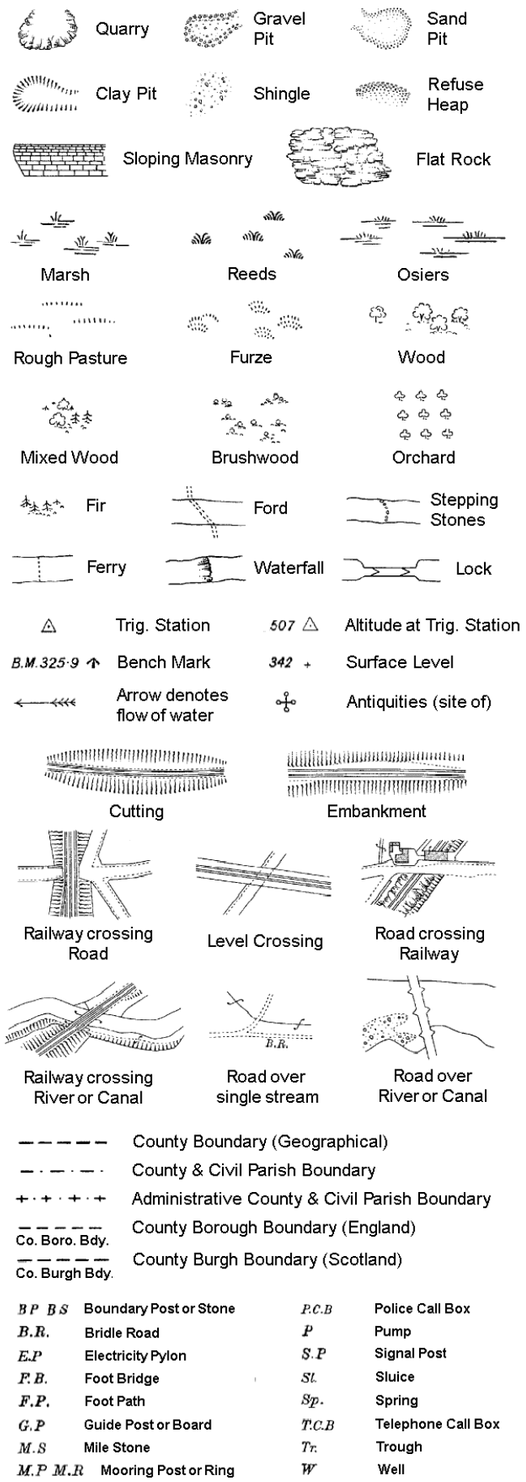
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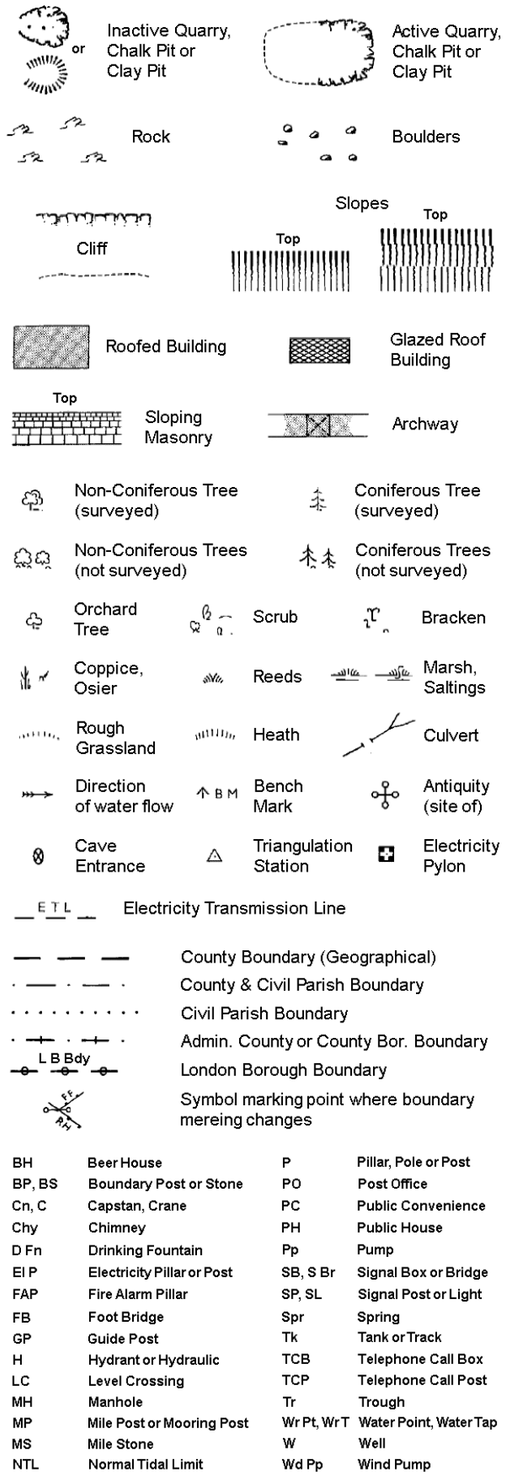
Historical Mapping Legends

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



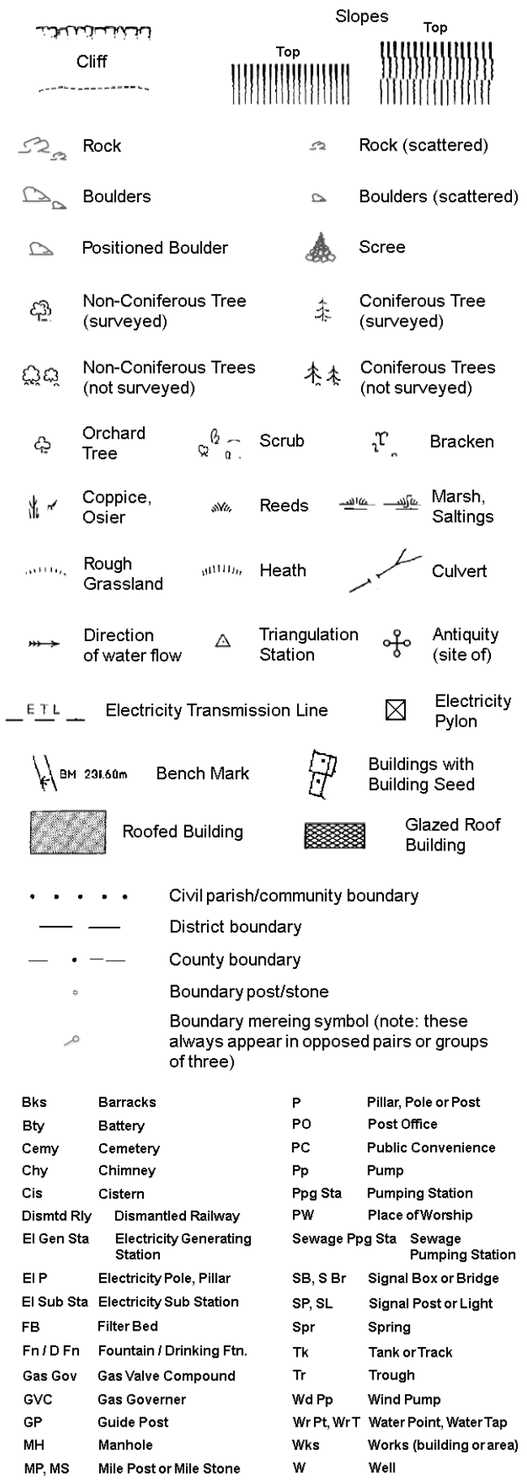
B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

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



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

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



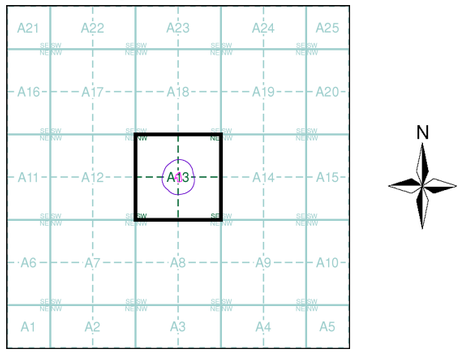
Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity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

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Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Yorkshire	1:2,500	1892	2
Yorkshire	1:2,500	1906	3
Yorkshire	1:2,500	1931	4
Ordnance Survey Plan	1:1,250	1960 - 1973	5
Additional SIMs	1:1,250	1960 - 1988	6
Ordnance Survey Plan	1:2,500	1961 - 1962	7
Ordnance Survey Plan	1:1,250	1973	8
Supply of Unpublished Survey Information	1:1,250	1976	9
Additional SIMs	1:1,250	1983 - 1992	10
Large-Scale National Grid Data	1:1,250	1993	11
Large-Scale National Grid Data	1:1,250	1993	12
Large-Scale National Grid Data	1:1,250	1997	13

Historical Map - Segment A13



Order Details

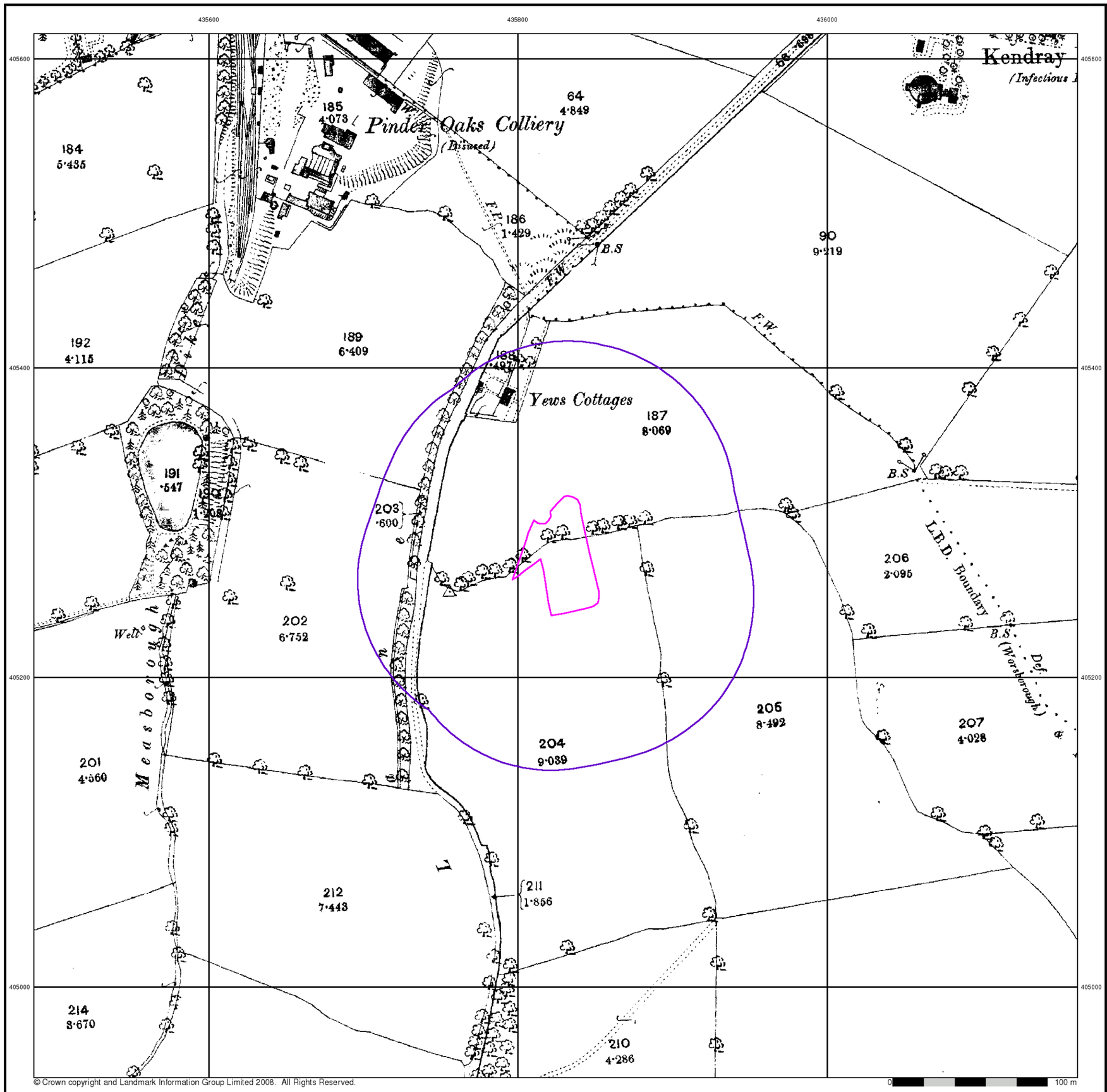
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Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	100

Site Details

Site at 435800, 405300

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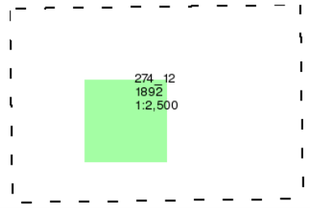
Yorkshire

Published 1892

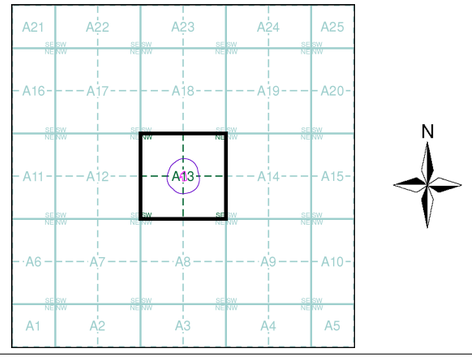
Source map scale - 1:2,500

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Map Name(s) and Date(s)



Historical Map - Segment A13



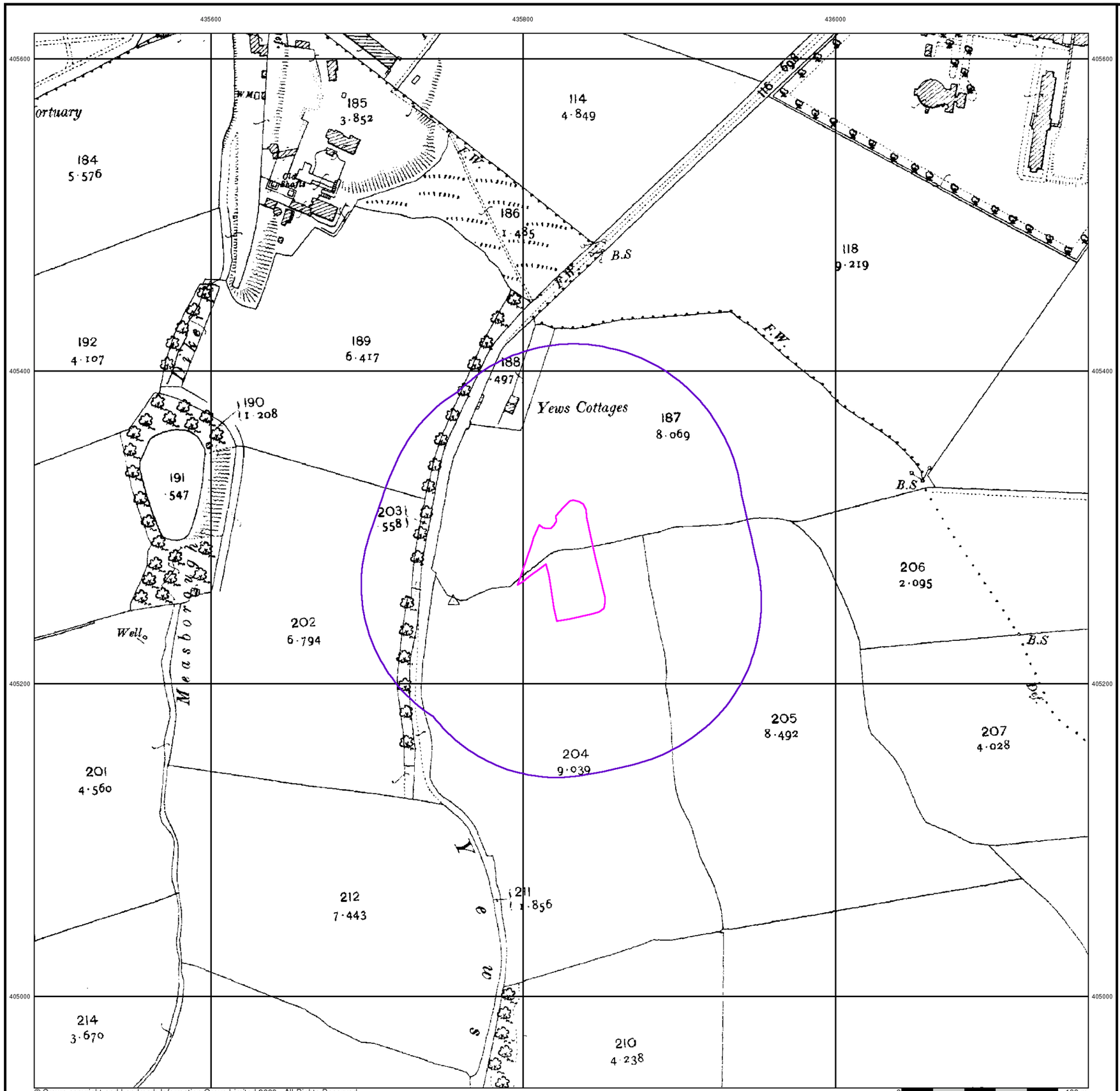
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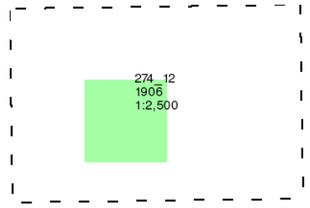
Yorkshire

Published 1906

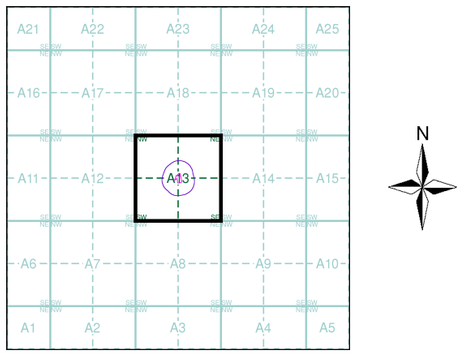
Source map scale - 1:2,500

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Map Name(s) and Date(s)



Historical Map - Segment A13



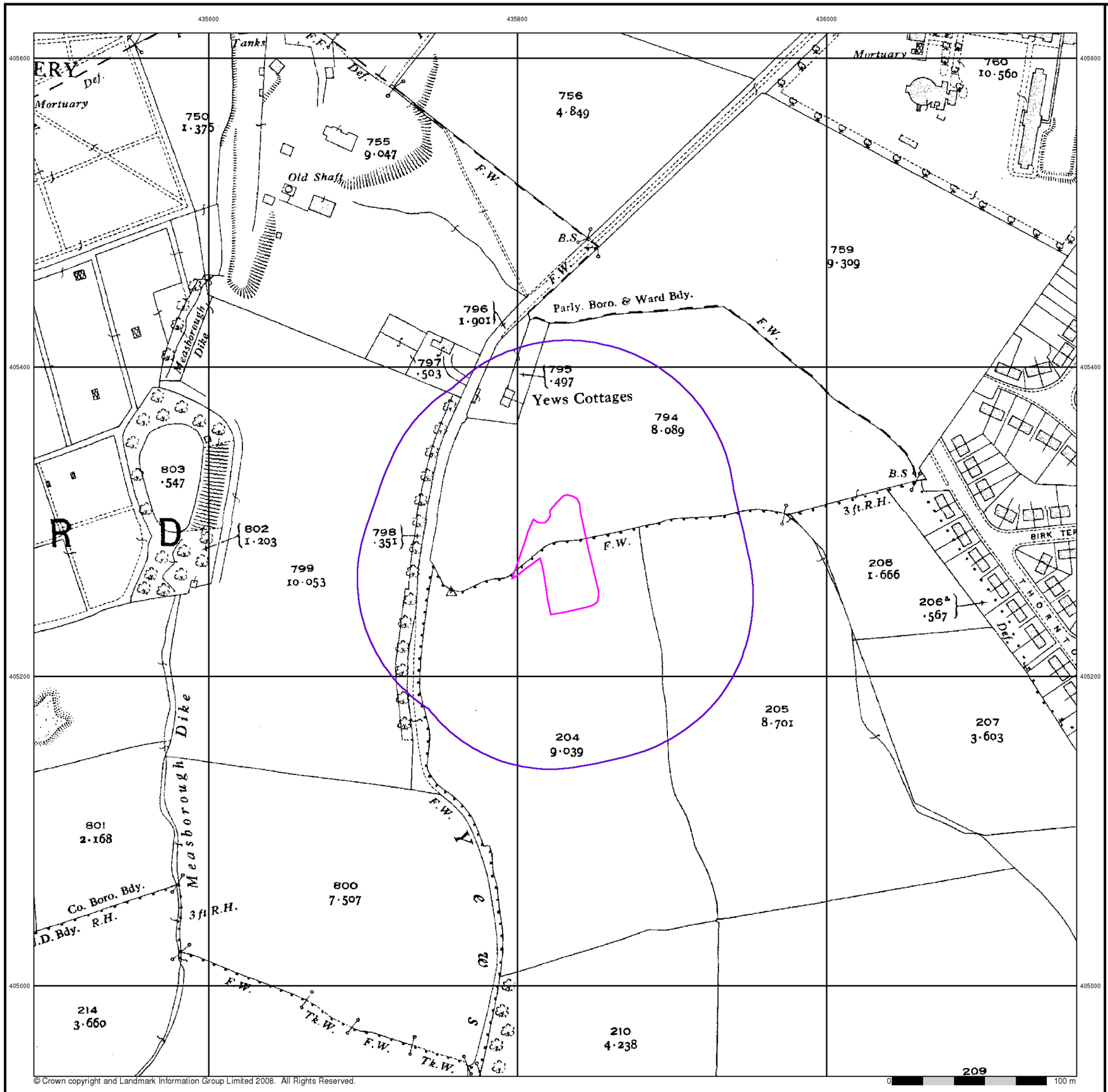
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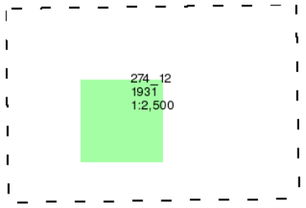
Yorkshire

Published 1931

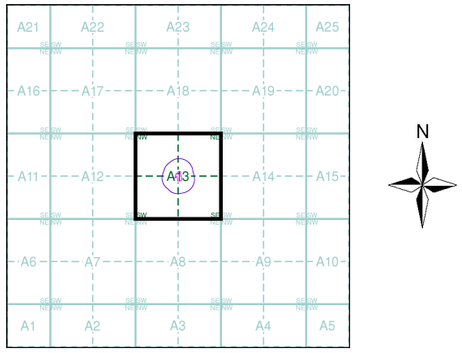
Source map scale - 1:2,500

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Map Name(s) and Date(s)



Historical Map - Segment A13



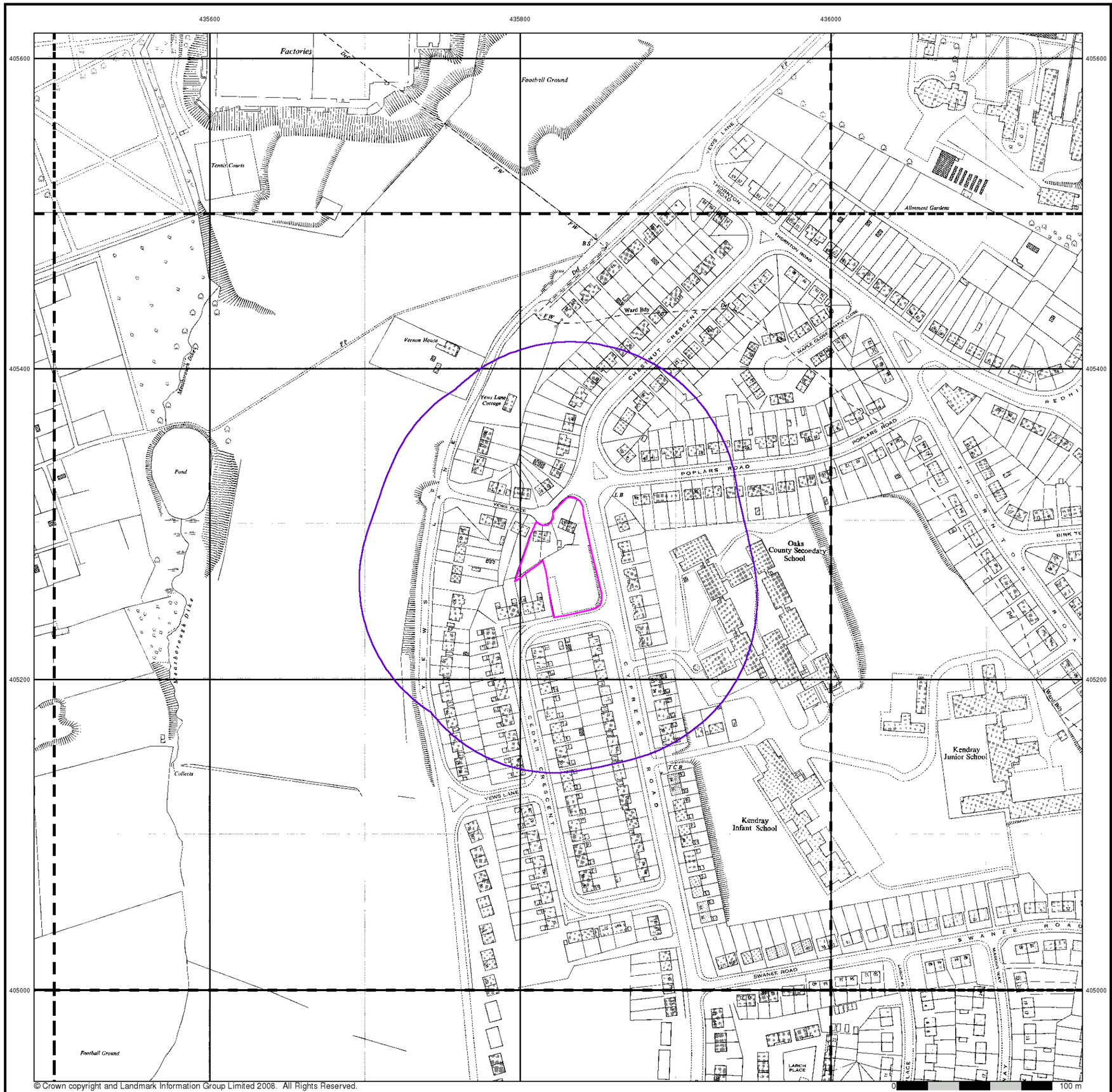
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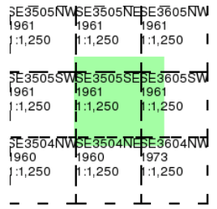
Ordnance Survey Plan

Published 1960 - 1973

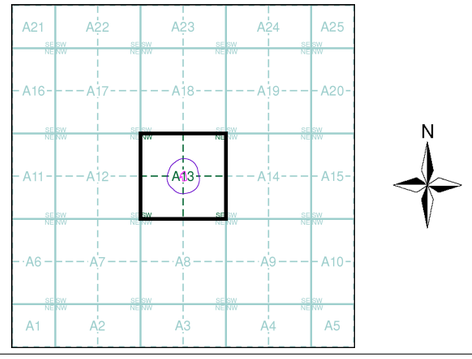
Source map scale - 1:1,250

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

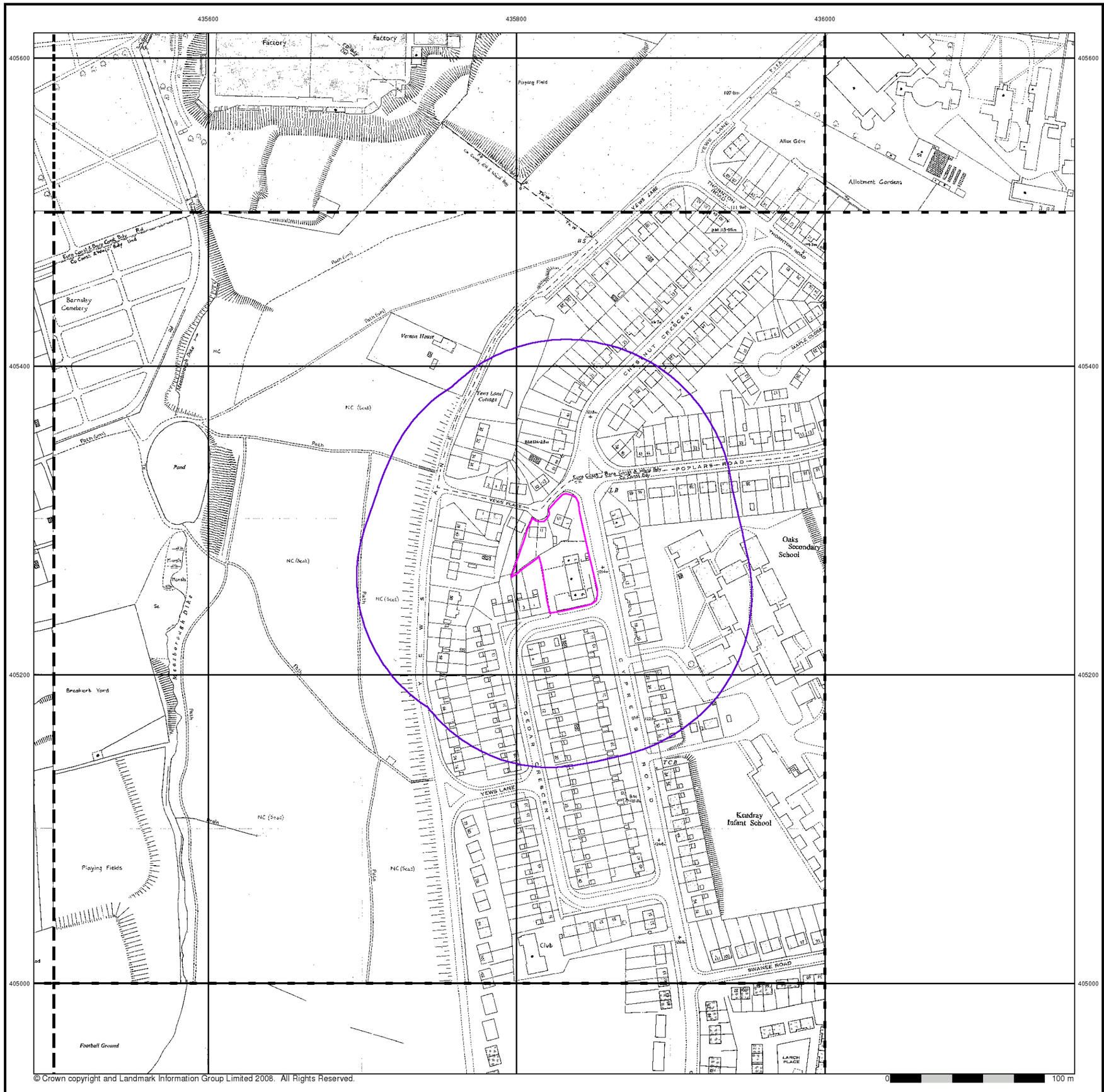
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Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
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Site Area (Ha):	0.24
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0 100 m

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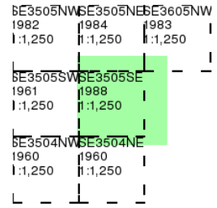
Additional SIMs

Published 1960 - 1988

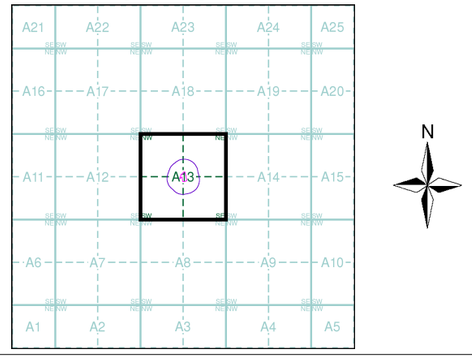
Source map scale - 1:1,250

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Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

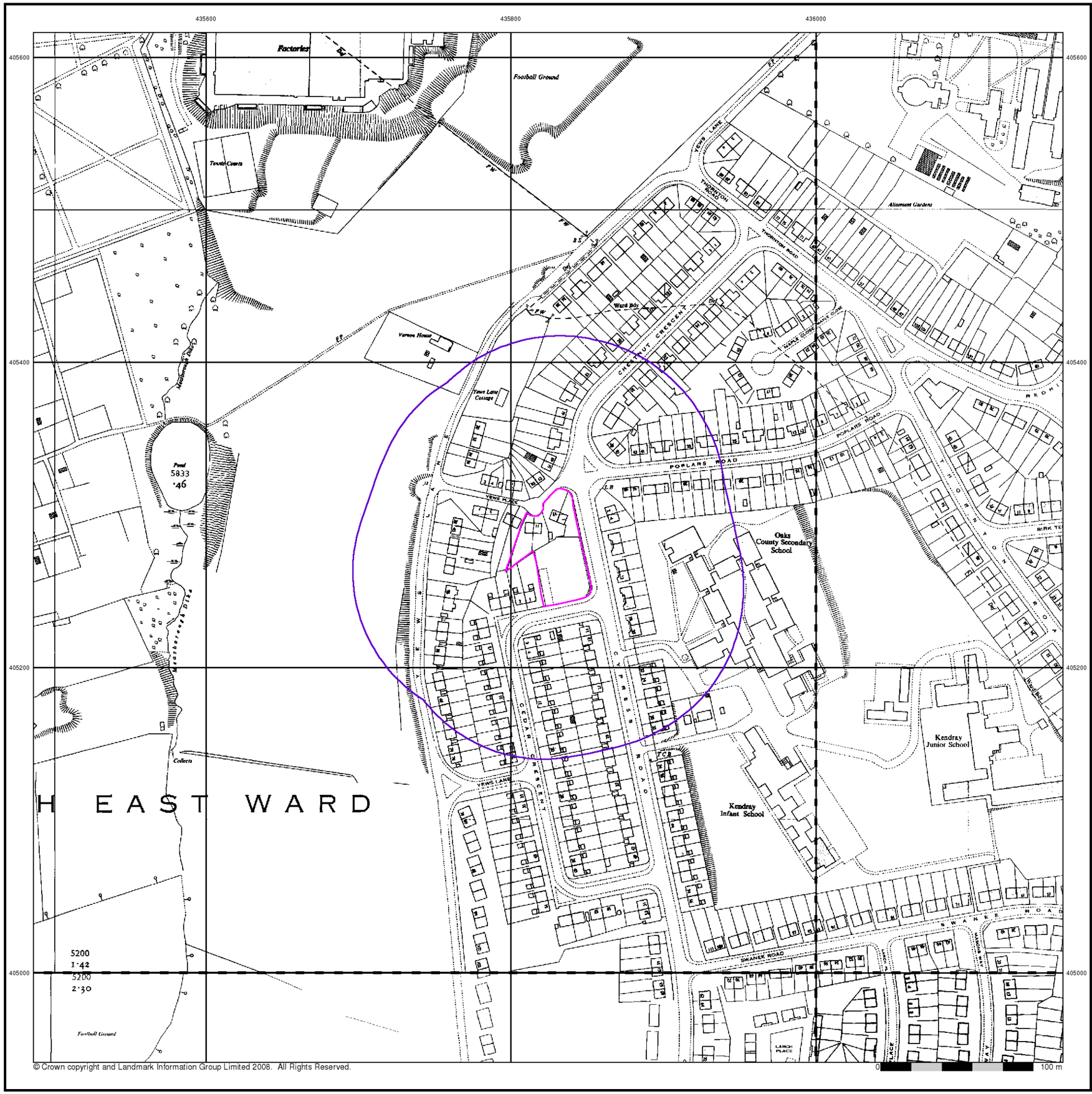
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National Grid Reference:	435830, 405280
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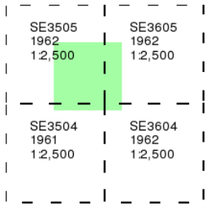
Ordnance Survey Plan

Published 1961 - 1962

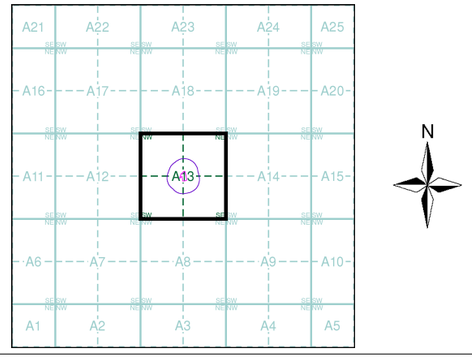
Source map scale - 1:2,500

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Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

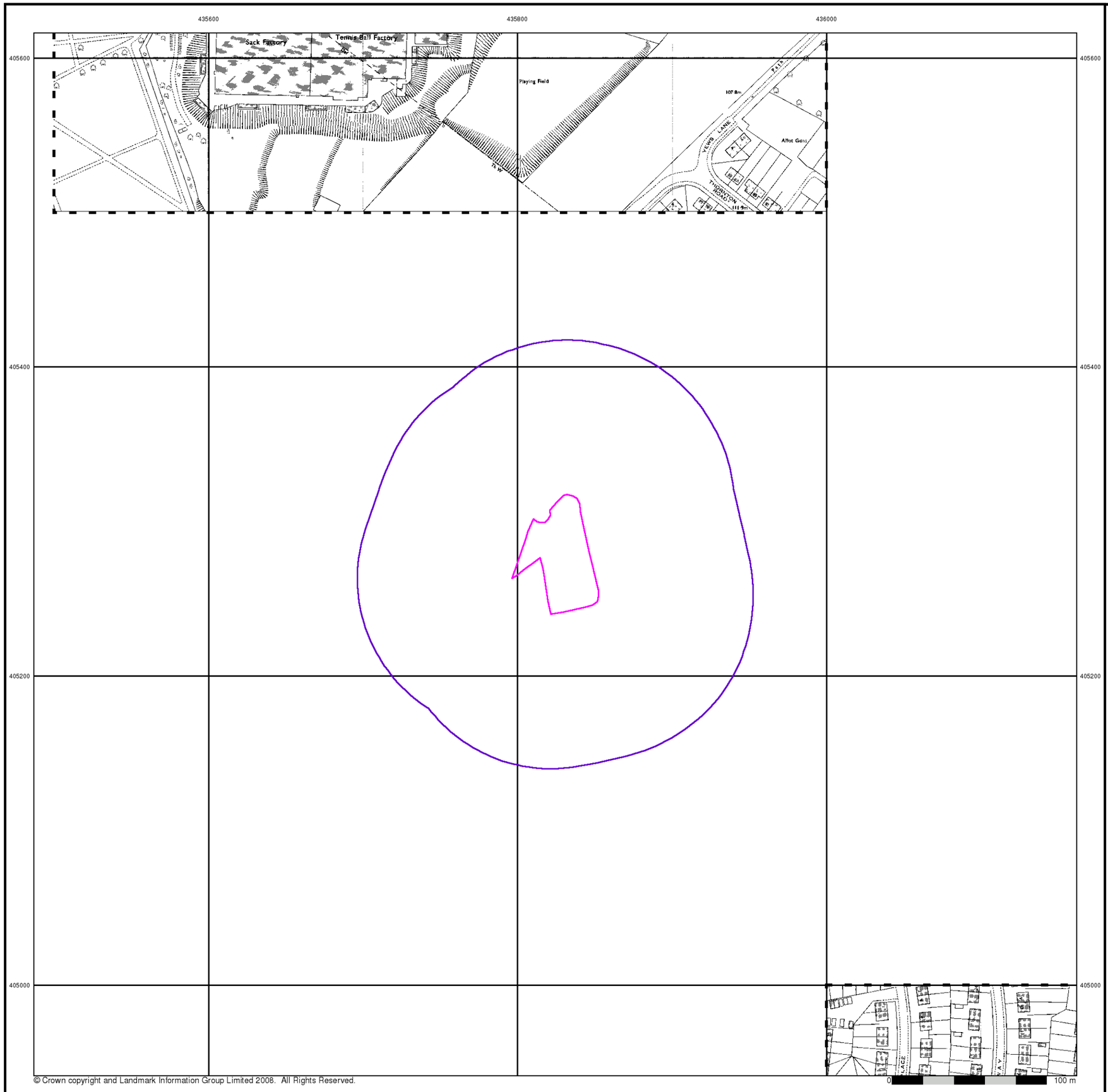
Order Number:	27556575_1_1
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National Grid Reference:	435830, 405280
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Site Area (Ha):	0.24
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Site at 435800, 405300

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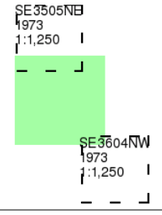
Ordnance Survey Plan

Published 1973

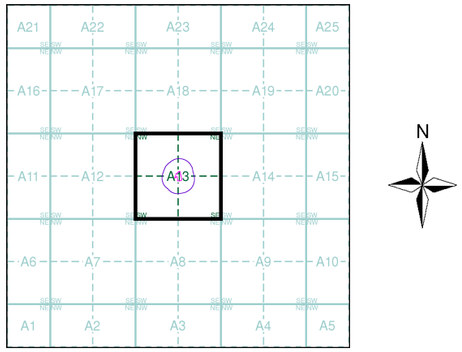
Source map scale - 1:1,250

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



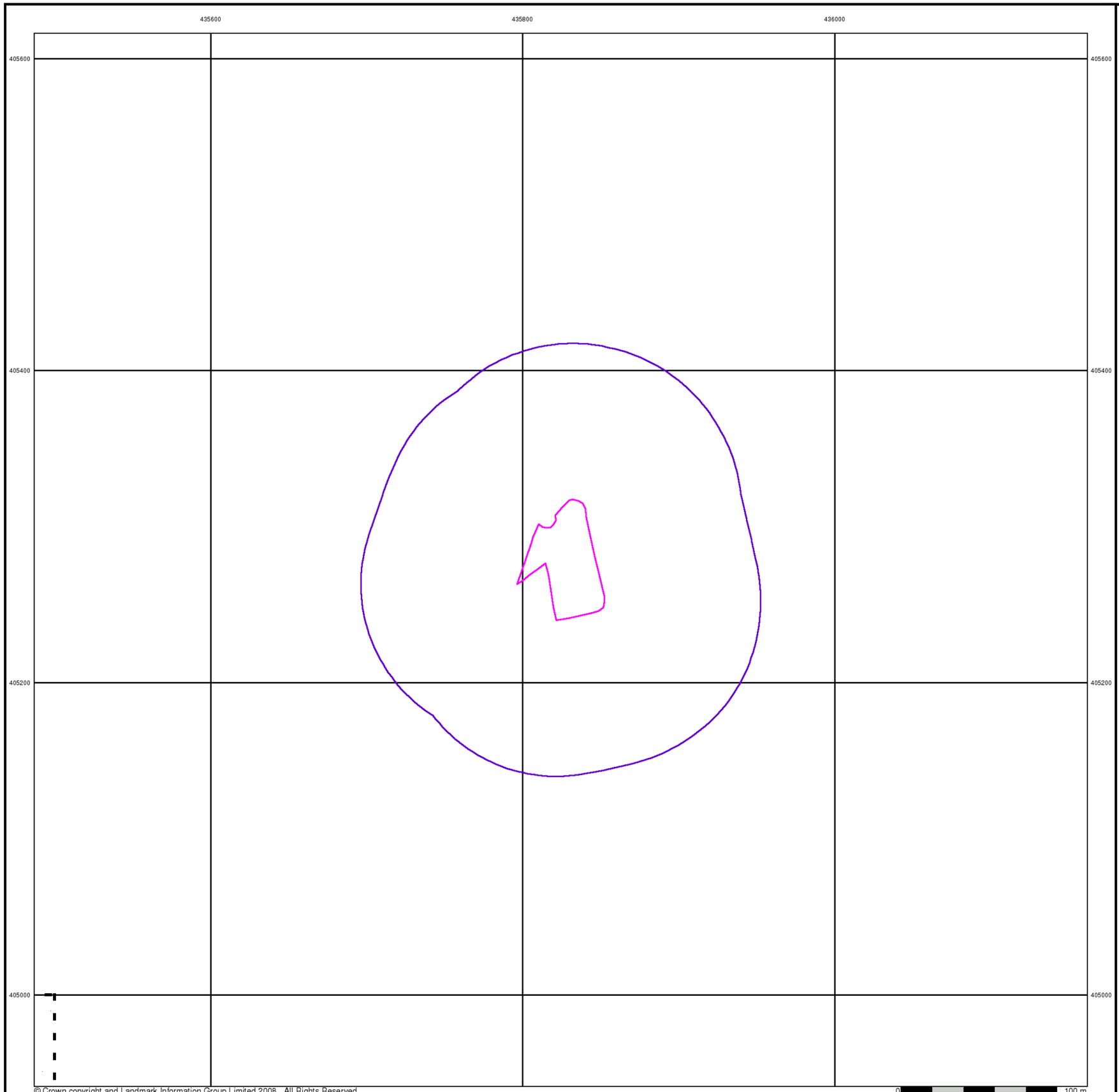
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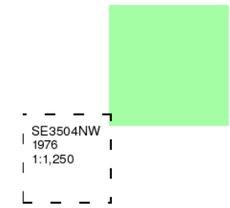
Supply of Unpublished Survey Information

Published 1976

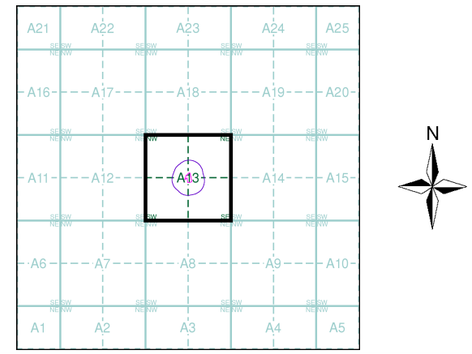
Source map scale - 1:1,250

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)



Historical Map - Segment A13



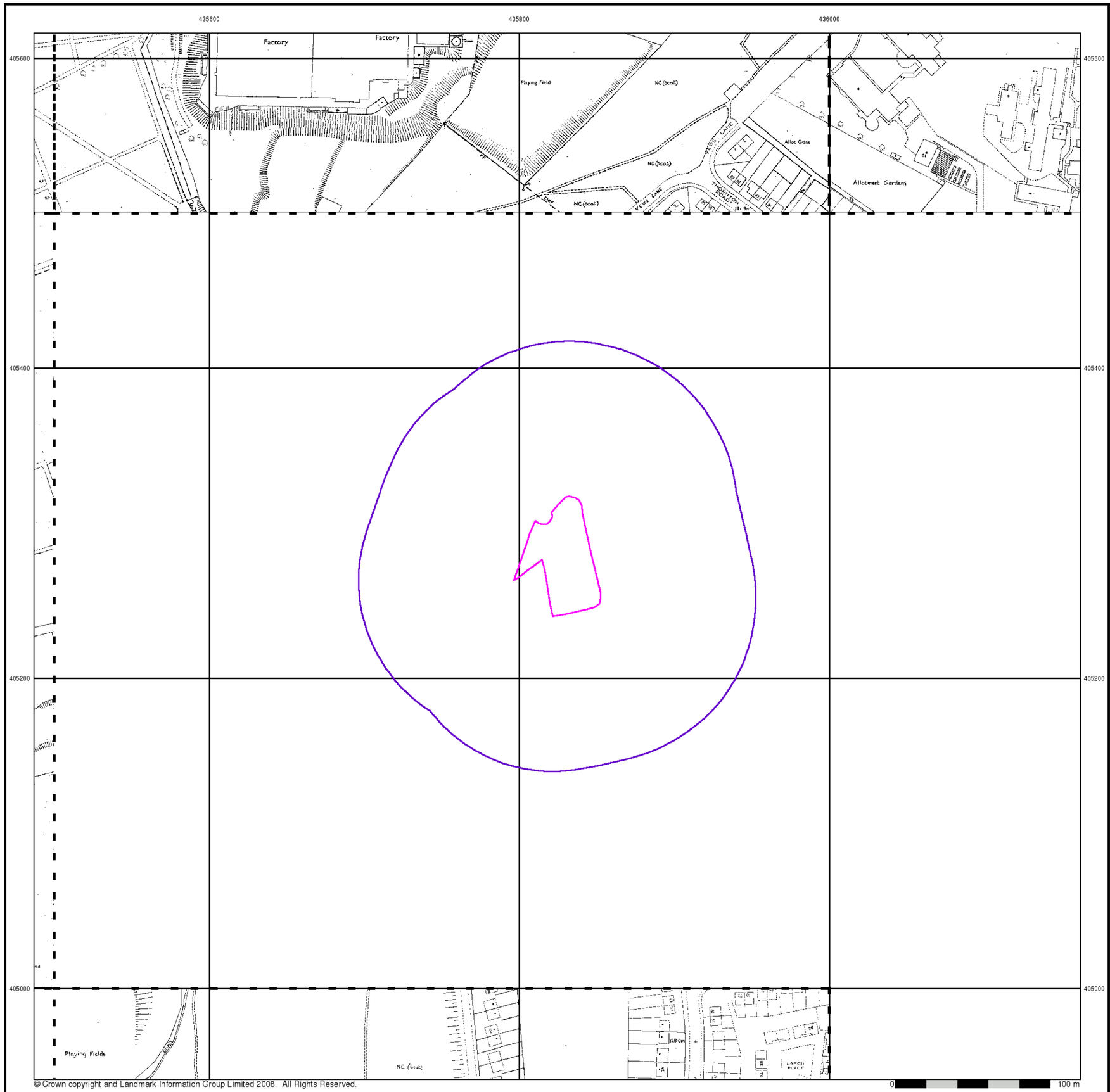
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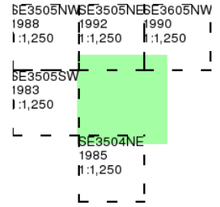
Additional SIMs

Published 1983 - 1992

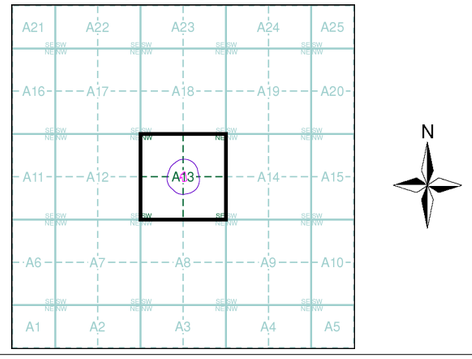
Source map scale - 1:1,250

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Map Name(s) and Date(s)



Historical Map - Segment A13



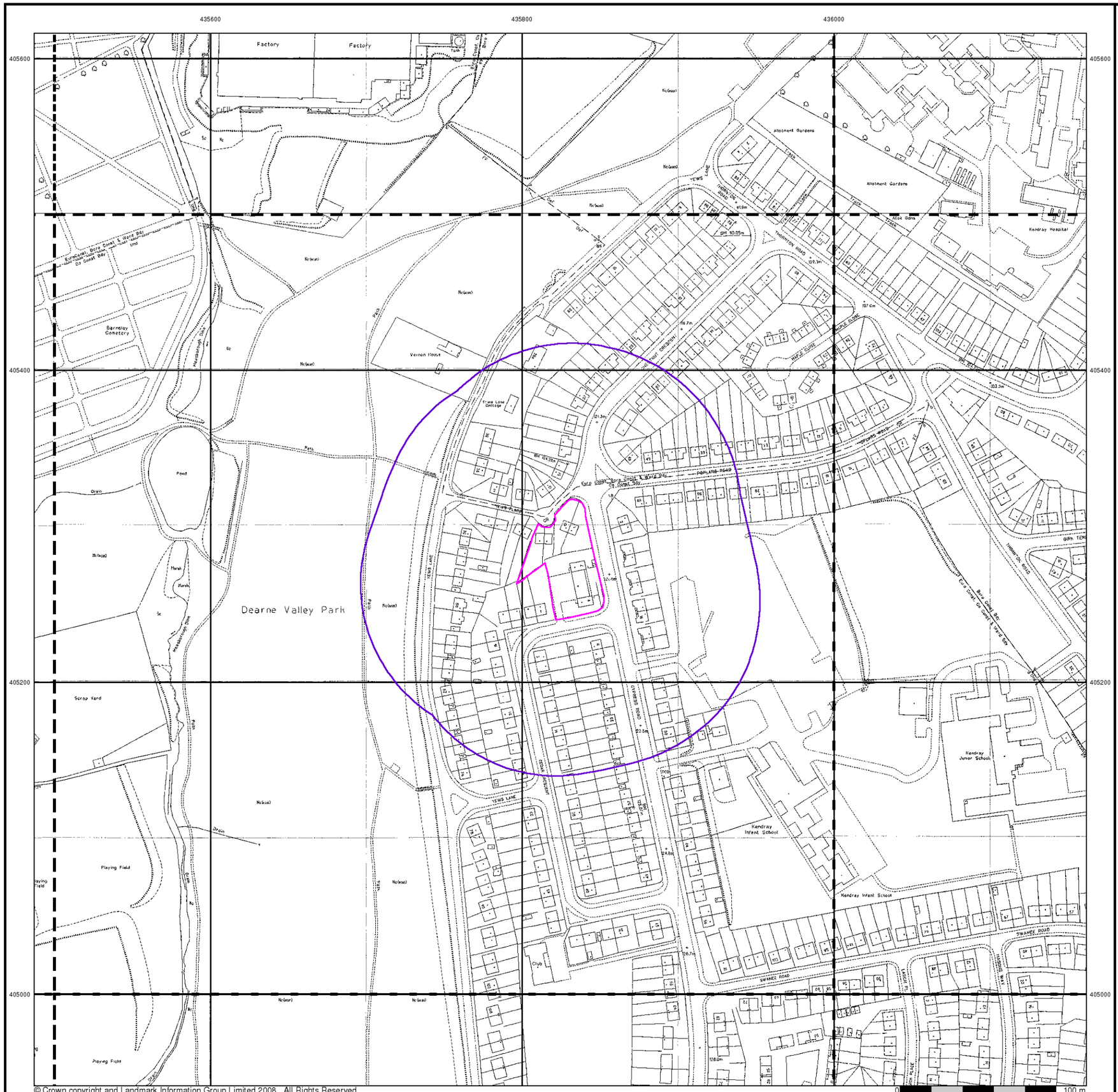
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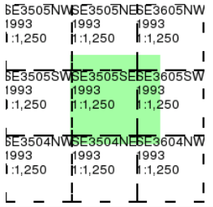
Large-Scale National Grid Data

Published 1993

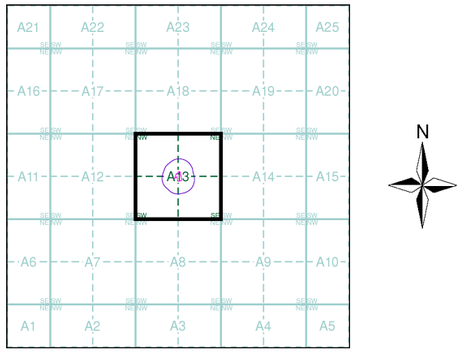
Source map scale - 1:1,250

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

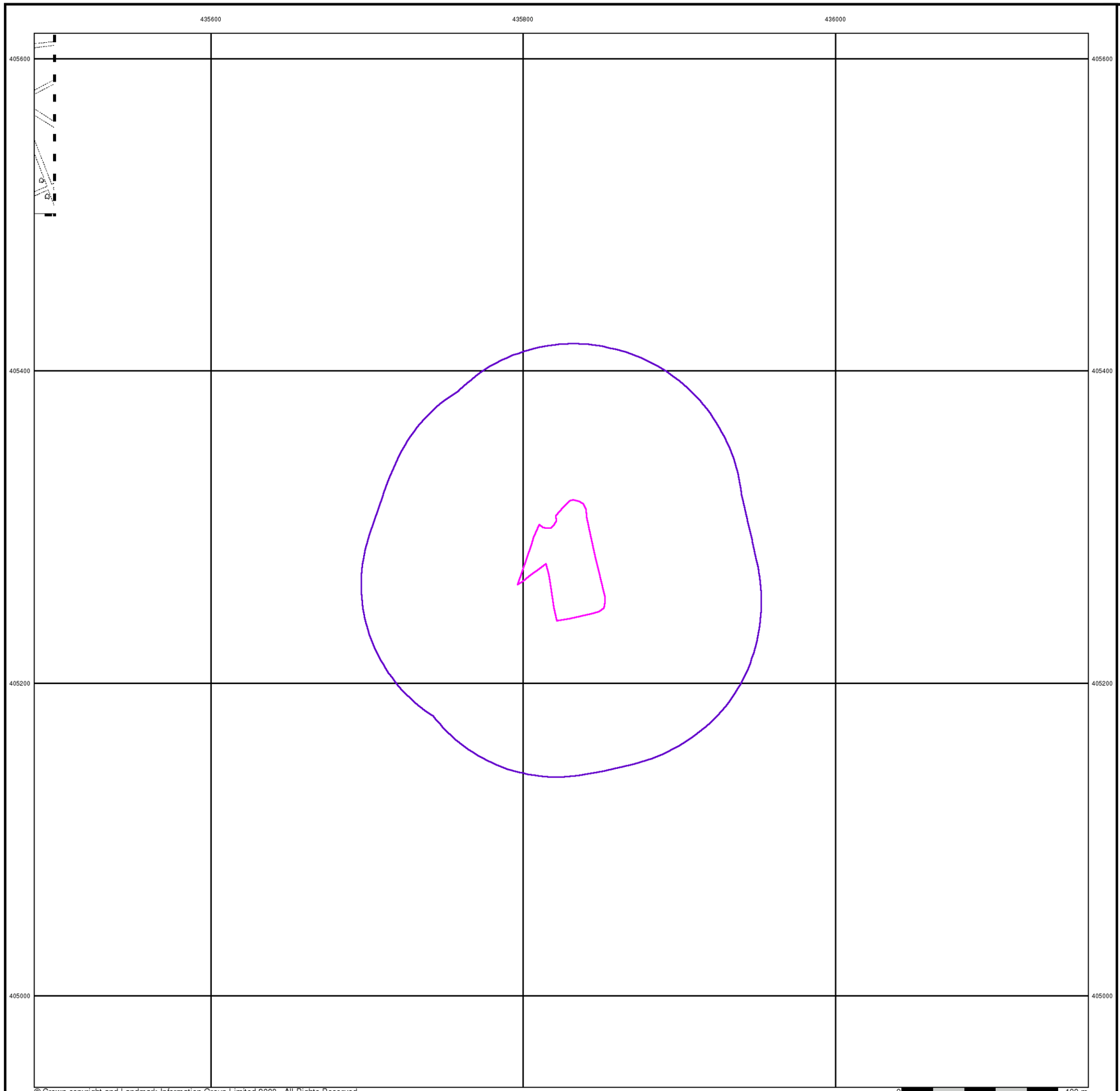
Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	100

Site Details

Site at 435800, 405300

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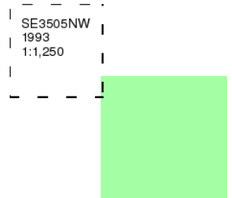
Large-Scale National Grid Data

Published 1993

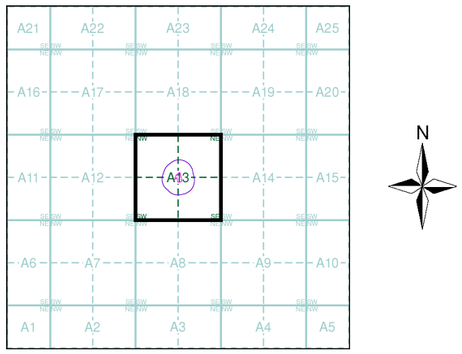
Source map scale - 1:1,250

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

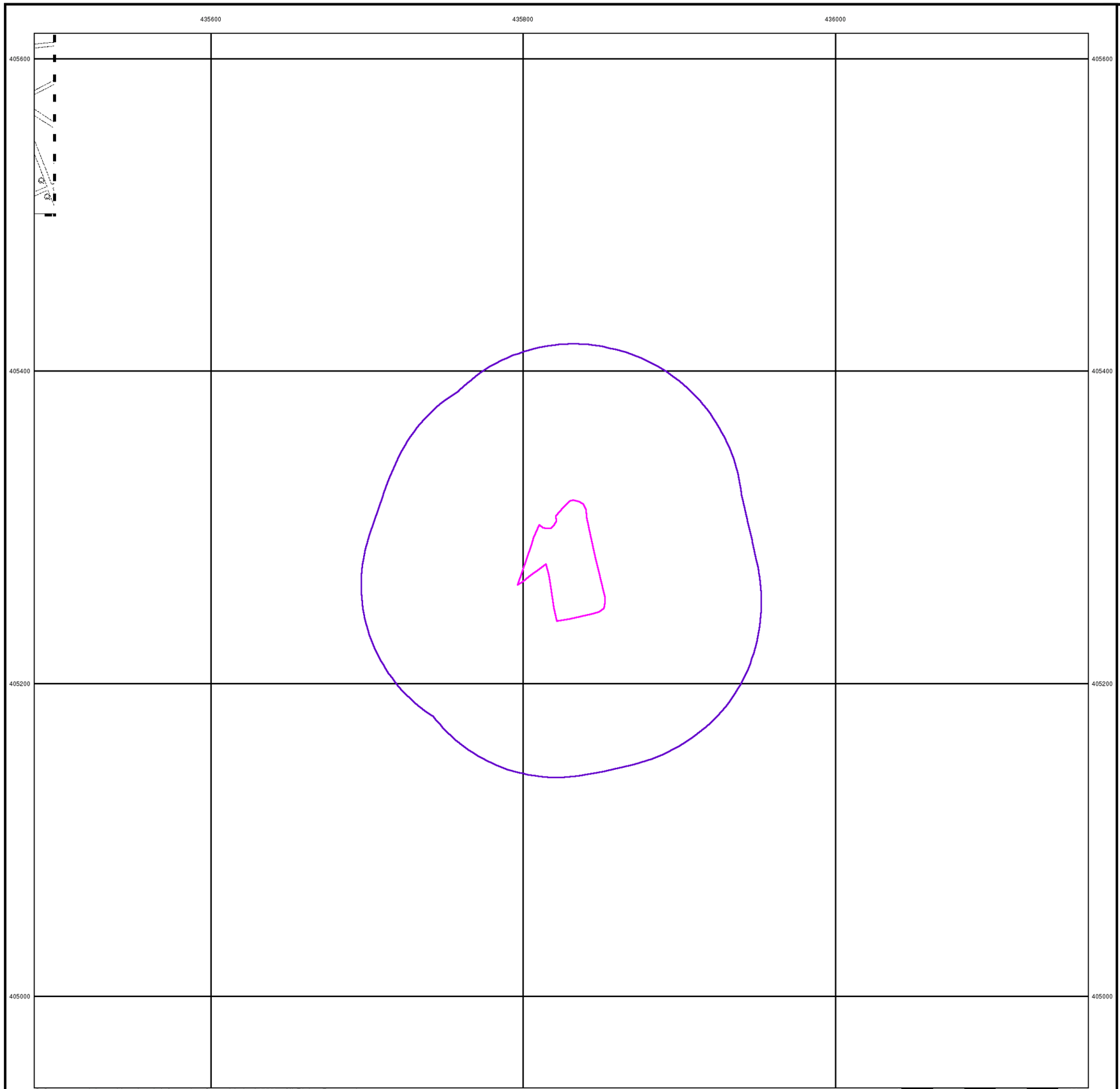
Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	100

Site Details

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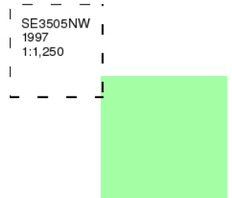
Large-Scale National Grid Data

Published 1997

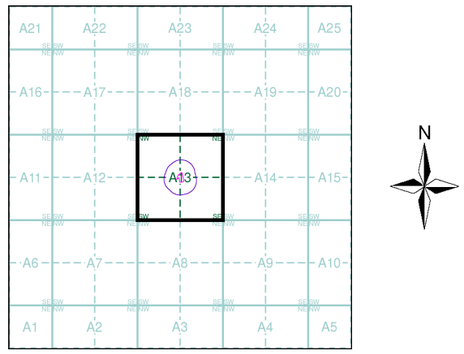
Source map scale - 1:1,250

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

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	100

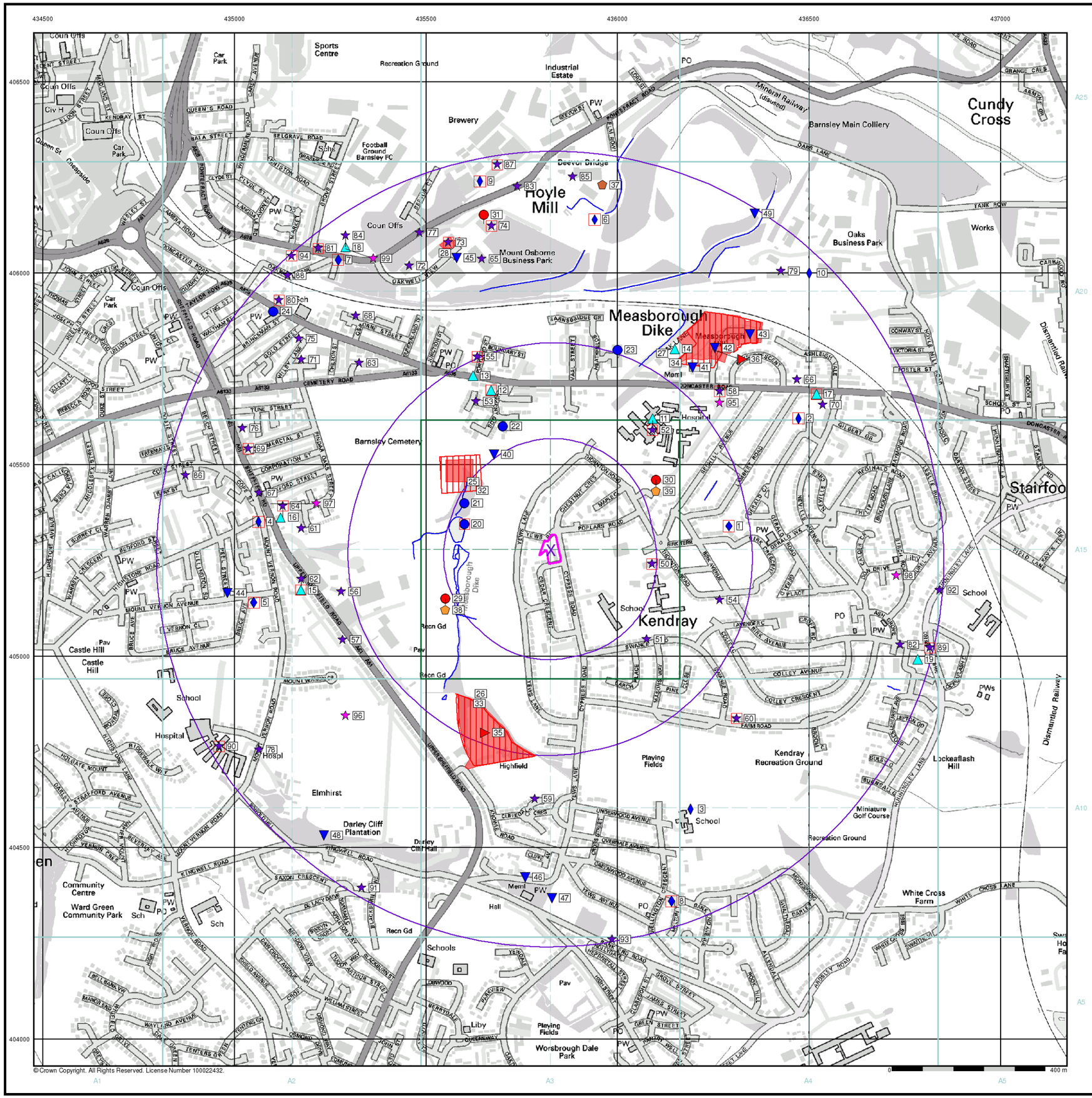
Site Details

Site at 435800, 405300

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APPENDIX E
SEARCH RESPONSES
(Some plans only included on accompanying CD)



ENCIA Environmental

General

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

Several of Type at Location

Agency and Hydrological

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

Geological

- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry

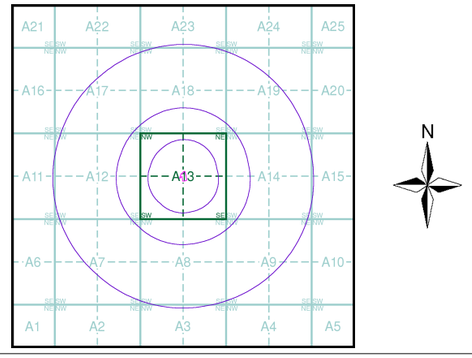
Waste

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

Hazardous Substances

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

Site Sensitivity Map - Slice A



Order Details

Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

Site Details

Site at 435800, 405300

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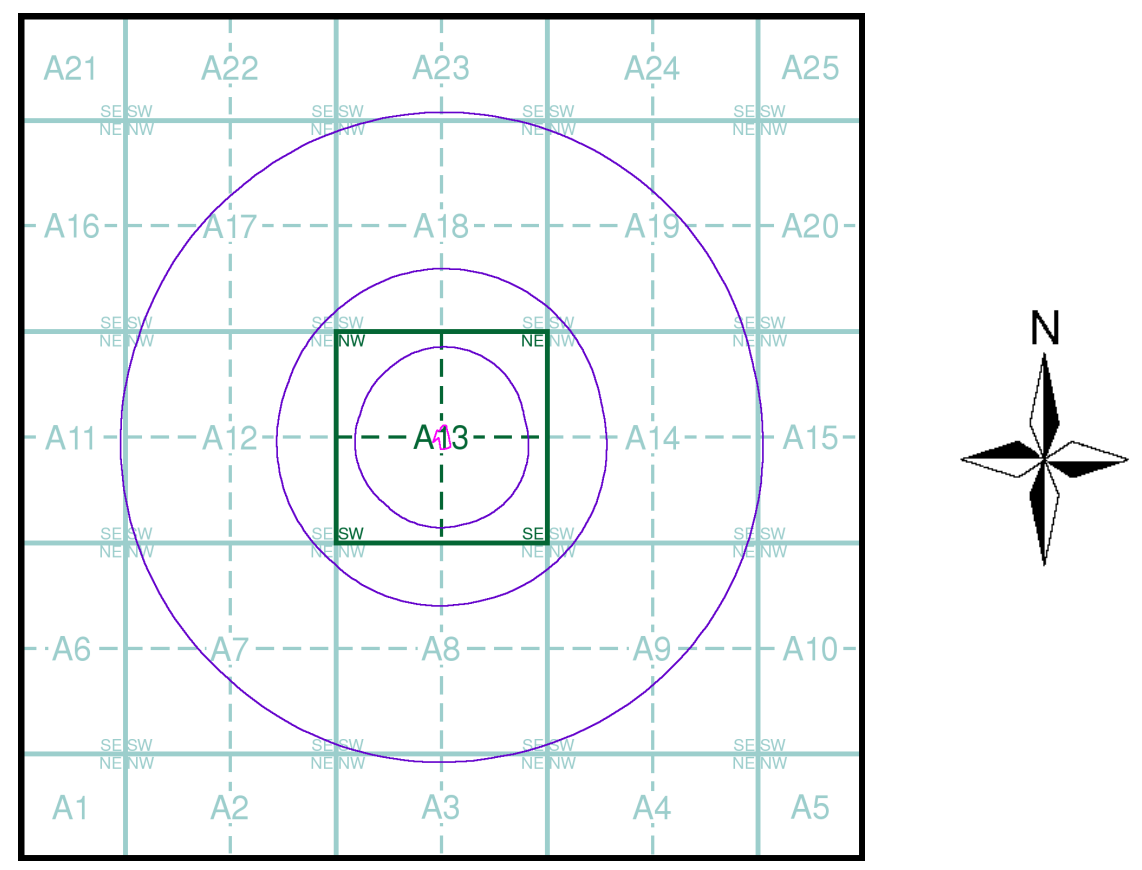
General

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

Agency and Hydrological (Flood)

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

Flood Map - Slice A



Order Details

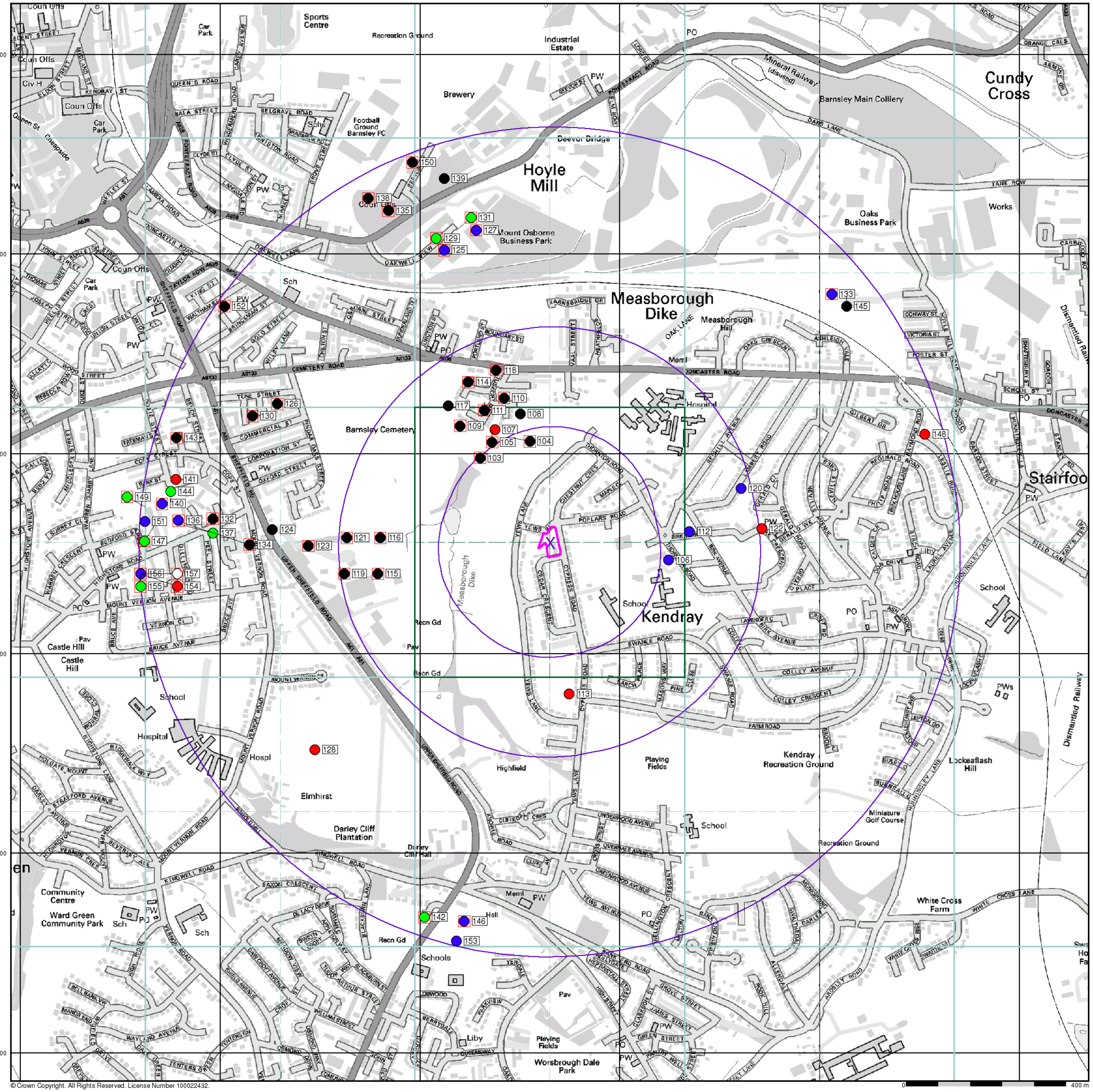
Order Number: 27556575_1_1
Customer Ref: 9642 - Yews Place, Kendray
National Grid Reference: 435830, 405280
Slice: A
Site Area (Ha): 0.24
Search Buffer (m): 1000

Site Details

Site at 435800, 405300

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ENCIA Environmental

General

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

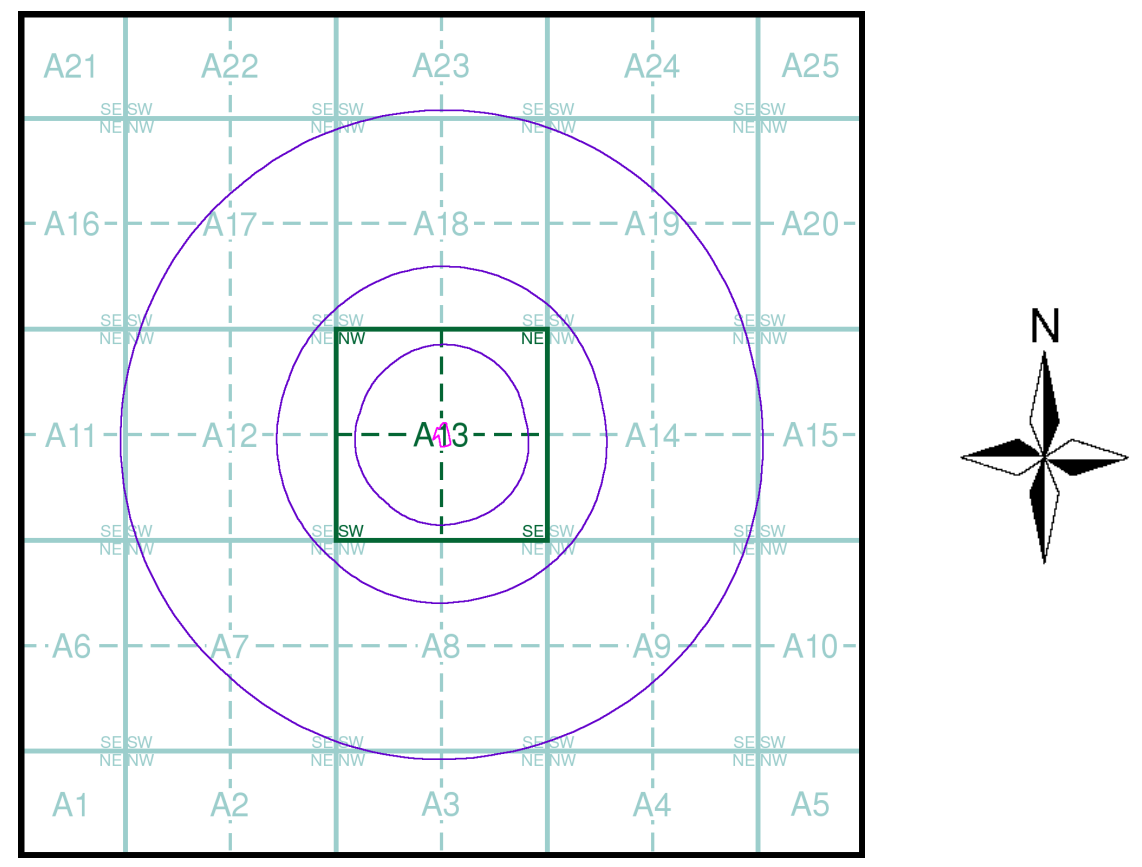
Agency and Hydrological (Boreholes)

- 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

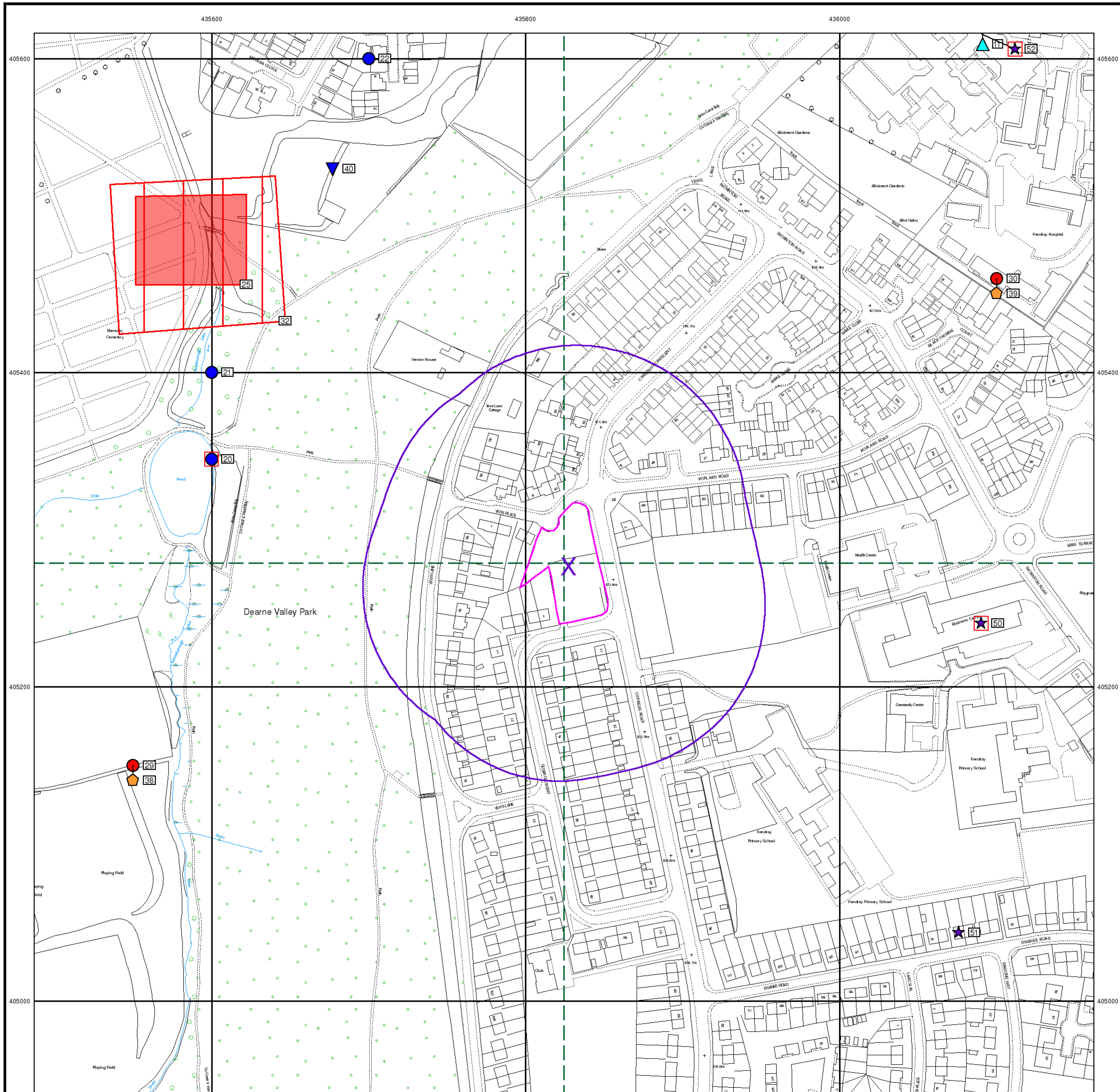
Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

Site Details

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ENCIA Environmental

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
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Geological

- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry

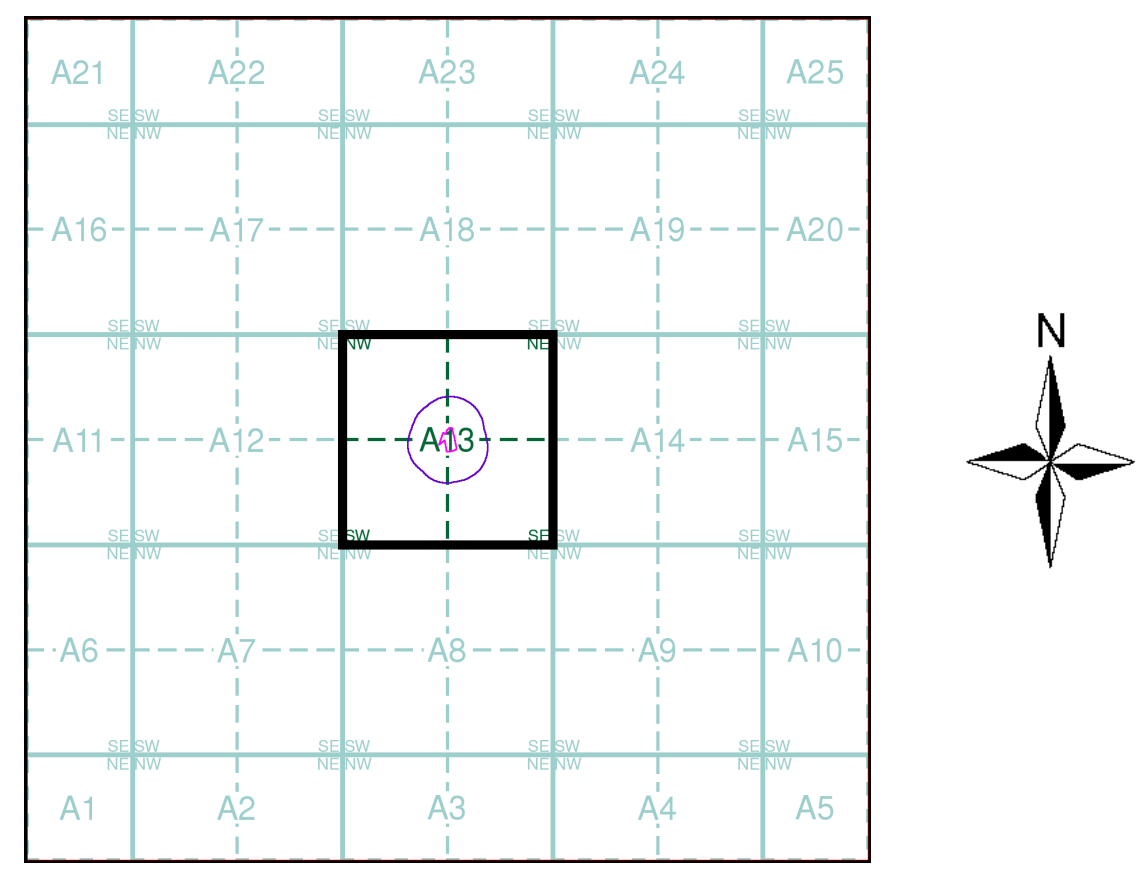
Waste

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

Hazardous Substances

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

Site Sensitivity Map - Segment A13



Order Details

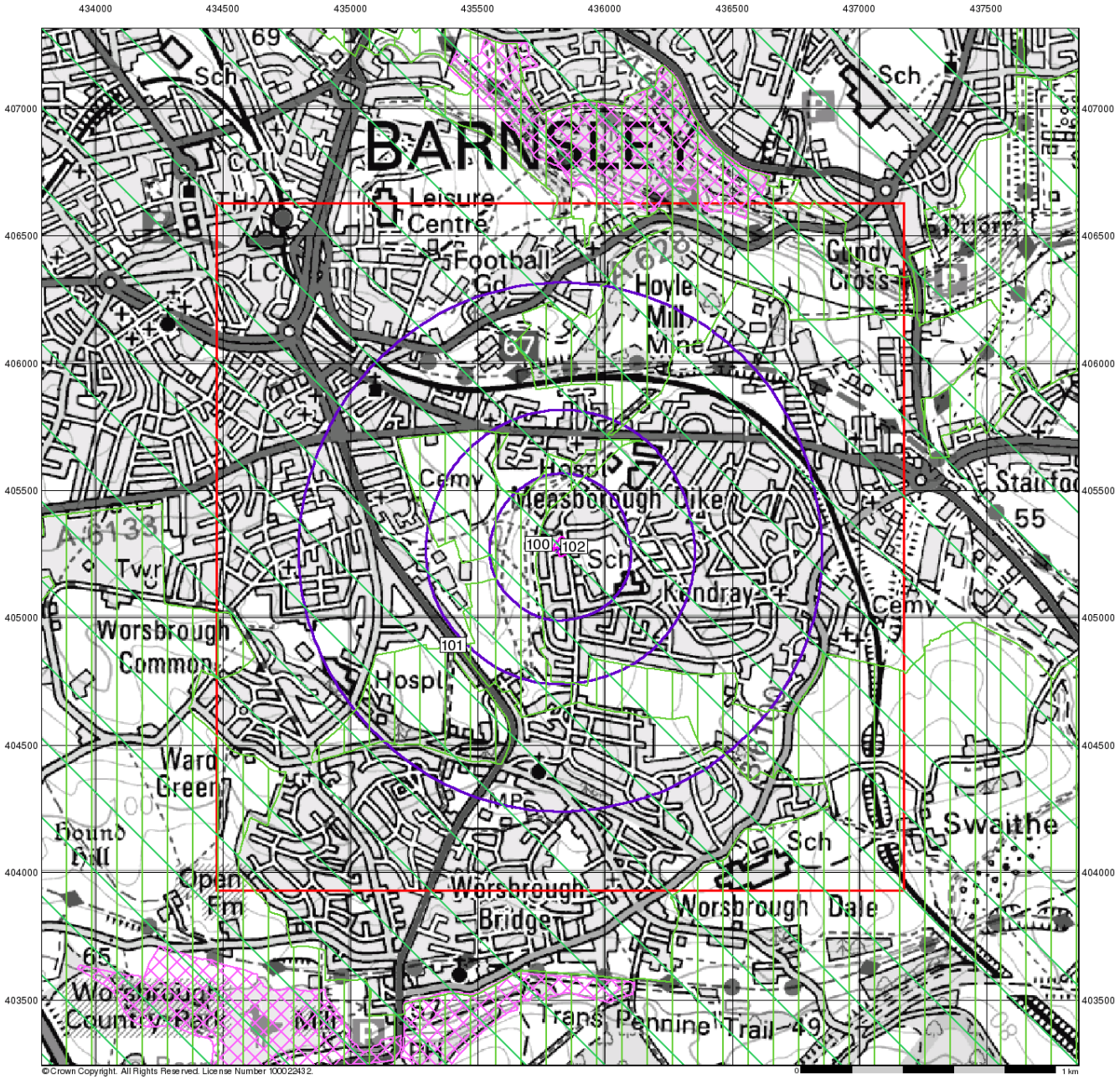
Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Plot Buffer (m):	100

Site Details

Site at 435800, 405300

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Sensitive Land Uses

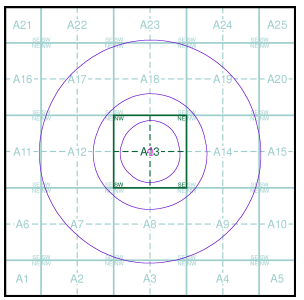
General

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

Sensitive Land Uses

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

Site Sensitivity Context Map - Slice A



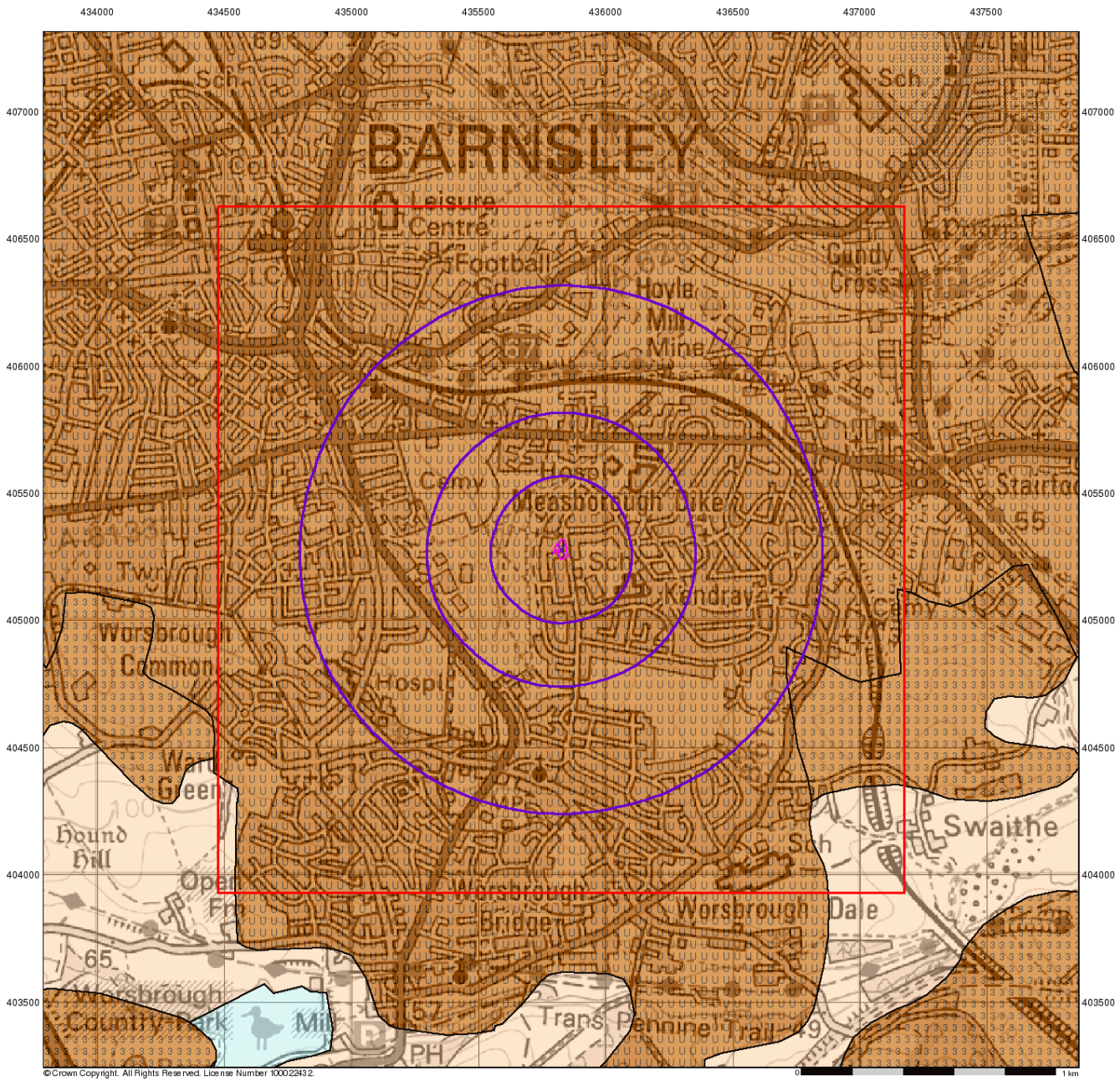
Order Details

Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

Site Details

Site at 435800, 405300

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Groundwater Vulnerability

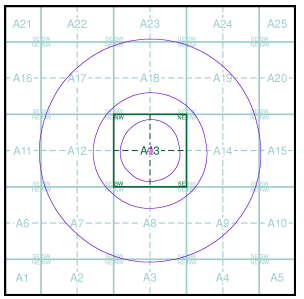
General

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

Agency and Hydrological

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

Site Sensitivity Context Map - Slice A



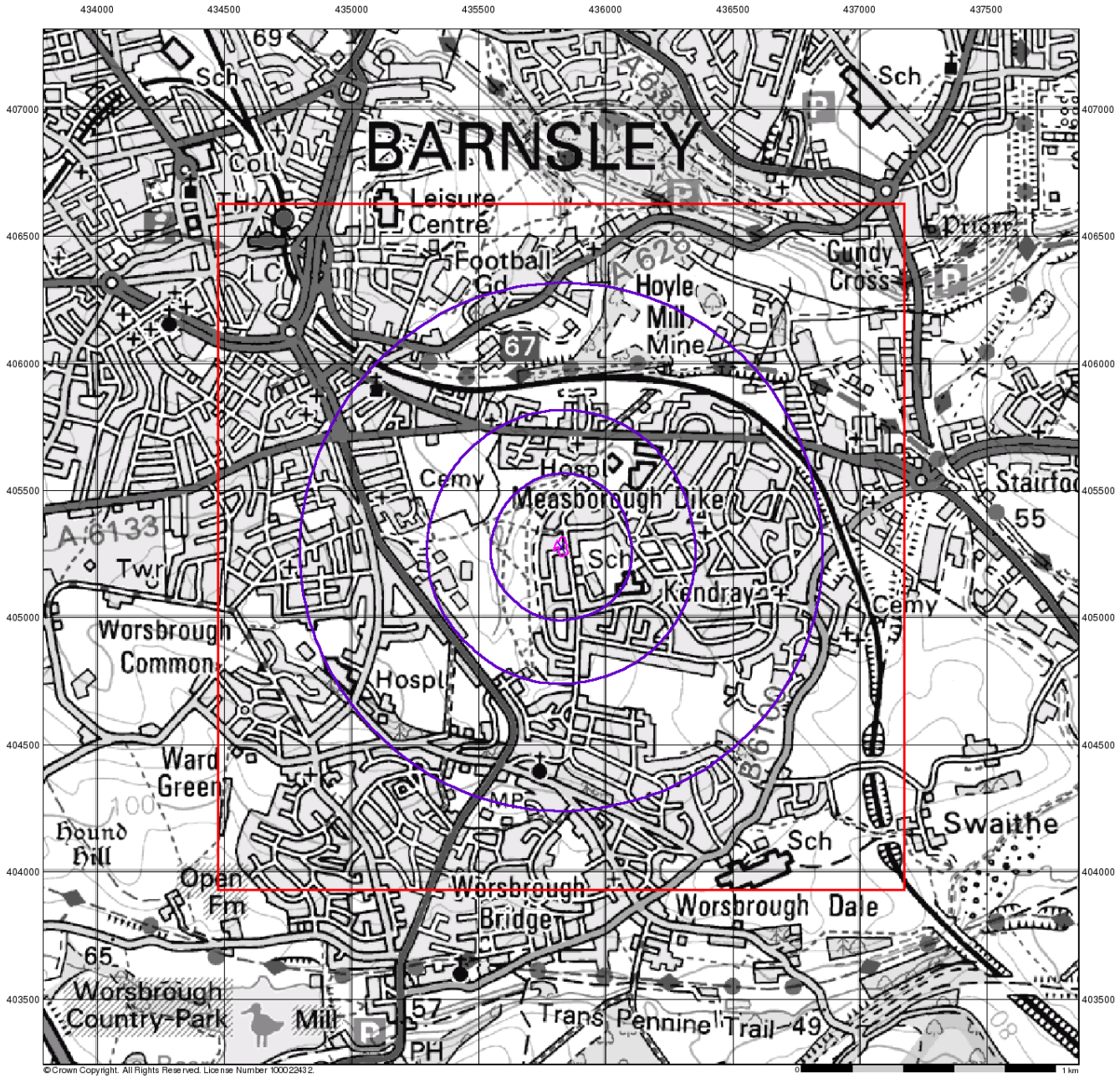
Order Details

Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
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

Source Protection Zone I

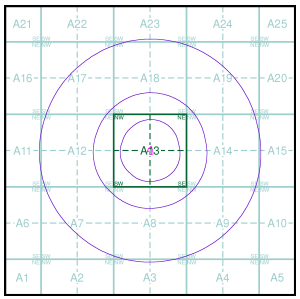
Source Protection Zone II

Source Protection Zone III

Zone of Special Interest

Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



Order Details

Order Number:	27556575_1_1
Customer Ref:	9642 - Yews Place, Kendray
National Grid Reference:	435830, 405280
Slice:	A
Site Area (Ha):	0.24
Search Buffer (m):	1000

Site Details

Site at 435800, 405300

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The Coal Authority, Mining Reports Office, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire NG18 4RG
On-Line Service: www.coalminingreports.co.uk - Phone: 0845 762 6848 - DX 716176 MANSFIELD 5

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DEVON,
EX2 7HY

Person dealing with this matter:	**Darren Moody**
Our reference:	**00013757-09**
Your reference:	27556575
Electronic Ref:	EME_00011357100002_005
RRUID:	005.00011357100002
Date of your enquiry:	**27 March 2009**
Date we received your enquiry:	**27 March 2009**
Date of issue:	**01 April 2009**

This report is for the property described in the address below and the attached plan.

Coal and Brine Report

Site At, Kendray, Barnsley, South Yorkshire

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	Yes
Brine extraction	No

Information from the Coal Authority

Underground Coal Mining

Past

The property is in the likely zone of influence from workings in 12 seams of coal at 150m to 560m depth, and last worked in 1974.

Any ground movement from these coal workings should have stopped by now.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

The property is not in an area for which a licence has been granted to remove coal using underground methods.

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The property is not in an area that is likely to be affected at the surface from any planned future workings.

However reserves of coal exist in the local area which could be worked at some time in the future.

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries

There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

Coal-mining geology

At the surface, there are no known faults or other lines of weakness due to coal mining that have made the property unstable.

Opencast Coal Mining

Past

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

Present

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

Coal-mining subsidence

The Coal Authority has not received a damage notice or claim for the property since 1 January 1984. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority has not received a request to carry out preventive work before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

Withdrawal of Support

The property is not in an area for which a notice of entitlement to withdraw support has been published.

The property is not in an area for which a notice has been given under section 41 of the Coal Industry Act 1994, revoking the entitlement to withdraw support.

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Working Facilities Orders

The property is not in an area for which an Order has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

Payments to Owners of Former Copyhold Land

The property is not in an area for which a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

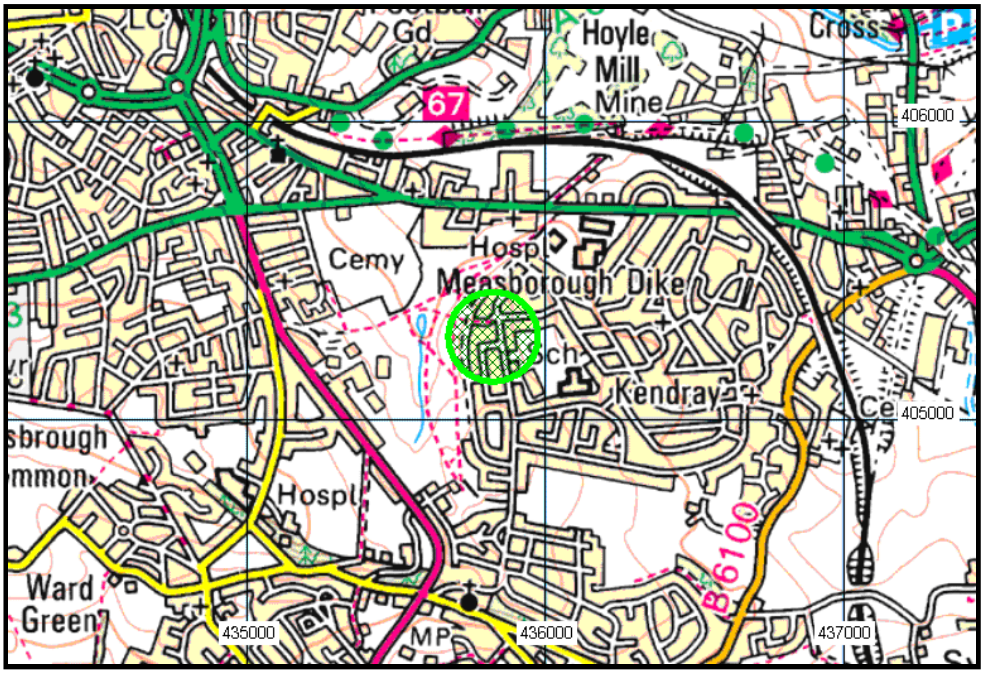
Additional remarks

This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions 2006. The report is compliant with Home Information Pack requirements.

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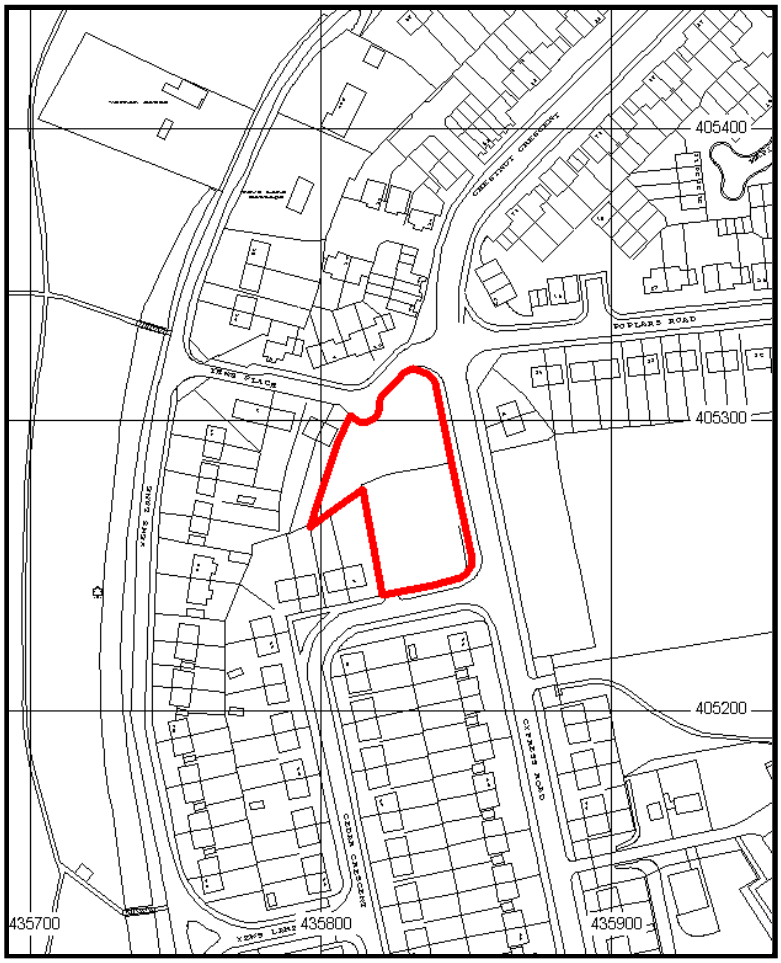
Location map

Approximate position of property



Enquiry boundary

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Key

Approximate position of enquiry boundary shown

Mapping sourced from Ordnance Survey®

APPENDIX F
WINDOW SAMPLE RECORDS

KEYS TO LOGS
Symbols & Legends

Samples / Tests

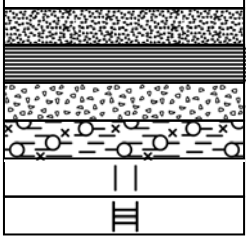
SYMBOL	Explanation
D	Small representative disturbed sample (c, 1kg). Collected in plastic tub
J	Small representative disturbed sample (c, 1kg). Collected in glass jar
T	Small representative disturbed sample (c, 10g). Collected in glass vial
V	Small representative disturbed sample (c, 10g). collected in glass vial
B	Bulk representative disturbed sample (>5Kg)
*	Unrepresentative “spot” sample
U	Undisturbed sample (100mm Ø)
W	Water Sample
S=	Standard Penetration Test. N value
C=	Cone Penetration Test N value
V=	In-situ shear vane reading. Shear strength value

SPT results are presented as S=N, where N is the number of blows for 300mm penetration. CPT results are presented in a similar manner, as C=N. If full penetration is not achieved, an extrapolated value is calculated or the result is reported as N/x mm, where N is the number of blows for a penetration of x mm.

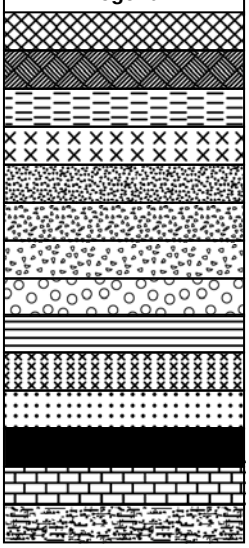
Water Strikes

Symbol	Explanation
	Depth at which water first struck
	Level to which water rose during excavation (This may not be the equilibrium water level)

Backfill Legends

Legend	Explanation
	Concrete
	Bentonite seal
	Gravel
	Arisings
	Well casing
	Well screen

Soil / Rock Legends

Legend	Explanation
	Made Ground
	Topsoil
	Clay
	Silt
	Sand
	Gravel
	Cobble
	Boulder
	Mudstone
	Siltstone
	Sandstone
	Coal
	Limestone
	Composite soil types are shown as combined symbols. The example shown is sandy clay.

KEY TO LOGS
(Terms & Definitions)

Soil Strength

COHESIVE SOILS		
Descriptor	Undrained Cohesion/KPa	Approx SPT N value
Very soft	<20	<4
Soft	20-40	4-8
Firm	40-75	8-15
Stiff	75-150	15-30
Very Stiff	>150	>30

GRANULAR SOILS	
Descriptor	**Approx SPT N Value**
Very Loose	<4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	>50

Amount of Minor Constituents

Descriptor before SOIL NAME	Amount of Minor Constituent / %	Descriptor after SOIL NAME
	<1	With a trace
Slightly ---y	1-5	With a little/occasional
---y	5-20	With some
Very ---y	>20	With much
and	50-50	

Particle Size

Soil Constituent	Grain size / mm
Boulder	>200
Cobble	60-200
Coarse Gravel	20-60
Medium Gravel	6-20
Fine Gravel	2-6
Coarse Sand	0.6-2
Medium Sand	0.2-0.6
Fine Sand	0.06-0.2
Silt	0.002-0.06
Clay	<0.002

Bedding / Discontinuity Spacing

Spacing / mm	Bedding	Fractures	General
>2000	Very thickly bedded	Scarcely fractured	Very widely
600-2000	Thickly bedded	Slightly fractured	Widely
200-600	Medium bedded	Moderately fractured	Medium
60-200	Thinly bedded	Highly fractured	Closely
20-60	Very thinly bedded	Very highly fractured	Very closely
6-20	Thickly laminated	Intensely fractured	Extremely closely
<6	Thinly laminated		

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS1

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D 2D 3D	0.00-0.20 0.20-0.35 0.35-0.80			MADE GROUND: Grey, sandy, angular to subangular fine to coarse gravel of concrete, brick and sandstone. (SUB-BASE)	0.20 0.35			
				MADE GROUND: Stiff (friable) dark brown slightly sandy clay with some rootlets. (RELICT SUBSOIL) At 0.2m depth, Geotextile.				
				Strong, orange-brown fine to coarse grained SANDSTONE. Recovered as sandy, angular coarse gravel and cobbles. At 1.4m depth, window sample hole refused.	1.40			
				End of window sample hole at 1.40 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS2

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D	0.00-0.20			MADE GROUND: Grey, sandy, angular to subangular fine to coarse gravel of brick, sandstone and concrete. (SUB-BASE)	0.20			
2D	0.20-0.40							
3D	0.40-1.00			MADE GROUND: Firm dark brown clay with rare angular gravel of ceramic. Some rootlets. (RELICT SUBSOIL)	0.40			
4D	1.10-1.50			At 0.2m depth, Geotextile.	1.10			
				Orange-brown, slightly clayey fine to coarse SAND with much subangular fine to coarse gravel of sandstone. (COMPLETELY WEATHERED SANDSTONE)				
				Strong, orange-brown fine to coarse grained SANDSTONE. Recovered as sandy coarse gravel and cobbles. (WEATHERED SANDSTONE)	2.00			
				End of window sample hole at 2.00 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS3

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D	0.00-0.40			MADE GROUND: Grey, sandy, angular to subangular fine to coarse gravel of brick, sandstone and concrete. (SUB-BASE)	0.40			
2D	0.40-0.70			MADE GROUND: Stiff (friable) dark brown clay with some rootlets. Occasional subangular fine to coarse gravel of mixed lithologies. Rare plastic sheet fragments. (RELICT SUBSOIL) At 0.4m depth, Geotextile.	0.70			
3D	0.70-1.00			Strong, orange-brown fine to coarse grained SANDSTONE. Recovered as very sandy angular coarse gravel and cobbles. (WEATHERED SANDSTONE) At 1.4m depth, window sample hole refused.	1.40			
				End of window sample hole at 1.40 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS4

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D 2D	0.00-0.15 0.15-0.50			MADE GROUND: Grey, sandy, angular to subangular fine to coarse gravel of brick, sandstone and concrete. (SUB-BASE)	0.15			
				MADE GROUND: Stiff (friable) dark brown slightly sandy slightly gravelly clay with some rootlets. Gravel is subangular to subrounded of mudstone, coal and quartz. Rare brick. (RELICT SUBSOIL)	0.50			
3D 4D	1.00-1.20 1.20-1.50			At 0.15m depth, Geotextile.	1.20			
				Strong, orange-brown fine to coarse grained SANDSTONE. Recovered as slightly clayey, sandy angular to subangular coarse gravel. (WEATHERED SANDSTONE)	1.50			
				Strong, grey fine to coarse grained SANDSTONE. Recovered as slightly sandy angular coarse gravel and cobbles. (WEATHERED SANDSTONE)				
				At 1.5m depth, window sample hole refused.				
				End of window sample hole at 1.50 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS5

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D	0.00-0.30			MADE GROUND: Grey, slightly sandy, angular to subangular fine to coarse gravel of brick and concrete. Occasional angular cobbles of concrete. (SUB-BASE)	0.30			
2D	0.30-0.60			Brown gravelly CLAY with occasional subangular fine to coarse gravel of sandstone. (COMPLETELY WEATHERED SANDSTONE)	0.60			
3D	0.60-1.00			Moderately strong, orange-brown fine to coarse grained SANDSTONE. Recovered as sandy cobbles. (WEATHERED SANDSTONE)	1.00			
				End of window sample hole at 1.00 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS6

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D	0.05-0.35			MADE GROUND: Black Tarmac. (TARMAC)	0.05			
2D	0.35-0.70			MADE GROUND: Grey brown, slightly sandy, angular to subangular fine to coarse gravel of brick, concrete and sandstone. (SUB-BASE)	0.35			
3D	0.70-1.00			MADE GROUND: Dark brown, becoming orange brown slightly sandy clay with occasional rootlets. (RELICT SUBSOIL) At 0.35m depth, Geotextile.	0.70			
4D	1.30-1.50			Orange-brown slightly clayey fine to medium SAND with occasional subangular to angular fine to coarse gravel of sandstone. (COMPLETELY WEATHERED SANDSTONE)	1.30			
				Weak orange-brown fine to coarse grained SANDSTONE. Recovered as sandy, angular to subangular fine to coarse gravel. (WEATHERED SANDSTONE)	2.10			
				Very stiff / hard grey mottled orange-brown CLAY. (WEATHERED SANDSTONE) At 2.7m depth, window sample hole refused.	2.70			
				End of window sample hole at 2.70 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS7

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D	0.00-0.35			MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of brick, concrete and sandstone. (SUB-BASE)	0.35			
2D	0.35-0.55			MADE GROUND: Stiff (friable) dark brown, slightly sandy clay with occasional angular to subangular fine to medium gravel of sandstone, mudstone and coal. (RELICT SUBSOIL) At 0.35m depth, Geotextile.	0.55			
3D	0.60-1.00			Strong orange-brown fine to coarse grained SANDSTONE. Recovered as sandy angular to subangular coarse gravel and cobbles. (WEATHERED SANDSTONE)	1.80			
				Strong, red-orange fine to coarse grained SANDSTONE. Recovered as angular fine to coarse gravel. (WEATHERED SANDSTONE) At 1.9m depth, window sample hole refused.	1.90			
				End of window sample hole at 1.90 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS8

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D	0.10-0.30			MADE GROUND: Black Tarmac. (TARMAC)	0.10			
2D	0.30-0.50			MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of brick, concrete and sandstone. (SUB-BASE)	0.30			
3D	0.70-1.00				0.50			
4D	1.10-1.50			MADE GROUND: Stiff (friable) dark brown, slightly gravelly clay with some rootlets. Gravel is angular to subangular fine to medium gravel of brick and quartz. (RELICT SUBSOIL) At 0.30m depth, Geotextile.	1.10			
				Orange-brown, slightly clayey fine to coarse SAND with occasional angular to subangular fine to coarse gravel of sandstone. (COMPLETELY WEATHERED SANDSTONE)	1.90			
				Strong, orange-brown fine to coarse grained SANDSTONE. Recovered as sandy angular coarse gravel and cobbles. (WEATHERED SANDSTONE) At 1.9m depth, window sample hole refused.				
				End of window sample hole at 1.90 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS9

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1D	0.00-0.25			MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of brick, sandstone and concrete. (SUB-BASE)	0.25			
2D	0.25-0.40			MADE GROUND: Red and dark brown sandy angular fine to coarse gravel of brick. (SUB-BASE)	0.40			
3D	0.50-1.00			At 0.25m depth, Geotextile.	0.50			
				MADE GROUND: Stiff (friable) dark brown sandy clay with occasional angular to subangular fine to coarse gravel of sandstone. (RELICT SUBSOIL)	1.50			
				Strong, orange-brown fine to coarse grained SANDSTONE. Recovered as slightly clayey, angular coarse gravel and cobbles. (WEATHERED SANDSTONE)	1.60			
				Strong, red-orange fine to coarse grained SANDSTONE. Recovered as slightly sandy angular coarse gravel and cobbles. (WEATHERED SANDSTONE)				
				At 1.6m depth, window sample hole refused.				
				End of window sample hole at 1.60 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

WINDOW SAMPLE LOG

CLIENT Keepmoat Homes

SITE Yews Place, Kendray

WS10

DATE 31 Mar 09 Co-ords Sheet 1 of 1

Ground Level Scale 1:50

sample no & type	depth (m)	in-situ test	well/ backfill	description	depth (m)	level (m)	ground water	legend
1J 1V	0.30-0.50			MADE GROUND: Black Tarmac. (TARMAC)	0.10			
				MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of brick, concrete, sandstone and tarmac. (SUB-BASE)	0.30			
2J 2V	0.90-1.00			MADE GROUND: Dark brown slightly gravelly clay with occasional rootlets. Gravel is angular to subangular fine to coarse of concrete and mudstone. (RELICT SUBSOIL) At 0.30m depth, Geotextile.	0.90			
				Strong, orange-brown fine to coarse grained SANDSTONE. Recovered as sandy, angular coarse gravel and cobbles. (WEATHERED SANDSTONE)	1.50			
				Strong, brown fine to coarse grained SANDSTONE. Recovered as sandy, angular coarse gravel. (WEATHERED SANDSTONE) At 1.6m depth, window sample hole refused.	1.60			
				End of window sample hole at 1.60 m				

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.

Equipment/Methods	Logged by	JOB	FIGURE
Window sample hole advanced by percussive methods using 120mm and 90mm sampling rods.	ASw	9642	

APPENDIX G
CHEMICAL TEST RESULTS
(Only on accompanying CD)

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 161323-2

Date of Report: 20-Apr-2009

Customer: ENCIA Environmental Limited
Encia House
Audby Lane
Wetherby
West Yorkshire
LS22 7RD

Customer Contact: Mr Alan Swales

Customer Job Reference: 9642
Customer Purchase Order: 9642/1-AS1-005296
Customer Site Reference: Yews Place Kendray
Date Job Recieved at SAL: 03-Apr-2009
Date Analysis Started: 20-Apr-2009
Date Analysis Completed: 20-Apr-2009

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs

UKAS TESTING
1549

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked and authorised by :
Amelia McVennon
Project Manager

Issued by :

Index to symbols used in this report

Value	Description
AR	As Received
10:1	Leachate
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
W	Analysis was performed at another SAL laboratory
U	Analysis is UKAS accredited
M	Analysis is MCERTS accredited
N	Analysis is not accredited

Methods

Value	Description
T21	OX/IR
T207	GC/MS(MCERTS)
T6	ICP/OES
T206	GC/FID (MCERTS)
T7	Probe
T162	Grav (1 Dec) (105 C)
T277	Grav (1 Dec) (40 C)
T8	GC/FID
T11	IC
T209	GC/MS(Head Space)(MCERTS)
T281	ICP/MS (Filtered)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Chloride (2:1)	T11	M40	0.5	mg/l	WN	001-004,006-007,009,011-013,015,017,019,022,025,027,029
Magnesium water soluble	T6	AR	0.1	g/l	N	001-004,006-007,009,011-013,015,017,019,022,025,027,029
Nitrate (2:1)	T11	M40	0.5	mg/l	WN	001-004,006-007,009,011-013,015,017,019,022,025,027,029
SO4(2:1)	T6	AR	0.1	g/l	WN	001-004,006-007,009,011-013,015,017,019,022,025,027,029
As (Dissolved)	T281	10:1	0.2	µg/l	U	002,004,009,011,022,029
Boron	T6	10:1	0.01	mg/l	N	002,004,009,011,022,029
Cd (Dissolved)	T281	10:1	0.02	µg/l	U	002,004,009,011,022,029
Cr (Dissolved)	T281	10:1	1.0	µg/l	U	002,004,009,011,022,029
Cu (Dissolved)	T281	10:1	0.5	µg/l	U	002,004,009,011,022,029
Pb (Dissolved)	T281	10:1	0.3	µg/l	U	002,004,009,011,022,029
Hg (Dissolved)	T281	10:1	0.05	µg/l	U	002,004,009,011,022,029
Ni (Dissolved)	T281	10:1	1.0	µg/l	U	002,004,009,011,022,029
Se (Dissolved)	T281	10:1	0.5	µg/l	U	002,004,009,011,022,029
Zn (Dissolved)	T281	10:1	2.0	µg/l	U	002,004,009,011,022,029
pH	T7	10:1			U	002,004,009,011,022,029
Arsenic	T6	M40	2.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Boron (water-soluble)	T6	AR	1.0	mg/kg	N	001-002,004-005,009,011-012,017,021-022,025,029
Cadmium	T6	M40	1.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Chromium	T6	M40	1.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Copper	T6	M40	1.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Lead	T6	M40	1.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Mercury	T6	M40	1.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Nickel	T6	M40	1.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Selenium	T6	M40	3.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Zinc	T6	M40	1.0	mg/kg	M	001-002,004-005,009,011-012,017,021-022,025,029
Total Organic Carbon	T21	M40	0.1	%	N	031
Moisture	T277	AR	0.1	%	N	001-007,009,011-013,015,017,019,021-022,025,027,029,031
Moisture @ 105 C	T162	AR	0.1	%	N	001-007,009,011-013,015,017,019,021-022,025,027,029,031
Acenaphthene	T207	M105	0.1	mg/kg	M	031
Acenaphthylene	T207	M105	0.1	mg/kg	U	031
Anthracene	T207	M105	0.1	mg/kg	U	031
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	031
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	031
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	M	031
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	031

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Chrysene	T207	M105	0.1	mg/kg	M	031
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	031
Fluoranthene	T207	M105	0.1	mg/kg	M	031
Fluorene	T207	M105	0.1	mg/kg	M	031
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	031
Naphthalene	T207	M105	0.1	mg/kg	M	031
Phenanthrene	T207	M105	0.1	mg/kg	M	031
Pyrene	T207	M105	0.1	mg/kg	M	031
PAH(total)	T207	M105	0.1	mg/kg	U	031
Benzene	T209	M105	10.0	µg/kg	M	031
EthylBenzene	T209	M105	10.0	µg/kg	M	031
M/P Xylene	T209	M105	10.0	µg/kg	M	031
Methyl-tert-Butyl Ether	T209	M105	10.0	µg/kg	M	031
O Xylene	T209	M105	10.0	µg/kg	M	031
Toluene	T209	M105	10.0	µg/kg	M	031
TPH (C5-C6 aliphatic)	T209	M105	0.1	mg/kg	N	031
TPH (C6-C8 aliphatic)	T209	M105	0.1	mg/kg	N	031
TPH (C8-C10 aliphatic)	T209	M105	0.1	mg/kg	N	031
TPH (C10-C12 aliphatic)	T206	AR	1.0	mg/kg	M	031
TPH (C12-C16 aliphatic)	T206	AR	2.0	mg/kg	M	031
TPH (C16-C21 aliphatic)	T206	AR	1.0	mg/kg	M	031
TPH (C21-C35 aliphatic)	T206	AR	4.0	mg/kg	M	031
TPH (C6-C7 aromatic)	T209	M105	0.1	mg/kg	N	031
TPH (C7-C8 aromatic)	T209	M105	0.1	mg/kg	N	031
TPH (C8-C10 aromatic)	T209	M105	0.1	mg/kg	N	031
TPH (C10-C12 aromatic)	T206	AR	1.0	mg/kg	M	031
TPH (C12-C16 aromatic)	T8	AR	1.0	mg/kg	N	031
TPH (C16-C21 aromatic)	T206	AR	1.0	mg/kg	M	031
TPH (C21-C35 aromatic)	T206	AR	1.0	mg/kg	M	031
pH	T7	AR			M	001-007,009,011-013,015,017,019,021-022,025,027,029

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**161323 001**	**161323 002**	**161323 003**	**161323 004**	**161323 005**
				Customer Sample Reference	**WS1 1 D 0.0-0.2**	**WS1 2 D 0.2-0.35**	**WS1 3 D 0.35-0.8**	**WS2 1 D 0.0-0.2**	**WS2 2 D 0.4-0.4**
				Top Depth	**0.0**	**0.2**	**0.35**	**0.0**	**0.2**
				Bottom Depth	**0.2**	**0.35**	**0.8**	**0.2**	**0.4**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture	T277	AR	0.1	%	**3.7**	**8.3**	**5.4**	**5.4**	**15**
Moisture @ 105 C	T162	AR	0.1	%	**7.0**	**12**	**5.2**	**6.8**	**15**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**161323 006**	**161323 007**	**161323 009**	**161323 011**	**161323 012**
				Customer Sample Reference	**WS2 3 D 0.4-1.0**	**WS2 4 D 1.1-1.5**	**WS3 2 D 0.4-0.7**	**WS4 1 D 0.0-0.15**	**WS4 2 D 0.15-0.5**
				Top Depth	**0.4**	**1.1**	**0.4**	**0.0**	**0.15**
				Bottom Depth	**1.0**	**1.5**	**0.7**	**0.15**	**0.5**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture	T277	AR	0.1	%	**6.7**	**7.1**	**8.0**	**6.7**	**13**
Moisture @ 105 C	T162	AR	0.1	%	**8.1**	**6.5**	**10**	**11**	**15**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**161323 013**	**161323 015**	**161323 017**	**161323 019**	**161323 021**
				Customer Sample Reference	**WS4 3 D 1.0-1.2**	**WS5 2 D 0.3-0.6**	**WS6 1 D 0.05-0.35**	**WS6 3 D 0.7-1.0**	**WS7 1 D 0.0-0.35**
				Top Depth	**1.0**	**0.3**	**0.05**	**0.7**	**0.0**
				Bottom Depth	**1.2**	**0.6**	**0.35**	**1.0**	**0.35**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture	T277	AR	0.1	%	**12**	**15**	**5.8**	**7.2**	**3.4**
Moisture @ 105 C	T162	AR	0.1	%	**11**	**14**	**8.5**	**8.1**	**5.6**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**161323 022**	**161323 025**	**161323 027**	**161323 029**	**161323 031**
				Customer Sample Reference	**WS7 2 D 0.35-0.55**	**WS8 2 D 0.3-0.5**	**WS8 4 D 1.1-1.5**	**WS9 2 D 0.25-0.4**	**WS10 1 J&V 0.3-0.5**
				Top Depth	**0.35**	**0.3**	**1.1**	**0.25**	**0.3**
				Bottom Depth	**0.55**	**0.5**	**1.5**	**0.4**	**0.5**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture	T277	AR	0.1	%	**13**	**9.8**	**7.3**	**9.9**	**11**
Moisture @ 105 C	T162	AR	0.1	%	**12**	**10**	**6.2**	**6.2**	**11**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
Encia pH and Metals

				SAL Reference	**161323 001**	**161323 002**	**161323 004**	**161323 005**	**161323 009**	**161323 011**
				Customer Sample Reference	**WS1 1 D 0.0-0.2**	**WS1 2 D 0.2-0.35**	**WS2 1 D 0.0-0.2**	**WS2 2 D 0.4-0.4**	**WS3 2 D 0.4-0.7**	**WS4 1 D 0.0-0.15**
				Top Depth	**0.0**	**0.2**	**0.0**	**0.2**	**0.4**	**0.0**
				Bottom Depth	**0.2**	**0.35**	**0.2**	**0.4**	**0.7**	**0.15**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**						
Arsenic	T6	M40	2	mg/kg	**7**	**17**	**6**	**20**	**15**	**14**
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	**1**	<1	<1	**1**	<1	<1
Chromium	T6	M40	1	mg/kg	**31**	**14**	**95**	**17**	**12**	**18**
Copper	T6	M40	1	mg/kg	**18**	**33**	**19**	**74**	**31**	**44**
Lead	T6	M40	1	mg/kg	**230**	**62**	**32**	**130**	**65**	**88**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**11**	**17**	**16**	**19**	**15**	**17**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**140**	**70**	**55**	**130**	**83**	**120**
pH	T7	AR			**9.8**	**7.7**	**10.0**	**7.8**	**7.7**	**7.9**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
Encia pH and Metals

				SAL Reference	**161323 012**	**161323 017**	**161323 021**	**161323 022**	**161323 025**	**161323 029**
				Customer Sample Reference	**WS4 2 D 0.15-0.5**	**WS6 1 D 0.05-0.35**	**WS7 1 D 0.0-0.35**	**WS7 2 D 0.35-0.55**	**WS8 2 D 0.3-0.5**	**WS9 2 D 0.25-0.4**
				Top Depth	**0.15**	**0.05**	**0.0**	**0.35**	**0.3**	**0.25**
				Bottom Depth	**0.5**	**0.35**	**0.35**	**0.55**	**0.5**	**0.4**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**						
Arsenic	T6	M40	2	mg/kg	**20**	**7**	**5**	**14**	**11**	**32**
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	**1**	**3**	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**16**	**21**	**18**	**13**	**10**	**14**
Copper	T6	M40	1	mg/kg	**49**	**33**	**15**	**24**	**19**	**25**
Lead	T6	M40	1	mg/kg	**120**	**110**	**240**	**42**	**34**	**41**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**18**	**13**	**11**	**17**	**13**	**19**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**110**	**86**	**140**	**61**	**47**	**71**
pH	T7	AR			**6.9**	**9.4**	**9.6**	**7.7**	**7.5**	**8.3**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
pH

				SAL Reference	**161323 001**	**161323 002**	**161323 003**	**161323 004**	**161323 005**
				Customer Sample Reference	**WS1 1 D 0.0-0.2**	**WS1 2 D 0.2-0.35**	**WS1 3 D 0.35-0.8**	**WS2 1 D 0.0-0.2**	**WS2 2 D 0.4-0.4**
				Top Depth	**0.0**	**0.2**	**0.35**	**0.0**	**0.2**
				Bottom Depth	**0.2**	**0.35**	**0.8**	**0.2**	**0.4**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	AR			**9.8**	**7.7**	**5.6**	**10.0**	**7.8**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
pH

				SAL Reference	**161323 006**	**161323 007**	**161323 009**	**161323 011**	**161323 012**
				Customer Sample Reference	**WS2 3 D 0.4-1.0**	**WS2 4 D 1.1-1.5**	**WS3 2 D 0.4-0.7**	**WS4 1 D 0.0-0.15**	**WS4 2 D 0.15-0.5**
				Top Depth	**0.4**	**1.1**	**0.4**	**0.0**	**0.15**
				Bottom Depth	**1.0**	**1.5**	**0.7**	**0.15**	**0.5**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	AR			**7.9**	**7.8**	**7.7**	**7.9**	**6.9**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
pH

				SAL Reference	**161323 013**	**161323 015**	**161323 017**	**161323 019**	**161323 021**
				Customer Sample Reference	**WS4 3 D 1.0-1.2**	**WS5 2 D 0.3-0.6**	**WS6 1 D 0.05-0.35**	**WS6 3 D 0.7-1.0**	**WS7 1 D 0.0-0.35**
				Top Depth	**1.0**	**0.3**	**0.05**	**0.7**	**0.0**
				Bottom Depth	**1.2**	**0.6**	**0.35**	**1.0**	**0.35**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	AR			**5.9**	**7.0**	**9.4**	**5.3**	**9.6**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
pH

				SAL Reference	**161323 022**	**161323 025**	**161323 027**	**161323 029**
				Customer Sample Reference	**WS7 2 D 0.35-0.55**	**WS8 2 D 0.3-0.5**	**WS8 4 D 1.1-1.5**	**WS9 2 D 0.25-0.4**
				Top Depth	**0.35**	**0.3**	**1.1**	**0.25**
				Bottom Depth	**0.55**	**0.5**	**1.5**	**0.4**
				Type	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**				
pH	T7	AR			**7.7**	**7.5**	**7.6**	**8.3**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
Encia BRE Suite

				SAL Reference	**161323 001**	**161323 002**	**161323 003**	**161323 004**	**161323 006**	**161323 007**
				Customer Sample Reference	**WS1 1 D 0.0-0.2**	**WS1 2 D 0.2-0.35**	**WS1 3 D 0.35-0.8**	**WS2 1 D 0.0-0.2**	**WS2 3 D 0.4-1.0**	**WS2 4 D 1.1-1.5**
				Top Depth	**0.0**	**0.2**	**0.35**	**0.0**	**0.4**	**1.1**
				Bottom Depth	**0.2**	**0.35**	**0.8**	**0.2**	**1.0**	**1.5**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**						
Chloride (2:1)	T11	M40	0.5	mg/l	**43**	**41**	**29**	**32**	**22**	**28**
Magnesium water soluble	T6	AR	0.1	g/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (2:1)	T11	M40	0.5	mg/l	**12**	**29**	**18**	**14**	**5.0**	**9.0**
SO4(2:1)	T6	AR	0.1	g/l	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
Encia BRE Suite

				SAL Reference	**161323 009**	**161323 011**	**161323 012**	**161323 013**	**161323 015**	**161323 017**
				Customer Sample Reference	**WS3 2 D 0.4-0.7**	**WS4 1 D 0.0-0.15**	**WS4 2 D 0.15-0.5**	**WS4 3 D 1.0-1.2**	**WS5 2 D 0.3-0.6**	**WS6 1 D 0.05-0.35**
				Top Depth	**0.4**	**0.0**	**0.15**	**1.0**	**0.3**	**0.05**
				Bottom Depth	**0.7**	**0.15**	**0.5**	**1.2**	**0.6**	**0.35**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**						
Chloride (2:1)	T11	M40	0.5	mg/l	**38**	**34**	**37**	**28**	**27**	**44**
Magnesium water soluble	T6	AR	0.1	g/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (2:1)	T11	M40	0.5	mg/l	**10**	**9.0**	**6.0**	**21**	**18**	**6.0**
SO4(2:1)	T6	AR	0.1	g/l	<0.1	**0.2**	**0.1**	<0.1	<0.1	<0.1

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
Encia BRE Suite

				SAL Reference	**161323 019**	**161323 022**	**161323 025**	**161323 027**	**161323 029**
				Customer Sample Reference	**WS6 3 D 0.7-1.0**	**WS7 2 D 0.35-0.55**	**WS8 2 D 0.3-0.5**	**WS8 4 D 1.1-1.5**	**WS9 2 D 0.25-0.4**
				Top Depth	**0.7**	**0.35**	**0.3**	**1.1**	**0.25**
				Bottom Depth	**1.0**	**0.55**	**0.5**	**1.5**	**0.4**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Chloride (2:1)	T11	M40	0.5	mg/l	**22**	**22**	**42**	**31**	**32**
Magnesium water soluble	T6	AR	0.1	g/l	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (2:1)	T11	M40	0.5	mg/l	**12**	**6.0**	**11**	**6.0**	**11**
SO4(2:1)	T6	AR	0.1	g/l	<0.1	<0.1	**0.2**	<0.1	<0.1

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

				SAL Reference	**161323 031**
				Customer Sample Reference	**WS10 1 J&V 0.3-0.5**
				Top Depth	**0.3**
				Bottom Depth	**0.5**
				Type	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Acenaphthene	T207	M105	0.1	mg/kg	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	**0.2**
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	**0.2**
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	**0.3**
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1
Chrysene	T207	M105	0.1	mg/kg	**0.2**
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	**0.5**
Fluorene	T207	M105	0.1	mg/kg	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1
Naphthalene	T207	M105	0.1	mg/kg	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	**0.2**
Pyrene	T207	M105	0.1	mg/kg	**0.5**
PAH(total)	T207	M105	0.1	mg/kg	**2.1**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
TOC

SAL Reference	**161323 031**
Customer Sample Reference	**WS10 1 J&V 0.3-0.5**
Top Depth	**0.3**
Bottom Depth	**0.5**
Type	**Clay**

Determinand	Method	Test Sample	LOD	Units	
Total Organic Carbon	T21	M40	0.1	%	**1.5**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Soil Analysed as Soil
Total Petroleum Hydrocarbons CWG

SAL Reference	**161323 031**
Customer Sample Reference	**WS10 1 J&V 0.3-0.5**
Top Depth	**0.3**
Bottom Depth	**0.5**
Type	**Clay**

Determinand	Method	Test Sample	LOD	Units	
Benzene	T209	M105	10	µg/kg	<10
EthylBenzene	T209	M105	10	µg/kg	<10
M/P Xylene	T209	M105	10	µg/kg	<10
Methyl-tert-Butyl Ether	T209	M105	10	µg/kg	<10
O Xylene	T209	M105	10	µg/kg	<10
Toluene	T209	M105	10	µg/kg	<10
TPH (C5-C6 aliphatic)	T209	M105	0.100	mg/kg	<0.100
TPH (C6-C8 aliphatic)	T209	M105	0.100	mg/kg	<0.100
TPH (C8-C10 aliphatic)	T209	M105	0.100	mg/kg	<0.100
TPH (C10-C12 aliphatic)	T206	AR	1	mg/kg	<1
TPH (C12-C16 aliphatic)	T206	AR	2	mg/kg	<2
TPH (C16-C21 aliphatic)	T206	AR	1	mg/kg	<1
TPH (C21-C35 aliphatic)	T206	AR	4	mg/kg	**15**
TPH (C6-C7 aromatic)	T209	M105	0.100	mg/kg	<0.100
TPH (C7-C8 aromatic)	T209	M105	0.100	mg/kg	<0.100
TPH (C8-C10 aromatic)	T209	M105	0.100	mg/kg	<0.100
TPH (C10-C12 aromatic)	T206	AR	1	mg/kg	<1
TPH (C12-C16 aromatic)	T8	AR	1	mg/kg	<1
TPH (C16-C21 aromatic)	T206	AR	1	mg/kg	<1
TPH (C21-C35 aromatic)	T206	AR	1	mg/kg	**9**

SAL Reference: 161323
Project Site: Yews Place Kendray
Customer Reference: 9642

Leachate Analysed as Water
Encia pH and Metals

				SAL Reference	**161323 002**	**161323 004**	**161323 009**	**161323 011**	**161323 022**	**161323 029**
				Customer Sample Reference	**WS1 2 D 0.2-0.35**	**WS2 1 D 0.0-0.2**	**WS3 2 D 0.4-0.7**	**WS4 1 D 0.0-0.15**	**WS7 2 D 0.35-0.55**	**WS9 2 D 0.25-0.4**
				Top Depth	**0.2**	**0.0**	**0.4**	**0.0**	**0.35**	**0.25**
				Bottom Depth	**0.35**	**0.2**	**0.7**	**0.15**	**0.55**	**0.4**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**						
As (Dissolved)	T281	10:1	0.2	µg/l	**1.8**	**2.5**	**2.1**	**1.8**	**1.3**	**9.5**
Boron	T6	10:1	0.01	mg/l	**0.02**	**0.03**	**0.02**	**0.03**	**0.02**	**0.02**
Cd (Dissolved)	T281	10:1	0.02	µg/l	**0.03**	<0.02	**0.02**	**0.02**	**0.02**	<0.02
Cr (Dissolved)	T281	10:1	1	µg/l	<1	**5**	**1**	<1	**1**	**2**
Cu (Dissolved)	T281	10:1	0.5	µg/l	**6.7**	**2.0**	**2.1**	**2.4**	**1.3**	**0.9**
Pb (Dissolved)	T281	10:1	0.3	µg/l	**1.3**	**0.6**	**1.4**	**1.2**	**1.4**	**1.7**
Hg (Dissolved)	T281	10:1	0.05	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ni (Dissolved)	T281	10:1	1	µg/l	**1**	<1	<1	**1**	<1	<1
Se (Dissolved)	T281	10:1	0.5	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zn (Dissolved)	T281	10:1	2	µg/l	**3**	<2	**4**	**6**	**6**	**3**
pH	T7	10:1			**7.6**	**10.3**	**8.5**	**8.3**	**8.3**	**8.6**

Encia Job No.	9642
Site Name	Yews Place, Kendray
Engineer	ASw

Analytical Data			Mean Value Test			Outlier Test	
Material Type	Data (mg/kg)	Log Data	n	t	t value	T_{crit} 10%	T_{crit} V
Sub-Base	7.00	0.8451	2	6.3138			
	6.00	0.7782	3	2.9200			
	7.00	0.8451	4	2.3534	2.353	1.425	1.425
	5.00	0.6990	5	2.1318		1.602	
			6	2.0150		1.729	
			7	1.9432		1.828	
			8	1.8946		1.909	
			9	1.8595		1.977	
			10	1.8331		2.036	
			11	1.8125		2.088	
			12	1.7959		2.134	
			13	1.7823		2.176	
			14	1.7709		2.213	
			15	1.7613		2.248	
			16	1.7531		2.279	
			17	1.7459		2.309	
			18	1.7396		2.336	
			19	1.7341		2.361	
			20	1.7291		2.385	
			21	1.7247		2.408	
			22	1.7207		2.429	
			23	1.7171		2.449	
			24	1.7139		2.468	
			25	1.7109		2.486	
			26	1.7081		2.503	
			27	1.7056		2.520	
			28	1.7033		2.536	
			29	1.7011		2.551	
			30	1.6991		2.565	
			31	1.6973		2.579	
			32	1.6955		2.592	
			33	1.6939		2.605	
			34	1.6924		2.618	
			35	1.6909		2.630	
			36	1.6896		2.641	
			37	1.6883		2.652	
			38	1.6871		2.663	
			39	1.6860		2.674	
			40	1.6849		2.684	
			41	1.6839		2.694	
			42	1.6829		2.704	
			43	1.6820		2.713	
			44	1.6811		2.722	
			45	1.6802		2.731	
			46	1.6794		2.739	
			47	1.6787		2.748	
			48	1.6779		2.756	
			49	1.6772		2.764	
			50	1.6766		2.772	

Determinand:	Arsenic
No. of samples:	4
SGV:	20
t value:	2.353
mean (x):	6.25
st.dev (s):	0.96
95% ile:	7

Is the Mean Value Test Higher or Lower than the SGV?	
Higher or Lower	Lower

Y max:	0.845
Y mean:	0.792
Y st.dev.:	0.069
T value	0.767
Comparator	1.425

Maximum Value Test Result:	
Outlier Test?	Maximum is within a Normal Distribution

Outlier Values	Sample Number
32	WS9 at 0.25m to 0.4m depth
14	WS4 at 0.0 to 0.15m depth

Encia Job No.	9642
Site Name	Yews Place, Kendray
Engineer	ASw

Analytical Data			Mean Value Test			Outlier Test	
Material Type	Data (mg/kg)	Log Data	n	t	t value	T_{crit} 10 %	T_{crit} V
Sub-Base	7.00	0.8451	2	6.3138			
	6.00	0.7782	3	2.9200			
	14.00	1.1461	4	2.3534		1.425	
	7.00	0.8451	5	2.1318		1.602	
	5.00	0.6990	6	2.0150	2.015	1.729	1.729
	32.00	1.5051	7	1.9432		1.828	
			8	1.8946		1.909	
			9	1.8595		1.977	
			10	1.8331		2.036	
			11	1.8125		2.088	
			12	1.7959		2.134	
			13	1.7823		2.176	
			14	1.7709		2.213	
			15	1.7613		2.248	
			16	1.7531		2.279	
			17	1.7459		2.309	
			18	1.7396		2.336	
			19	1.7341		2.361	
			20	1.7291		2.385	
			21	1.7247		2.408	
			22	1.7207		2.429	
			23	1.7171		2.449	
			24	1.7139		2.468	
			25	1.7109		2.486	
			26	1.7081		2.503	
			27	1.7056		2.520	
			28	1.7033		2.536	
			29	1.7011		2.551	
			30	1.6991		2.565	
			31	1.6973		2.579	
			32	1.6955		2.592	
			33	1.6939		2.605	
			34	1.6924		2.618	
			35	1.6909		2.630	
			36	1.6896		2.641	
			37	1.6883		2.652	
			38	1.6871		2.663	
			39	1.6860		2.674	
			40	1.6849		2.684	
			41	1.6839		2.694	
			42	1.6829		2.704	
			43	1.6820		2.713	
			44	1.6811		2.722	
			45	1.6802		2.731	
			46	1.6794		2.739	
			47	1.6787		2.748	
			48	1.6779		2.756	
			49	1.6772		2.764	
			50	1.6766		2.772	

Determinand:	Arsenic
No. of samples:	6
SGV:	20
t value:	2.015
mean (x):	11.83
st.dev (s):	10.38
95% ile:	20

Is the Mean Value Test Higher or Lower than the SGV?	
Higher or Lower	Lower
Y max:	1.505
Y mean:	0.970
Y st.dev.:	0.303
T value	1.767
Comparator	1.729

Maximum Value Test Result:	
Outlier Test?	Maximum is an Outlier

Outlier Values	Sample Number

TPH Assessment (Step 3 - Consideration of cumulative effects).

04a Residential development with gardens - no cover or 300mm cover

Site: Yews Place, Kendray **Job no.** 9642

Client: Keepmoat Homes **Source:** Fuel Storage Tank

TPH Fraction	Max site conc - mg/kg (in source area)	Hazard Quotient (HQ)
Aliphatic		
C5-C6	0.10	0.001
C6-C8	0.10	0.000
C8-C10	0.10	0.002
C10-C12	1.00	0.000
C12-C16	2.00	0.000
C16-C21	1.00	0.000
C21-C35	15.00	0.000
Aromatic		
C5-C7	0.10	0.006
C7-C8	0.10	0.003
C8-C10	0.10	0.002
C10-C12	1.00	0.003
C12-C16	1.00	0.002
C16-C21	1.00	0.002
C21-C35	9.00	0.016
	Hazard Index	**0.04**

Site: **Job no.**

Client: **Source:**

TPH Fraction	Max site conc - mg/kg (in source area)	Hazard Quotient (HQ)
Aliphatic		
C5-C6		0.000
C6-C8		0.000
C8-C10		0.000
C10-C12		0.000
C12-C16		0.000
C16-C21		0.000
C21-C35		0.000
Aromatic		
C5-C7		0.000
C7-C8		0.000
C8-C10		0.000
C10-C12		0.000
C12-C16		0.000
C16-C21		0.000
C21-C35		0.000
	Hazard Index	**0.00**

The Hazard Index has been calculated based in the actual targets derived by RISC. No amendment has been incorporated for odour or asthetics as the HI is concerned solely with toxicity.