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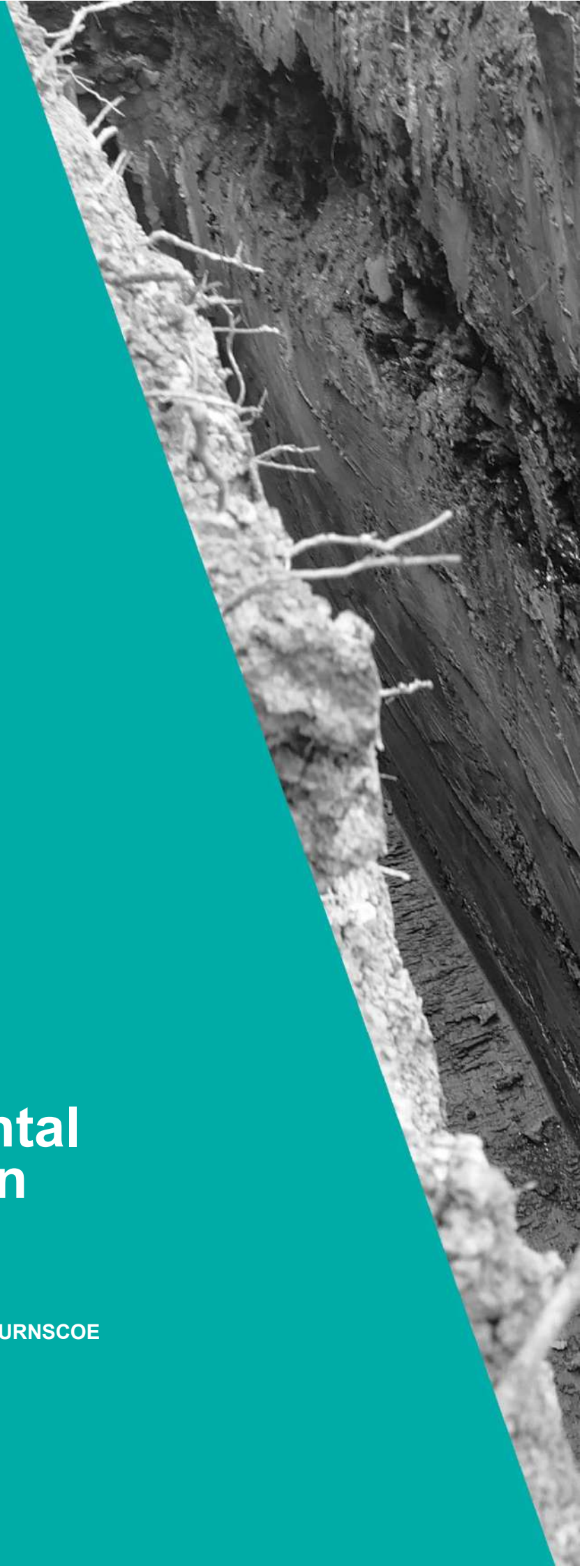

Geotechnical & Geo-Environmental Site Investigation

LAND OFF THURNSCOE BRIDGE LANE, THURNSCOE

AVANT HOMES

10 SEPTEMBER 2024

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GEOTECHNICAL AND GEO-ENVIRONMENTAL SITE INVESTIGATION

LAND OFF THURNSCOE BRIDGE ROAD, THURNSCOE

FOR

AVANT HOMES

ISSUE 2

48926-ECE-XX-XX-RP-C-0002 **10 SEPTEMBER 2024**

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FOR

AVANT HOMES

ISSUE 2

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Kate Edwards
Technical Director

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1.0 EXECUTIVE SUMMARY

1. The 13.7 ha site is located on the west side of Thurnscoe Bridge Lane in Thurnscoe. The southwestern triangular portion of the site (~3.7 ha) is proposed to be utilised for surface water attenuation; the remainder of the site which is separated from this parcel by a former railway line/embankment is to feature the housing development.

2. The proposed residential site is currently an agricultural field and has not been developed previously. A former railway embankment is present on the southern side of the field, up to 4 m tall. Waterlogged ground was noted at the base of this embankment in the south of the field.

3. The northern field generally slopes to the south at a gradient of around 1 in 10 to 1 in 14, with the western quarter sloping to west at a gradient of around 1 in 6.

4. Thurnscoe Dike runs along the southern boundary of the southern field. A second drainage ditch is present on the western site boundary.

5. The solid geology beneath the site is expected to comprise strata of the Pennine Middle Coal Measures (i.e., interbedded mudstone, siltstone and sandstone with coal seams) in the south and northwest of the site and Ackworth Rock (sandstone) of the Pennine Upper Coal Measures in the north and east. Superficial alluvium is shown to underlie the southeastern corner of the southern parcel.

6. Although no evidence of underground workings was encountered in the Highgate opencast, indicating underground workings are not present in this seam below the development site, underground workings in the Shafton coal seam are recorded at around 30 m depth. An inspection of the natural ground surface should be undertaken to determine if unrecorded mining features are present. Such features will need to be treated, if encountered.

7. Thirty-two trial pits were undertaken across the proposed residential site. The ground conditions here comprise around 300 mm of topsoil over natural firm to stiff clay below the southern third of the field, and sand or interbedded sand and clay below the remainder. Sandstone bedrock was encountered below most of the trial pits undertaken on higher ground, with mudstone or siltstone generally encountered below the southern third of the field, as well as in a localised area in the northwest. Coal was locally encountered in the south east of the parcel.

8. The only evidence of made ground was encountered in one of the monitoring wells, MW09, installed within the former opencast in the southern parcel. This borehole recorded 5.9 m of cohesive fill.

9. Groundwater was encountered between ~0.9 and 2.9 m bgl in the exploratory holes, and in the upper 1 m in MW01 and MW02. A potential spring line was encountered in TP08 at 1.5m bgl leading to a rapid ingress of groundwater. Groundwater control should be allowed for, particularly in deeper excavations.

10. Given the slopes within the northern field, regrading of ground levels is likely to be required, and tanking, underbuild and retaining walls should be allowed for.

11. The former railway embankment in the south of the northern parcel is expected to remain as it is as part of the proposed development. At this stage any plots should be located at least 10 m from the base of this slope. Consideration will need to be given to ensure that the slopes are not destabilised during any construction works.

12. The most suitable foundations for the site are considered to be strip or trench fill footings, taken onto natural non-desiccated firm to stiff clay at a minimum depth of 900 mm, or 600 mm where non-shrinkable sand is present.

13. Where foundations are within influencing distance of past, present or proposed trees in or over cohesive ground, the footing depth will need to be increased in accordance with the NHBC Standards. Precautions against soil heave are required where the footing depth exceeds 1,500 mm due to tree influence.

14. A water main runs northwest-southeast through the centre-west of the site; its actual position is unknown. Foul water and combined sewers are also present in the west of the site..

15. Shallow bedrock which became difficult to excavate was located in a number of the northern exploratory holes.

16. Six infiltration tests were undertaken. Soakaway drainage is not a viable means of surface water drainage.

17. No radon measures are considered necessary. A gas and groundwater monitoring programme has been carried out, with groundwater ongoing. Results indicate no ground gas precautions are necessary.

18. The topsoil and natural ground are considered chemically suitable for re-use in the development.

19. Glass fragments were noted in the topsoil in TP01; brick and pottery fragments were also noted in the topsoil in nearby trial pits, potentially associated with cross-contamination from a nearby footpath. During site clearance a visual inspection should be undertaken to determine how widespread these fragments are, and any significantly sized visible fragments should be removed. The topsoil could then be considered physically suitable for re-use.

20. A shallow coal seam may be present in the southeast of the northern field. Should the coal outcrop be identified to remain near finished ground level, a 1 m clean capping should be provided.

21. Cohesive fill was encountered in MW09 to a depth of 5.9 m. This material should not be brought onto the residential development unless additional chemical testing is undertaken to show it is suitable for re-use.

22. DS-1 AC-1 sulphate precautions are required for concrete in contact with natural sand, clay and sandstone. DS-2 AC-2 measures are recommended for concrete in contact with mudstone. Additional sulphate testing is being undertaken on the opencast backfill. Should coal be encountered within the foundations, the level of sulphate measures should also be increased, with DS-3 AC-3 recommended.

23. The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies, such as the Local Authority, and any warranty provider.

2.0 INTRODUCTION

2.1 Terms of Reference

This report presents the findings of a Geotechnical and Geo-environmental Site Investigation carried out by Eastwood Consulting Engineers for Avant Homes. Any other parties using the information in this report do so at their own risk and any duty of care is excluded.

2.2 Context

A site investigation was previously completed by ID Geo in 2022. This report has been provided by Avant and reviewed as part of this investigation although we understand Avant Homes do not have reliance on this report.

2.3 Aims and Objectives

The aims and objectives of this additional investigation were as follows;

- To assimilate and review information extracted from published documentation, past reports and a site walkover to derive an outline conceptual model identifying potential contaminants, pathways and receptors, as well as possible linkages between these;
- Detail the ground conditions and their geotechnical properties enabling outline foundation proposals to be made for the proposed residential development;
- Undertake chemical testing enabling refinement and subsequent further testing of the conceptual model;
- Carry out a tiered risk assessment to establish the likely risks to future receptors, involving the use of generic assessment criteria and, where unacceptable risks are identified, site specific assessment criteria within a detailed quantitative risk assessment;
- Identify feasible remediation options if unacceptable risks are highlighted; and
- Develop an appropriate remediation strategy if required.

2.4 Scope of Investigation

This document is split into two sections. These constitute the findings of the Phase 1 and Phase 2 investigations, consecutively.

2.4.1 Phase 1

The Phase 1 investigation involved a review of information extracted from published documentation as well as that obtained from a site reconnaissance. Information regarding the current and former land uses both on and surrounding the site, as well as the environmental sensitivity of the site location as determined by factors including geology, hydrogeology and hydrology have been examined.

Information analysed in this section of the report has been obtained from a variety of sources and included the following:

- Landmark Envirocheck;
- Consultants Coal Mining Report;
- Geological Maps and Associated Geological Memoirs; and
- A site walkover.

2.4.2 Phase 2

This part of the investigation consisted of intrusive works and laboratory analysis. The findings were used to test the conceptual model and produce a final risk assessment. The intrusive works comprised trial pits and rotary boreholes which were undertaken to enable:

- Examination of the shallow ground conditions;
- In situ description of soils, enabling any localised lateral and vertical changes in soil conditions to be logged;
- Assessment of any contamination identified using visual and olfactory methods;
- Collection of soil samples for chemical and geotechnical testing;
- Infiltration testing; and
- Installation of gas and groundwater monitoring wells

2.5 Limitations of Investigation

This report is based on the assumption that the site will be developed with residential properties, each with private gardens and areas of hardstanding. The dwellings will be of conventional

construction and will be three storeys or less in height. If this is not the case, then the advice given in this report may not be appropriate.

Where assessments of site areas affected in particular ways are given, these are approximate. All information, comments and opinions given in this report are based on the ground conditions encountered during the site work, on the results of laboratory testing carried out as part of the investigation and information gained from a geological and historical desk study. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata and water conditions between or below investigation points. It should be noted that groundwater levels vary due to seasonal or other effects, and may at times differ from those measured during the investigation.

This report considers the ground and groundwater and does not cover any buildings or their fabric or the constituents of any existing hardstanding materials. Generally, testing has only been carried out for contaminants identified as potentially present with no assessment made of biological contamination. Risks to ecological receptors, such as bats, have not been considered.

3.0 THE SITE

3.1 Description

The 13.7 ha site is located on the west side of Thurnscoe Bridge Lane in Thurnscoe, centred on grid reference 445320, 404850. The southwestern triangular portion of the site (~3.7 ha) is proposed to be utilised for surface water attenuation; the remainder of the site is to feature the housing development.

The site is covered by topsoil and the stems of a crop which has been harvested; mature trees and bushes are present around the eastern, western and southern boundary of the northern field.

A steep embankment approximately 4 m high with a heavily overgrown footpath along the top is present along the east of the southern boundary of the northern field, merging into the cutting for the former railway line in the west of the site. Further west, the cutting becomes an embankment, around 2.5 m tall.

An approximately 1.5 m wide and 0.5 m deep drainage ditch (Thurnscoe Dike) is present along the southeastern boundary of the site. This heavily vegetated ditch was not observed to contain any water in May 2024. A ditch is also present on the western boundary of the southern field, around 1.0 to 2.5 m deeper than the site.

Waterlogged ground was noted in the south of the northern field, at the base of the embankment.

The northern part of the site appears relatively level, forming a plateau which is ~11 m higher than the south of the site. Ground levels slope down to the south or south west at around 1 in 6 at their steepest, but commonly at around 1 in 10 to 1 in 14.

The topographically highest point of the site lies at around 46.8 m AOD, located in the centre-north west, whilst the lowest point is considered to be the site's south western corner lying at around 26.5 m AOD.

The site is bordered by fields to the west and south and houses to the north. Thurnscoe Bridge Lane runs along the eastern boundary. A scrap yard is present to the south of the site on the opposite side of the railway embankment.

Additionally, a number of concrete capped manhole chambers were noted in the west of the site in both the northern and southern fields. These appear to follow the route of a combined sewer that runs below the west of the site. Additionally, a water main crosses the centre of the northern field.

The appended Exploratory Hole Location Plan shows some of the features described.

3.2 History

Historical Ordnance Survey maps obtained as part of the Envirocheck have been studied to assess the previous use of the site. Copies of the maps are presented in Appendix 1.

3.2.1 The Site

The earliest map viewed, dated 1854, shows the site to comprise of agricultural fields. Thurnscoe Bridge Line borders the site in the east whilst Thurnscoe Dike borders the far southern site boundary. By the 1890s, a number of possible ponds are shown on the southern and western boundary of the southern parcel, associated with the Thurnscoe Dike and incoming drainage channel present on the site's western boundary. Most of the features are later shown as small clusters of woodland.

By 1906, a railway line cuts through the site on a raised embankment. Between 1956 and 1966, the Thurnscoe Dike appears to have been realigned in a straighter orientation, with the two southern possible pond features now no longer shown. An abandonment plan (reference NE344) obtained from the Coal Authority shows an area of opencast extended onto the south west of the site. The plan notes the age of the workings to be 1956 and 1957, with the area reinstated by 1958.

The 1983 map shows the railway lines as being dismantled. The site has remained relatively unchanged, although the 2000 and 2006 maps show an annotation of 'miniature rifle range' on the central third of the northern parcel.

3.2.2 The Surrounding Area

The earliest map, dated 1854, shows the surrounding land to be dominated by agricultural land. Thurnscoe Hall is located around 250 m north of the site.

By 1894 the Midland and North Eastern Railway is shown around 80 m east of the site. Highgate Colliery is shown 250 m east of the site by 1931.

By 1956 a greyhound stadium is shown as being present 50 m south of the site, beyond the railway embankment and Thurnscoe Dike. The 1966 map shows a new housing estate extends up to the northern boundary, with a second estate extending up to within 50 m of the site's north western corner by the early 1990s. By this time Highgate Colliery has been replaced with an industrial estate.

The greyhound track is shown to still be a greyhound track by 1999, however, it is presently a scrap yard.

The area remains relatively unchanged to the present.

3.3 Geology

The geological map sheets SE40SE (1:10,000 scale), SE40NE (1:10,000 scale) Yorkshire 275SE (1:10,560 scale), the British Geological Survey (BGS) Online Viewer and Coal Authority Interactive Map have been consulted.

The solid geology beneath the site is expected to comprise strata of the Pennine Middle Coal Measures (i.e., interbedded mudstone, siltstone and sandstone with coal seams) in the south and northwest of the site and Ackworth Rock (sandstone) of the Pennine Upper Coal Measures in the north and east.

Superficial alluvium is shown to underlie the southeastern corner of the southern parcel.

The strata are annotated to dip at around 3 to 4 degrees to the north-northwest.

The Highgate coal seam is conjectured to outcrop in the southeastern corner of the southern parcel of the site, and has been open casted below this parcel just north of the outcrop.

The railway embankment which divides the two parcels is shown as ‘made ground’.

3.4 Hydrogeology

The underlying bedrock, as well as the superficial deposits which may extend onto the south of the attenuation area, are classified as a Secondary A Aquifer comprising permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

There are no groundwater abstractions within 1 km of the site.

3.5 Hydrology

The Envirocheck records the nearest surface water feature, Thurnscoe Dike, to run along the southern boundary of the site. A drainage ditch is also shown flowing south along the site’s western boundary.

Information within the Envirocheck states that the site does not lie within a Groundwater Source Protection Zone.

3.6 Coal Mining

The nearest outcropping coal seam is conjectured to be the Highgate coal which is conjectured to outcrop within the southeastern corner of the southern parcel, and dip to the northwest below the site. The stratigraphic column notes the seam is around 0.5 m thick.

According to the geological maps, the next shallowest coal seam is the Shafton coal which is conjectured to outcrop 800 m south of the site. In nearby Highgate Colliery, the Shafton is logged to lie around 29 m below the Highgate coal. The seam is noted on the stratigraphic column to be between 1.0 and 1.9 m thick, and in nearby shaft sinkings to be ~1.5 m thick. At this thickness, and since the seam is expected to lie at least 25 m below the site, workings within the Shafton coal seam are not considered to pose a significant risk to the proposed development.

A Coal Authority Consultants Mining Report has been obtained for the site, and is included within the Appendix.

The report states that the site is within the likely zone of influence from recorded workings in six seams of coal (Shafton, Newhill, Meltonfield, Top Hard Barnsley, Parkgate and Silkstone), at depths of between 27 and 828 m bgl. The last recorded date of mining was 1990 in the Silkstone coal seam.

The report states that there are no probable unrecorded shallow workings within the area and no spine roadways are recorded at shallow depth.

No mine entries are recorded within 100 m of the site.

The report shows the Highgate coal seam is conjectured to outcrop in the very south of the southern parcel and a number of unlicenced opencast coal sites located within the southern field.

There are no Coal Authority tips recorded within 500 m of the site and no records of any mine gas emissions or mine water treatment schemes within 500 m of the site.

Three abandonment plans for workings below the site have been purchased and are included in Appendix 1.

- NE344: opencast workings within the Highgate coal which extends onto the southern field. The seam is 0.45 m thick and no underground workings were encountered. The opencast was in operation in 1956 and 1957, and site levels were reinstated in 1958;

- 16528 SE4404 & SE4405: underground workings in the Shafton coal. Localised patches of workings are shown in the east, south and west of the northern field, as well as below most of the southern field. The seam contours show the seam to dip to the north west, lying at around 1 to 2 m AOD in the southeast of the northern field (equivalent to around 32.5 m depth), dipping to around -20 m AOD in the site's western corner (equivalent to around 52 m depth). The coal seam is recorded to be around 1.6 m thick.

The Coal Authority has received two damage notices or claims for properties or addresses within 50m of the site boundary. No information is given regarding the outcome of these claims.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

The property is not within an area where the Coal Authority has plans to grant a license to remove coal by underground methods.

The property is in an area where notices to withdraw support was given in 1946, 1977, 1980, 1982, 1983 and 1986. The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Risk Assessment

Based on the information from the geological maps and Coal Authority Report, the shallowest coal seam expected to be present beneath the proposed development is the Highgate coal seam, which is conjectured to outcrop within the south of the southern field and be present at shallow depth in the southern half of the site. Assuming a dip angle of 3° and accounting for local topography, the Highgate coal seam is expected to underlie the south of the northern field in the upper ~5 m, and deepening to around 25 m below the north of the site.

The workings within the Shafton seam are expected to be present at depths greater than 30 m below the northern field. With an expected seam thickness of 1.6 m, any workings would require at least 16 m of competent rock cover for drilling and grouting to not be necessary. Since the seam lies at a depth of at least 29 m, no treatment of workings should be considered to be necessary for the proposed residential area.

Given that workings are recorded below the site at 'shallow' i.e. ~30 m depth, the presence of unrecorded mine entries cannot be discounted. Such features will need to be treated if encountered.

3.7 Ground Gas

The site is indicated to be in lower and intermediate probability radon areas meaning that the site is in an area where up to 3% of homes are at or above the action level. No radon protective measures are therefore necessary in the construction of new dwellings or extensions.

The majority of the site is Greenfield, therefore there is not expected to be a significant thickness of made ground which poses a gas risk to the proposed residential development. The proposed attenuation area may have once featured small localised ponds adjacent to the watercourse, however these are not expected to pose a significant gas risk due to their small size. There are also no houses proposed within 150 m or so of the possible ponds.

Coal workings are expected at a depth of at least 30 m however, they are expected to be overlain by relatively impermeable mudstone which should hinder gas migration. The Ackworth Rock sandstone which underlies the northern field is not expected to extend down to the workings, therefore if fractures in the sandstone are present they should not act as pathways for mine gas migration.

Within the proposed attenuation area lies an area of opencast; the Coal Authority plan notes this opencast, which was backfilled in 1958, is around 3 to 12 m deep where it extends below the site. The opencast extends offsite to the west, and there is also an area of opencast around 100 m south of the site, beyond the Thurnscoe Dike. Given that the backfill has been in place for at least 65 years, and since no housing is proposed overlying the backfill, no significant gas risk is expected to be posed. However, monitoring wells are recommended to confirm this.

The Envirocheck does not record any landfill sites within 500 m of the site but does record three infilled features within 250 m of the site:

Distance (m) and Direction	Notes
91 m E	Section of Thurnscoe Dike, infilled when Highgate Colliery expanded in the 1950s
135 m E	Former Highgate Colliery land; occupied by an industrial estate since the 1990s
220 m NE	Pond in the grounds of Thurnscoe Hall; backfilled when housing estate was constructed in the 1960s

Given their small size and age, these infilled features are not considered to pose a risk to the proposed development.

In summary, the only source of gas is expected to be the opencast areas to the south of the site.

3.8 Pollution Incidents to Controlled Waters

The Envirocheck lists nine pollution incidents within 250 m of the site, with six being classified as Category 2 – Significant Incidents. The closest occurred 9 m south of the site in 1992 where animal waste/slurry entered a freshwater river or stream, assumed to be Thurnscoe Dike. The pollution incidents are summarised in the below table.

Distance from Site m (Direction)	Pollutant	Date	Category
9 (S)	Animal Waste/Slurry	27 July 1992	2
41 (W)	Sewage	13th May 1998	2
69 (SE)	Sewage	4 January 1996	3
104 (S)	Cement/Mortar	26 March 1992	3
109 (S)	Mud/Clay/Soil	18 March 1992	3
126 (N)	Sewage	12 August 1992	2
143 (SE)	Unknown	17 July 1992	2
201 (SE)	Coal solids	15 October 1992	2
232 (SE)	Mining water	26 November 1996	2

3.9 Local Authority Pollution Prevention and Controls

The Envirocheck does not list any controls within 250 m of the site.

3.10 Discharge Consents

The Envirocheck lists five discharge consents 250 m of the site, all relating to discharge into a Thurnscoe Dike tributary. The closest is located 1 m west of the site for a storm tank. The next is located 22 m northwest of the site for the discharge of screened sewage. The third is located 42 m west of the site for storm tank sewage discharge whilst the fourth is located 129 m north for mine water discharge. The final discharge consent is located 139 m north of the site and is for the discharge from mineral workings.

3.11 Flooding

The site lies within Flood Zone 1 with the exception of the southern boundary of the southern parcel which is shown to be in Flood Zone 2 and 3.

The northern half of the northern parcel is shown to have limited potential for groundwater flooding to occur. The southwestern corner of the southwestern parcel is shown to have potential for groundwater flooding at the surface.

The majority of the site is not shown to be at risk from surface water flooding with the exception of the southern boundary of the northern and southern parcels, the southeastern corner of the southern parcel and a narrow strip through the east of the northern parcel which are shown to be at low-medium risk of flooding from surface water.

3.12 Soil Geochemistry

The Envirocheck estimates the following concentrations of arsenic, cadmium, chromium, nickel and lead to be present in the natural soil at the site. These have been compared to the appropriate assessment value protective of residential human health receptors with home-grown produce.

Contaminant	Estimated Concentration (mg/kg)	Assessment Value (mg/kg)
Arsenic	<15 to 25	37
Cadmium	<1.8	11
Chromium	60 to 90	910
Lead	<100	200
Nickel	15 to 45	180

Given the above, no naturally elevated concentrations of metals/metalloids are anticipated.

3.13 Contemporary Trade Directory Entries and Fuel Station Entries

There are 8 contemporary trade directory entries within 250 m of the site, of which 5 are active and relate to a scrap metal merchants 162 m south of the site, air conditioning and refrigeration contractors 177 m east of the site, a support services 215 m east, a PCV-U manufacturer 226 m east and a concrete and mortar manufacturers 181 m east of the site. None of these entries are expected to pose a significant risk of contamination migration onto site.

There are no petrol stations within 250 m of the site.

4.0 OUTLINE CONCEPTUAL MODEL

It is proposed that the site will be developed with residential properties with private gardens and associated infrastructure.

4.1 Potential Sources of Contamination

Historically, the site has predominantly been agricultural land and has remained unchanged to the present day. An area of backfilled opencast workings is recorded by the Coal Authority to underlie the proposed attenuation area.

Any made ground which may present on the site may contain elevated concentrations of metals/metalloids, polycyclic aromatic hydrocarbons (PAHs), asbestos fibres and sulphates.

Given the close proximity of a railway line, there may be ashy atmospheric fall out in near surface soils.

4.2 Ground Gas

Radon precautions are not required.

The desk study identifies an area of backfilled opencast extending onto the site from the south. This source poses a low risk of gas generation, however a programme of gas monitoring is recommended to confirm the level of gas measures required for the proposed residential development.

4.3 Potential Pollutant Linkages

The following table details the possible sources and associated contaminants of concern, pathways and receptors, highlighted by the Phase 1 as potentially present.

Source	Potential Contaminants	Potential Pathways	Potential Receptors
Made ground (if present)	Heavy metals/metalloids Asbestos PAHs Asbestos	Ingestion Inhalation Direct contact Biological uptake Migration through ground	Site residents and visitors to the site Site construction workers Secondary A Aquifer Plants Water supply pipes
Made or natural ground	Sulphates Low pH	Direct contact	Below ground concrete
Opencast workings and infilled ground	Ground gas and mine gas	Migration through ground	Site residents and visitors Construction workers Buildings

5.0 GROUND INVESTIGATION

5.1 Site Works

ECE visited site on 16 to 18 April 2024 and excavated thirty-two trial pits, TP01 to TP32, across the site to determine the shallow ground conditions. The trial pits reached depths of between 0.9 and 4.2 m below ground level (bgl).

Six of the trial pits, TP01, TP03, TP18, TP26, TP28 and TP30 were used for infiltration testing. The soakaway pits reached depths of between 1.3 and 2.6 m.

Ten no. rotary boreholes (MW1 to MW10) were carried out to depths of 3 and 6 m to allow for gas and groundwater monitoring wells to be installed.

Copies of the trial pit and rotary borehole logs are presented in Appendix 2, and their locations are plotted on the Exploratory Hole Location Plan also in Appendix 2.

Ten ground gas and groundwater monitoring wells were installed across the site and a period of monitoring is underway. This has so far comprised of seven visits for gas and groundwater monitoring; a further seven monthly visits for groundwater monitoring will follow.

5.2 Laboratory Testing

Six samples of natural clay and three samples of natural mudstone were sent for plasticity testing to Professional Soils Laboratory in Doncaster. Laboratory testing results are presented in Appendix 3 and discussed further in Section 7.0.

29 samples of topsoil and 16 of natural ground were despatched for chemical testing. Additionally, one sample of a dark mudstone and three samples of cohesive fill material were dispatched for sulphate testing. Soil samples were taken in 1 kg plastic tubs and 250 ml amber glass jars and analysed at i2 analytical, using MCERTs accredited methodologies where available. Laboratory testing results are presented in Appendix 4 and discussed further in Section 8.0.

6.0 GROUND CONDITIONS

6.1 Surface Covering

The entirety of the site is surfaced by topsoil between 0.25 and 0.4 m which was generally comprised of slightly gravelly sandy clay to a slightly gravelly clayey sand with gravel of sandstone, mudstone and coal.

Brick fragments were encountered in a number of the northern most trial pits, closest to the residential developments north of the site. Additionally, TP01 found glass within the topsoil and TP06 encountered fragments of pottery.

6.2 Made Ground

No made ground was encountered in any of the trial pits.

Soft sandy clay 'fill' was encountered in MW09 down to 5.9 m. This is likely associated with the backfilled opencast workings.

6.3 Natural Ground

Natural ground was encountered in all of the exploratory holes, comprising firm to stiff slightly gravelly sandy clay and slightly gravelly clayey sands underlain by mudstone and sandstone below depths of 0.8 to 2.4 m bgl.

Sandstone was encountered in the north and northeast of the site with mudstone encountered in the south and northwest of the site. The presence of sandstone correlates with the geological mapped position of the Ackworth Rock.

A dark grey mudstone was encountered in three trial pits (TP21, TP23 and TP30) at depths between 1.3 and 2.0 m bgl.

A black shaley mudstone/coal containing possible pyrite was recovered from TP11 below 3.5 m; based on the depth this material is believed to be the Highgate coal seam. The trial pit terminated in this seam.

The majority of the rotary boreholes encountered clay from near surface up to depths of 2.1 m bgl, underlain by mudstone, siltstone and sandstone. A dark shale was encountered in MW05 and MW07 at 2.0 and 1.7 m bgl respectively. A black siltstone/coal band 0.4 m thick encountered in MW04 at 5.2 m.

6.4 Groundwater

Groundwater was encountered in a number of exploratory holes from depths of between 1.2 and 2.9 m. The ingresses were mainly concentrated in the eastern third of the site, with a few noted in the far north and south west of the northern field. In the eastern pits, a rapid ingress was noted at 1.5 m within the sandstone in TP08; two other pits nearby also recorded water at around 1.4 to 2.2 m within the sandstone. Further to the east, water was noted in TP02 at 2.2 m within clay and mudstone strata. This could be indicative of a possible spring located near TP08, emerging near the sandstone/mudstone interface.

Groundwater was not encountered in any of the boreholes during drilling. The results recorded to date are summarised in the below table.

Monitoring Well	Depth to Water (m bgl)							Depth to Base of Well (m bgl)
	25.04.24	13.05.24	29.05.24	13.06.24	27.06.24	19.07.24	05.08.24	
MW01	0.96	1.12	1.01	1.26	1.46	1.79	2.12	~2.9
MW02	0.76	0.82	1.31	1.65	1.96	1.95	2.08	~2.5
MW03	1.93	1.92	1.18	1.57	1.46	1.61	1.66	~2.8
MW04	5.41	5.5	5.42	5.27	5.32	5.52	WAB	~5.7
MW05	5.37	5.48	5.61	5.64	5.18	5.72	WAB	~5.85
MW06	WAB	Dry	5.04	5.16	5.22	5.32	5.66	~5.7
MW07	WAB	WAB	5.41	4.73	4.55	4.8	4.87	~5.8
MW08	4.68	5.21	5.05	5.24	5.34	5.62	5.52	~5.7
MW09	3.05	3.09	3.54	3.62	4.38	3.83	3.88	~5.9
MW10	4.92	5.06	4.69	4.85	4.62	5.23	5.45	~5.8

Wells MW01, MW02 and MW09 were bailed during the first visit and took between 1 hour and 2.5 hours to recharge. On the third visit, MW01, MW02, MW03 and MW09 were bailed and recharge times were a lot slower for MW01 (took over 3 hours to recharge ~1 m head of water), MW02 (3 hour recharge) and MW03 (2 hours to recharge ~0.3 m). MW09 however recharged just as quickly, in less than 1 hour. On the seventh round, MW03 recharged in 45 minutes whilst MW09 recharged in 2 hours.

A fluctuating water is evident. Wells MW01 and MW02 recorded up to 1.3 m difference in water depth between April and August 2024. In MW07, there is also a 1.3 m difference in water level; other wells recorded between 0.4 and 0.75 m fluctuation. These narrower fluctuations occurred in

May and June, indicating they could be related to localised weather events rather than a widespread fluctuation in groundwater table.

Within the southern field, water was encountered from around 3.1 to 5.5 m depth, and groundwater levels fluctuated by around 0.8 to 1.3 m over the last 4 months.

7.0 GEOTECHNICAL APPRAISAL

It is proposed that the site will be developed with residential properties of conventional construction with private gardens and associated infrastructure.

Within the proposed residential area, the ground conditions comprise around 300 mm of topsoil over natural firm to stiff clay below the southern third of the field, and sand or interbedded sand and clay below the remainder. Sandstone bedrock was encountered below most of the trial pits undertaken on higher ground, with mudstone or siltstone generally encountered below the southern third of the field, as well as in a localised area in the northwest. Coal was locally encountered in the south east of the parcel.

Below the proposed attenuation area, an area of backfilled opencast workings extends onto site; one of the monitoring well boreholes recorded up to 5.9 m of cohesive fill.

Groundwater ingresses were noted in the upper 2 m of a number of exploratory holes in the north, east and south of the northern field. Additionally, TP08 encountered a potential spring at 1.5 m bgl leading to a rapid ingress of groundwater.

Given the slopes within the northern field, regrading of ground levels is likely to be required, and tanking, underbuild and retaining walls should be allowed for.

The former railway embankment in the south of the northern parcel is expected to remain as it is as part of the proposed development. At this stage any plots should be located at least 10 m from the base of this slope. Consideration will need to be given to ensure that the slopes are not destabilised during any construction works.

The Party Wall Act will need to be considered for structures associated with neighbouring properties along the site boundaries.

Although no evidence of underground workings was encountered in the Highgate opencast, indicating underground workings are not present below the development site, an inspection of the natural ground surface should be undertaken to determine if unrecorded mining features are present. Such features will need to be treated, if encountered.

Atterberg Testing

Six samples of natural clay and three samples of natural mudstone were sent for plasticity testing to Professional Soils Laboratory. The results are appended (Appendix 3).

Two samples of mudstone from TP03 2.1 m and TP18 2.3 m were recorded as non-plastic. The third mudstone sample from TP26 1.7 m recorded a modified plasticity index of 22.7% which equates to medium (20 to 40%) volume change potential in accordance with NHBC Standards.

Five of the samples of natural clay recorded modified plasticity indices of between 20.9 and 38% equating to medium volume change potential. One sample of clay from TP29 recorded a modified plasticity index of 14.7% which equates to low volume change potential.

Therefore, the cohesive ground can be considered to be of medium volume change potential.

Hand Vane Readings

Hand vane tests were conducted within natural clay in nine trial pits, recording values between 73 and 149 kPa which ranges from firm (40 to 75kPa) to stiff (75 to 150kPa). Only two tests recorded shear strengths below 75 kPa; TP20 and TP31 both recorded shear strengths of 73 kPa which is just below the limit for stiff clay.

Tests were often unable to be completed in other trial pits due to the high sand content.

7.1 Foundations

A bearing capacity of around 125 kN/m² is considered appropriate for the natural weathered soils, increasing to at least 200 kN/m² for the sandstone and mudstone bedrock.

For the proposed low-rise housing scheme, the most suitable foundations for the site are considered to be strip or trench fill footings, taken through any topsoil, made or soft/loose ground onto natural non-desiccated firm to stiff clay at a minimum depth of 900 mm below existing or proposed ground level, whichever is the lower.

Where natural sand or non-shrinkable bedrock is present at shallow depth, the minimum footing depth could be reduced to 600 mm, although footings may need to be locally deepened should they lie in close proximity to retaining walls or drainage runs.

Where coal or coal-rich soils are encountered in foundation trenches, these should be blinded using a lean mix of concrete. If coal is present in the base of foundation trenches, then the footing should be deepened through the coal until competent ground is present.

Where foundations are within influencing distance of past, present or proposed trees in or over cohesive ground, the footing depth will need to be increased in accordance with the NHBC

Standards Chapter 4.2. Precautions against soil heave due to the influence of past or present trees are likely to be required wherever the footing depth is increased to greater than 1500 mm.

To avoid potential problems with differential settlement, foundations should bear within similar stratum. If differing ground conditions are encountered within the footing, the foundation should be deepened onto uniform strata, or be thickened and reinforced.

Shallow water may be present; groundwater control should be allowed for in deeper excavations and considered given to time of year when pulling foundations.

7.2 Ground Floors

Since levels are to be regraded, it is likely that most ground floors will be suspended, such as reinforced suspended slabs or precast concrete floors with a minimum 150 mm high ventilated void.

Where less than 600 mm of made ground is present, ground bearing slabs could be appropriate.

If the footings require heave precautions due to trees, a precast concrete floor with a ventilated void will be required. This void should be a minimum of 250 mm high.

7.3 Superstructure Precautions

Additional superstructure precautions due to the ground conditions are not considered to be required.

7.4 Excavation Problems and Obstructions

A water main runs northwest-southeast through the centre-west of the site; its actual position is unknown. Foul water and combined sewers are also present in the west of the site. A number of concrete capped manhole chambers were noted in the west of the site and appear to be associated with these services.

Shallow bedrock which became difficult to excavate was located in a number of the northern exploratory holes.

Groundwater was encountered between ~0.9 and 2.9 m bgl in the exploratory holes, and in the upper 1 m in MW01 and MW02. A potential spring line was encountered in TP08 at 1.5m bgl leading to a rapid ingress of groundwater. Groundwater control should be allowed for, particularly in deeper excavations.

The trial pits were generally stable for the duration of the excavation.

Support will be required in accordance with current Health & Safety Regulations wherever access is required to trenches deeper than 1.2 m or less where there is risk of collapse.

7.5 Roads

A CBR value of at least 2% is likely to be appropriate for road design. The ground should be assumed to be frost susceptible and a minimum construction thickness of 450 mm will therefore apply. It is recommended that CBR tests are undertaken along any proposed roads prior to construction so that more accurate CBR values can be obtained.

7.6 Surface Water Drainage

Six infiltration tests, were undertaken across the site within the natural clay and bedrock.

All tests were monitored for at least 3 hours and no significant drop in water levels was recorded in four of the six tests. TP30/SA05 recorded a 0.2 m drop in water level before levelling off; this water likely drained into the sandy material above 1.3 m before it became too clay-rich which hindered infiltration drainage. TP28/SA06 drained quickly with tests taking between 1 to 2 hours to complete. It has therefore not been possible to calculate BRE365 infiltration rates in any test aside from TP28.

Soakaway drainage is not considered a viable means of surface water drainage for the site and a piped discharge will be required to a suitable outfall.

8.0 REFINEMENT OF OUTLINE CONCEPTUAL MODEL

8.1 Source Characterisation

An outline conceptual model, detailing the possible sources and associated contaminants of concern, potential pathways and receptors identified in the Phase 1 was detailed in Section 4.0.

This section of the report documents the works undertaken to obtain information to test and refine this model enabling a risk assessment to be produced and, where significant risks are expected, remediation recommendations.

8.2 Investigation of Potential Contamination Sources

The investigation works undertaken to cover each of the sources of potential contamination outlined in Section 4 are detailed in the table below:

Source	Potential Contaminants	Targeted Exploratory Holes
Made ground (if present)	Heavy metals/metalloids Asbestos PAHs Asbestos	No made ground was encountered below the proposed residential development area
Made or natural ground	Sulphates Low pH	Natural ground was encountered in all of the exploratory holes.
Opencast workings	Ground gas	One monitoring well, MW09, recorded opencast backfill

8.3 Gas Precautions

No radon precautions are required.

No made ground was encountered on the site.

Shallow mine workings were not recorded in any of the rotary boreholes.

Seven rounds of ground gas monitoring have been completed as the third round encountered a number of damaged bungs which had to be replaced. The results recorded to date are summarised as follows:

- No detectable methane;
- Maximum 5.5% carbon dioxide;

- Generally zero flow except for MW01 and MW02 in the 1st round which recorded peak flows of 15 and -13.2 l/hr. These peaks steadied to zero, and were likely due to water being present within the plain pipe section of the monitoring well.

8.4 Unexpected Contamination

No visual or olfactory observations of unexpected contamination were noted in any trial pits.

8.5 Chemical Testing

Twenty-nine samples of topsoil and sixteen of natural ground were sent for testing. Additionally, one sample of dark grey mudstone and three samples of opencast backfill were dispatched for sulphate testing only, as well as calorific value for the backfill samples.

Each of the samples was analysed for the suite of contaminants listed below:

TOPSOIL	
Contaminant Type	**Actual Contaminants**
Metals/Metalloids	Arsenic, cadmium, chromium, lead, mercury, nickel, selenium, copper and zinc
pH	pH
PAHs	Speciated PAH
Asbestos	Fibres
Pesticides*	Pesticides
TOC**	Total Organic Carbon
NATURAL GROUND	
Contaminant Type	**Actual Contaminants**
Metals/Metalloids	Arsenic, cadmium, chromium, lead, mercury, nickel, selenium, copper and zinc
pH	pH
PAHs	Speciated PAH
Sulphates	Water soluble sulphate, acid soluble sulphate, total sulphur

*2 topsoil samples only

**9 topsoil samples only

Testing was undertaken by i2 analytical, using MCERTs accredited methodologies, where available.

8.6 Assessment Criteria

The proposed development is to be residential with associated private gardens. Therefore, the assessment criteria relating to a residential end use with homegrown produce have been used. Tables detailing the relevant assessment concentrations used are included in Appendix 4.

8.7 Chemical Test Results

8.7.1 Topsoil

Total organic carbon (TOC) results ranged between 2.0 and 3.5%, with an average of 2.82%. This is equivalent to 4.85% soil organic matter (SOM). Assessment values derived using 2.5% SOM have therefore been used.

None of the samples recorded elevated concentrations above their respective human health or phytotoxic assessment values and no asbestos was detected.

None of the pesticide concentrations exceeded the laboratory detection limit.

8.7.2 Natural Ground

Assessment values derived using 1% SOM have been used.

None of the samples recorded elevated concentrations above their respective human health or phytotoxic assessment values.

8.7.4 Sulphates

In accordance with BRE Special Digest 1, the site comes under the classification of 'greenfield' and groundwater is expected to be mobile. The following table displays the results of the samples tested:

Natural Ground	Range of Results	Characteristic Value
Water Soluble Sulphate (mg/l)	4.01 to 89.9	70.6
Total Sulphur (%)	<0.005 to 0.08	-
Total Potential Sulphate (%)	0.015 to 0.24	0.12
pH	5.5 to 7.8	6.2
Grey Mudstone (TP21)		
Water Soluble Sulphate (mg/l)	19.6	-
Total Sulphur (%)	0.1	-
Total Potential Sulphate (%)	0.3	-
pH	5.9	-
Made Ground		
Water Soluble Sulphate (mg/l)	18.6 – 39	-
Total Sulphur (%)	0.014 – 0.04	-
Total Potential Sulphate (%)	0.042 – 0.12	-
pH	7.3-8	-

Calorific Value	<0.120	-

8.8 Significant Pollutant Linkages

The significant pollutant linkages consequently identified are thus documented in the following table.

Source	Contaminant	Pathway	Receptor
Opencast workings	Ground Gas	Migration Inhalation	Site residents, workers and visitors Construction workers Buildings

9.0 RISK ASSESSMENT

9.1 Human Health: Future Site Users

No elevated concentrations of any determinands were detected in any samples tested.

The topsoil and natural ground are therefore considered chemically suitable for re-use.

Glass fragments were noted in the topsoil in TP01; brick and pottery fragments were also noted in the topsoil in nearby trial pits, potentially associated with cross-contamination from a nearby footpath. During site clearance a visual inspection should be undertaken to determine how widespread these fragments are, and any significantly sized visible fragments should be removed. The topsoil could then be considered physically suitable for re-use.

A shallow coal seam may be present in the southeast of the northern field. Should the coal outcrop be identified to remain near finished ground level, a 1 m clean capping should be provided.

Cohesive fill was encountered in MW09 to a depth of 5.9m. This material should not be brought onto the residential development unless additional chemical testing is undertaken to show it is suitable for re-use.

9.2 Human Health: During Construction

Groundworkers employed during the construction phase of the development are most at risk of harm due to them having direct contact with the affected soils. However, the contact is generally of short duration, and all competent ground workers will be aware of the potential risks associated with handling soils. Therefore, the overall risk to the health of construction workers is considered to be low.

All groundworkers employed on the site should be made aware that elevated concentrations of Normal site procedures, such as the wearing of gloves when handling soils and the washing of hands prior to eating, should be implemented at all times, plus any additional protective measures deemed appropriate.

9.3 Plants

No samples recorded concentrations of any determinands above their respective phytotoxicity assessment values. Therefore, there can be considered to be no significant risk to plant growth from site won materials.

9.4 Construction Materials

Based on the chemical test results, a design sulphate class of DS-1 and an ACEC class of AC-1 is considered appropriate for concrete in contact with the natural sand, clay and mudstone as well as the infilled ground in the southwest of the site.

The sample of mudstone from TP21 recorded a total potential sulphate of 0.3%, which requires DS-2 AC-2 sulphate measures.

Should coal be encountered within the foundations, the level of sulphate measures should also be increased, with DS-3 AC-3 recommended.

The results of the chemical testing will need to be forwarded to the water company so that appropriate water supply pipes can be selected. However, it is not expected that barrier pipe or other similar protective measures will be required.

9.5 Controlled Waters

The site is located over a Secondary A Aquifer and the site is not within a Groundwater Source Protection Zone.

No elevated concentration of any determinands were identified to be present within the topsoil or natural ground. Therefore, it is considered that there is no significant risk to controlled waters.

Standard good site practice during the construction phase of the development must still be adhered to in terms of surface water run-off control measures, to ensure there is no risk to controlled waters.

9.6 Ground Gas

No radon measures are required.

No detectable methane has been noted.

A maximum peak carbon dioxide concentration of 5.5% has been recorded, with generally no positive gas flow.

Using a maximum flow of 0.1 l/hr (i.e. the detection limit of the gas monitor), a carbon dioxide gas screening value (GSV) of 0.0055 l/hr is calculated in accordance with BS8485 (2015) + A1 (2019). The GSV and maximum carbon dioxide concentration lie within the gassing regime Characteristic Situation 1 (CS1) as defined by BS8485 (2015) + A1 (2019).

The only wells which recorded carbon dioxide concentrations over 5% were MW01 (5th and 7th rounds) and MW07 (7th round). However, as the carbon dioxide concentrations were only slightly elevated, no significant positive flow was recorded, and five of the visits were conducted during the more conservative falling or low pressure events it is considered that the concentrations recorded are unlikely to be significantly exceeded. Consequently, it is considered that characterisation of the site as CS1 would be appropriate.

Therefore no gas measures are considered to be necessary

9.7 Unexpected Contamination

Due to the Greenfield nature of the site, it is unlikely that there are areas of the site which are more significantly contaminated than areas of the site investigated to date.

However, should any unusual, brightly coloured, ashy, fibrous or odorous material or material suspected of containing asbestos be encountered during construction this should be brought to the attention of the site staff and investigated.

9.8 Disposal of Material

If material needs to be removed, it should to be taken to a suitably licensed landfill or waste treatment facility. The costs of disposal and landfill tax can be substantial. The disposal of material should therefore be seen as a last resort with options such as treatment and reuse either on-site or off-site considered where possible.

The category of landfill which can accept the waste (inert, non-hazardous or hazardous) would need to be determined and will also have a significant effect on the costs. Additional testing may be required by the landfill operator and the acceptance of material will be at the landfill operator's discretion.

Appendix 1

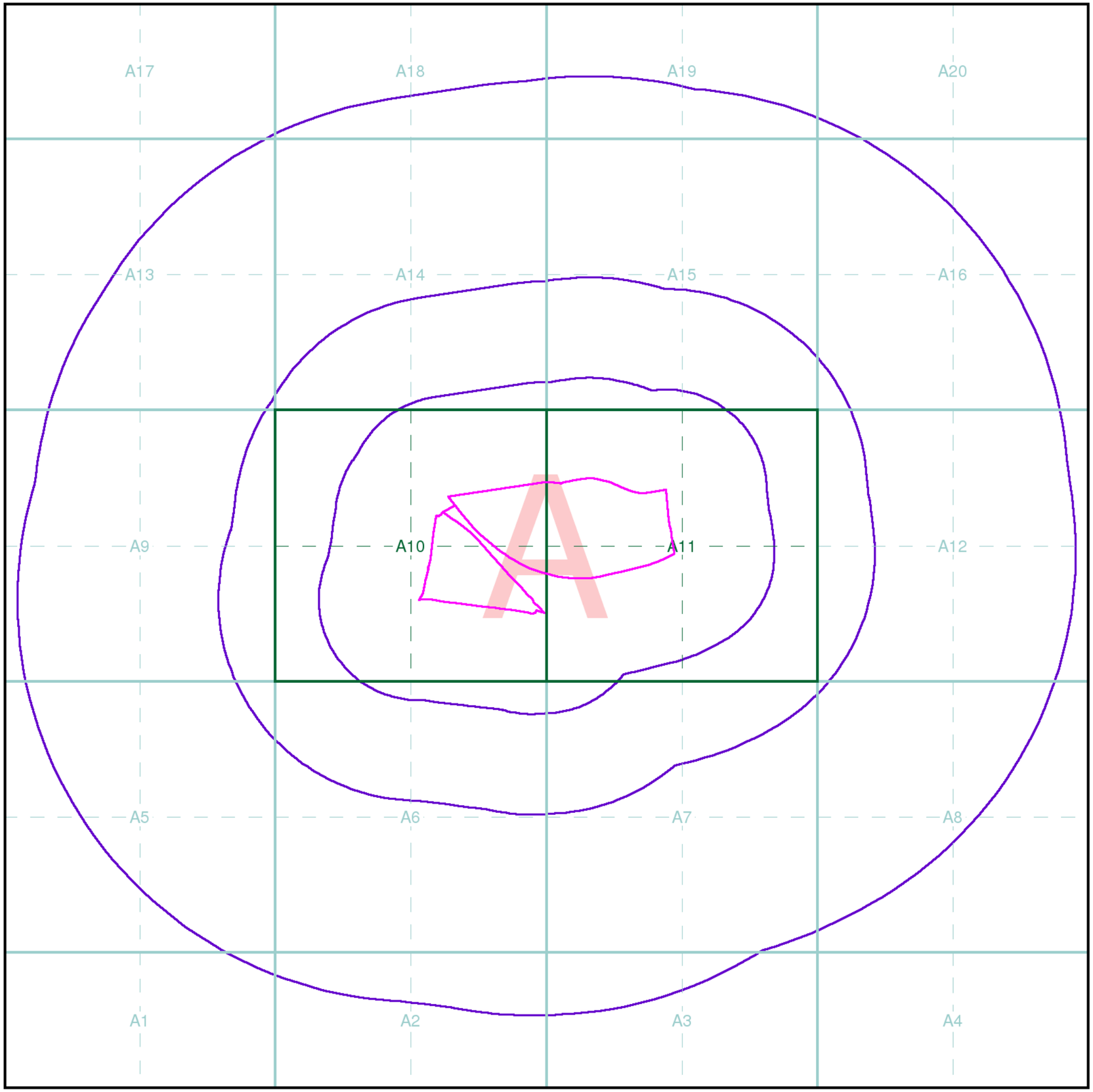
Landmark Envirocheck

Consultants Coal Mining Report

Abandonment Plan Overlay 16528_444404 - Drawing 48926-ECE-XX-XX-DR-C-0030 P01

Abandonment Plan Overlay 16528_444405 - Drawing 48926-ECE-XX-XX-DR-C-0031 P01

Abandonment Plan Overlay NE344 - Drawing 48926-ECE-XX-XX-DR-C-0032 P01



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Index Map

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

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

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

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

A selection of organisations who provide data within this report:

Map data

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Environment Agency

NATURAL ENGLAND

Envirocheck reports are compiled from 136 different sources of data.

Client Details

Mrs L Mitchell, Eastwood & Partners Ltd, St Andrews House, 23 Kingfield Road, Sheffield, S11 9AS

Order Details

Order Number:	341038485_1_1
Customer Ref:	48926
National Grid Reference:	445320, 404860
Site Area (Ha):	13.73
Search Buffer (m):	1000

Site Details

Site at 445320, 404880

Full Terms and Conditions can be found on the following link:
http://www.landmarkinfo.co.uk/Terms/Show/515

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Web: www.envirocheck.co.uk

Historical Mapping Legends

Ordnance Survey County Series 1:10,560

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

Ordnance Survey Plan 1:10,000

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

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

1:10,000 Raster Mapping

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

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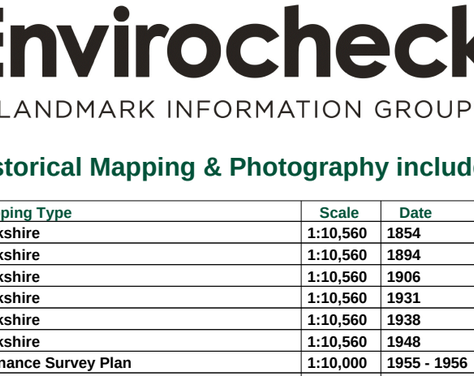
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Yorkshire	1:10,560	1854	2
Yorkshire	1:10,560	1894	3
Yorkshire	1:10,560	1906	4
Yorkshire	1:10,560	1931	5
Yorkshire	1:10,560	1938	6
Yorkshire	1:10,560	1948	7
Ordnance Survey Plan	1:10,000	1955 - 1956	8
Ordnance Survey Plan	1:10,000	1966 - 1967	9
Ordnance Survey Plan	1:10,000	1976	10
Ordnance Survey Plan	1:10,000	1980 - 1988	11
Ordnance Survey Plan	1:10,000	1989	12
Ordnance Survey Plan	1:10,000	1991	13
10K Raster Mapping	1:10,000	2000	14
10K Raster Mapping	1:10,000	2006	15
VectorMap Local	1:10,000	2024	16

Historical Map - Slice A



Order Details

Order Number:	341038485_1_1
Customer Ref:	48926
National Grid Reference:	445320, 404850
Slice:	A
Site Area (Ha):	13.73
Search Buffer (m):	1000

Site Details

Site at 445320, 404880

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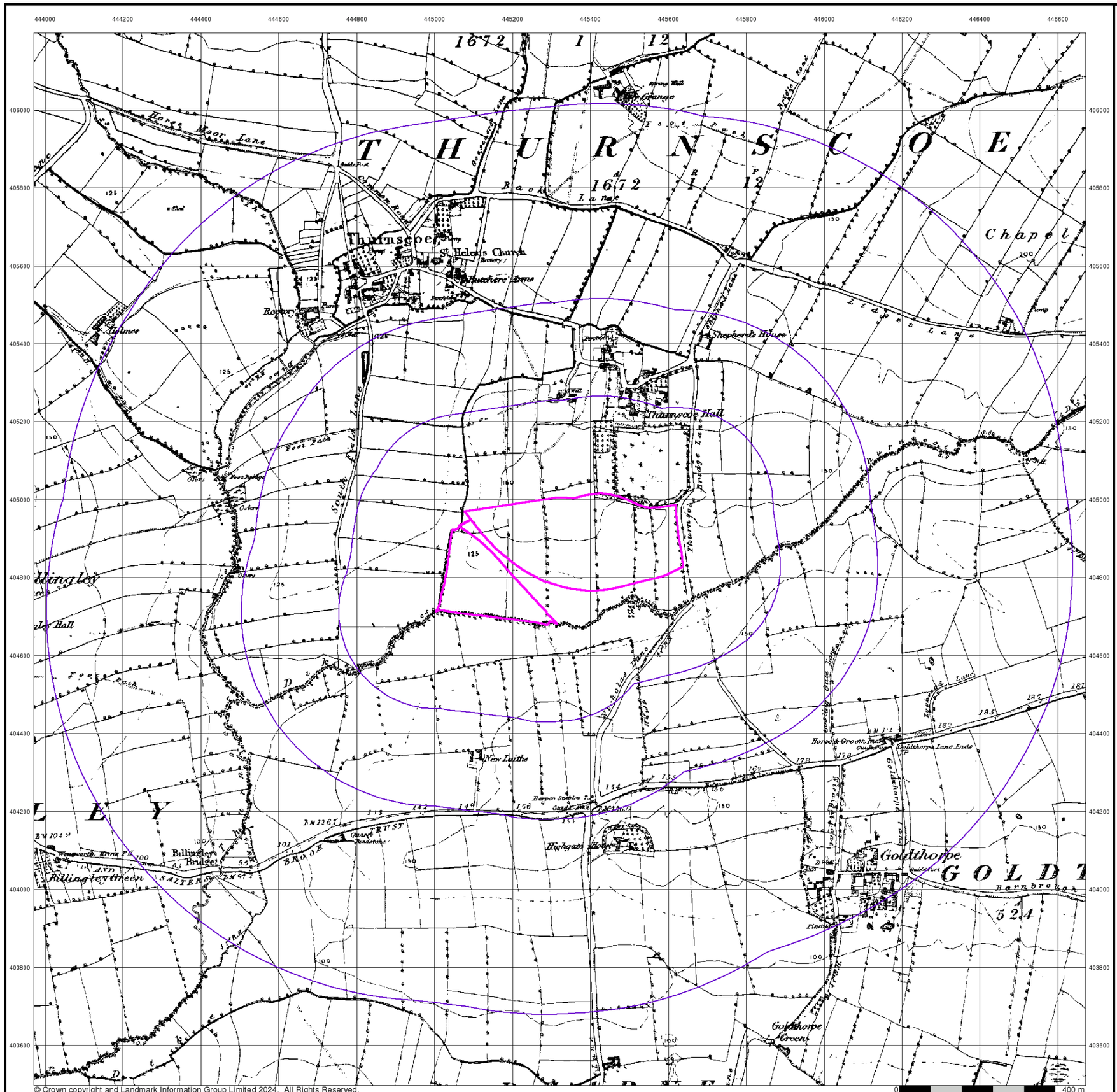
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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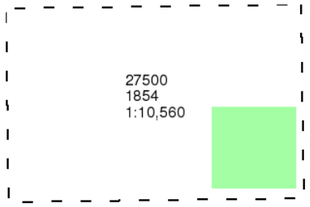
Yorkshire

Published 1854

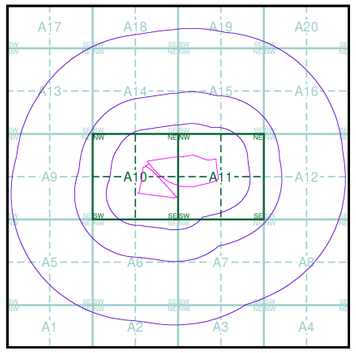
Source map scale - 1:10,560

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

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	341038485_1_1
Customer Ref:	48926
National Grid Reference:	445320, 404850
Slice:	A
Site Area (Ha):	13.73
Search Buffer (m):	1000

Site Details

Site at 445320, 404880

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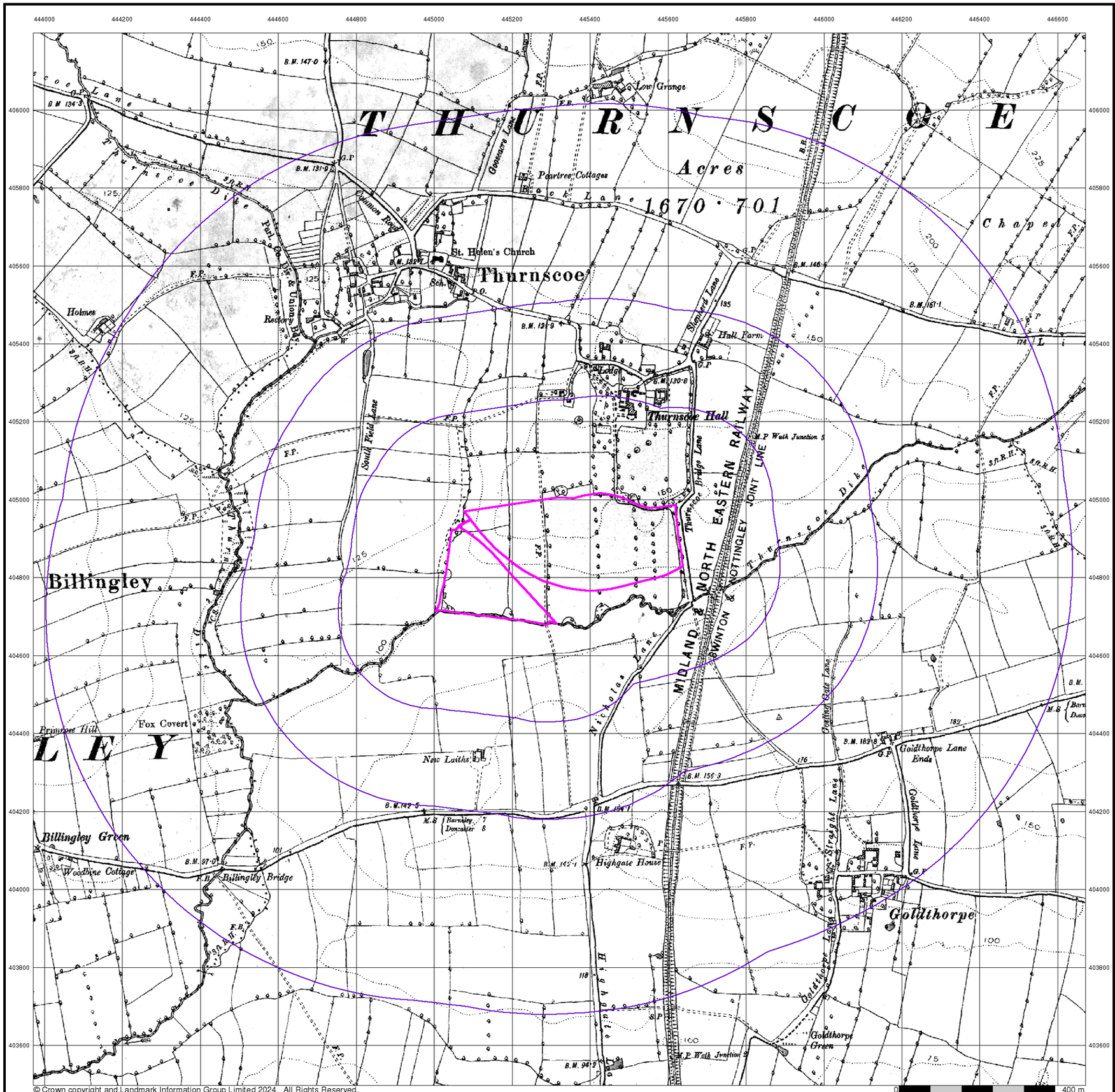

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LANDMARK INFORMATION GROUP®

Yorkshire

Published 1894

Source map scale - 1:10,560

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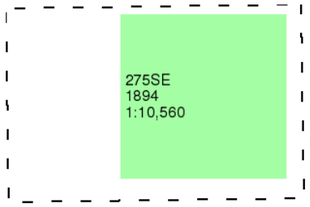
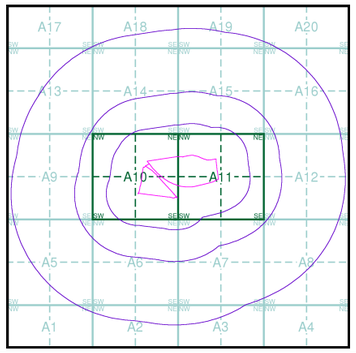
Map Name(s) and Date(s)



Historical Map - Slice A



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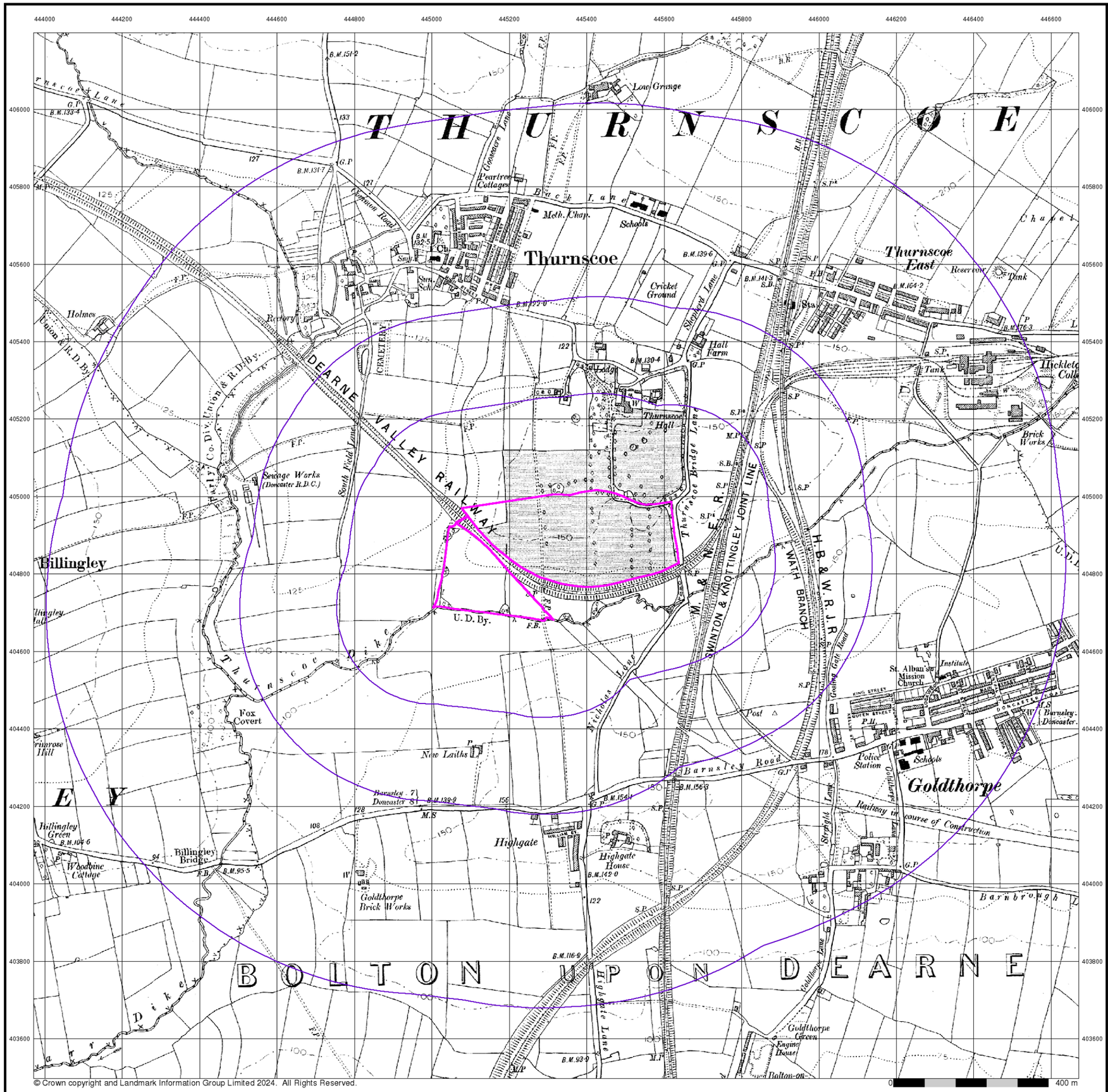

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LANDMARK INFORMATION GROUP®

Yorkshire

Published 1906

Source map scale - 1:10,560

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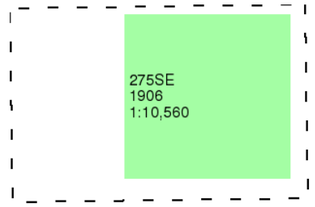
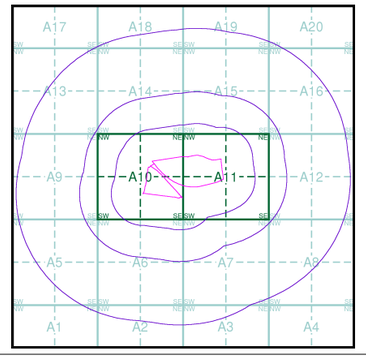
Map Name(s) and Date(s)



Historical Map - Slice A



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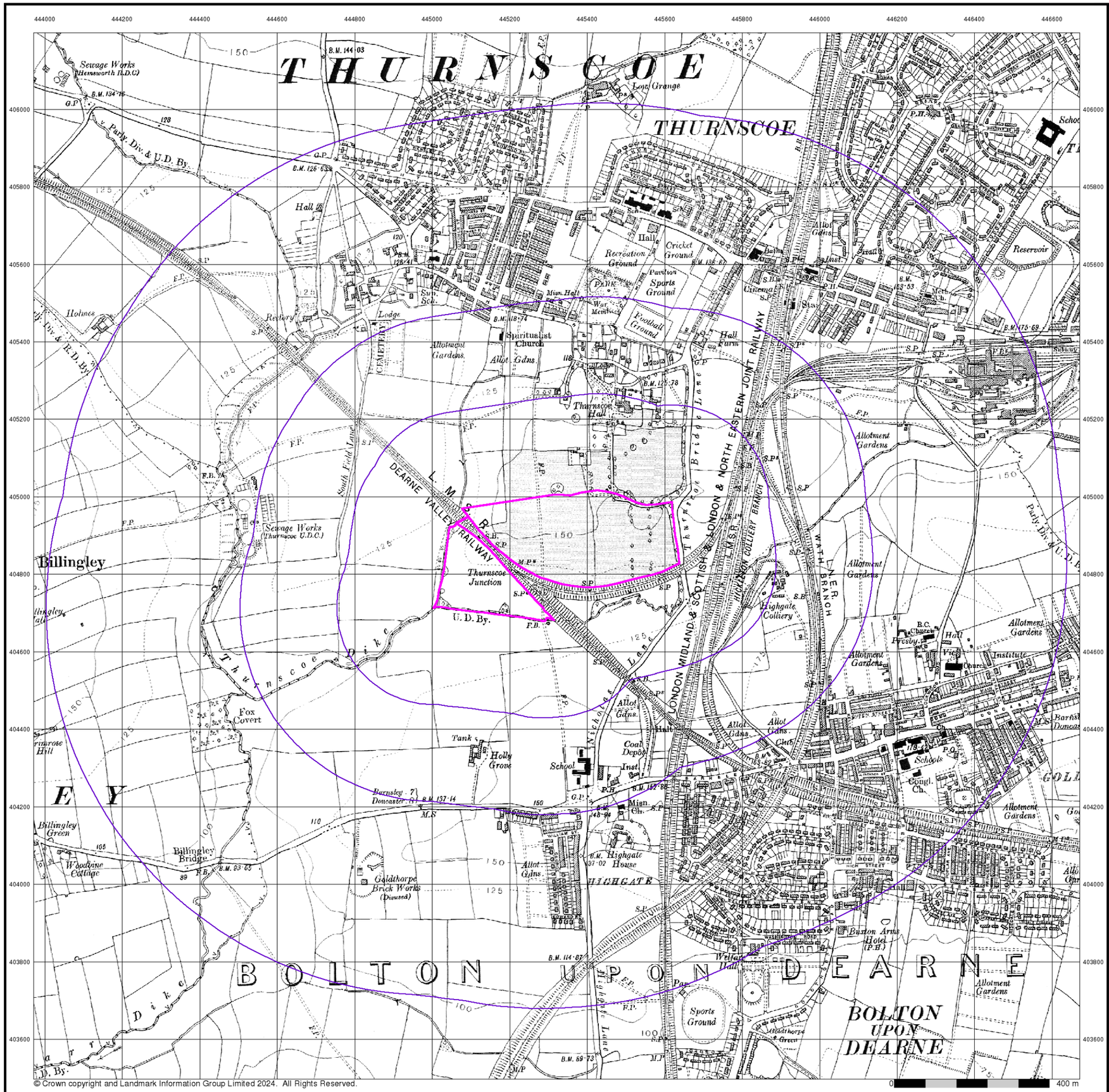

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Yorkshire

Published 1931

Source map scale - 1:10,560

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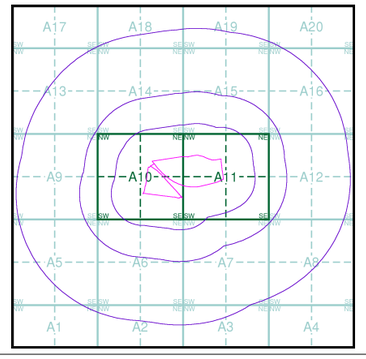
Map Name(s) and Date(s)

275SE
1931
1:10,560

Historical Map - Slice A



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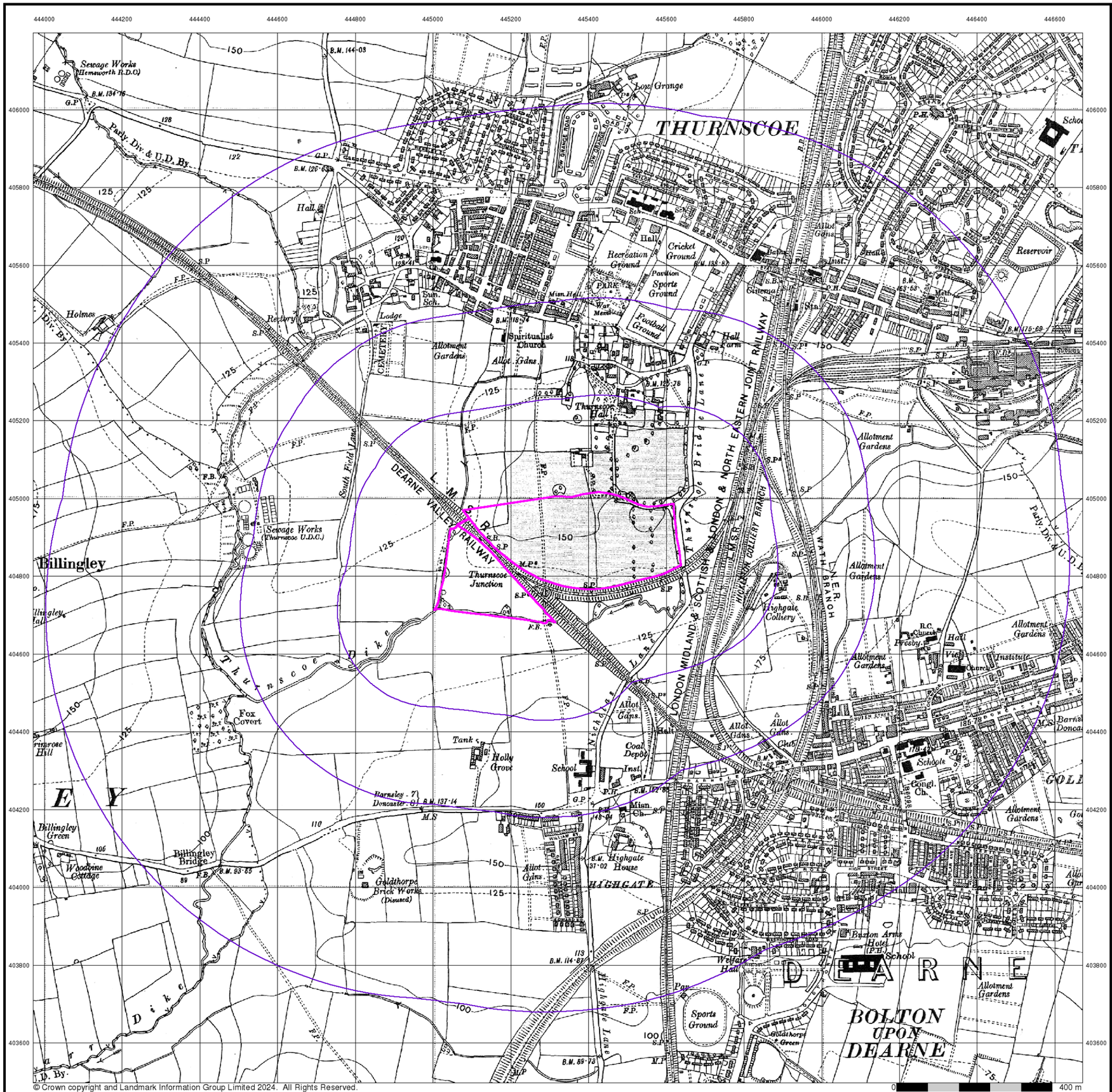

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Yorkshire

Published 1938

Source map scale - 1:10,560

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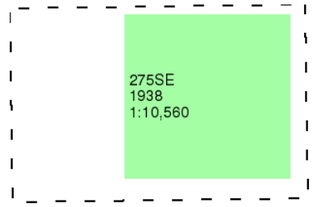
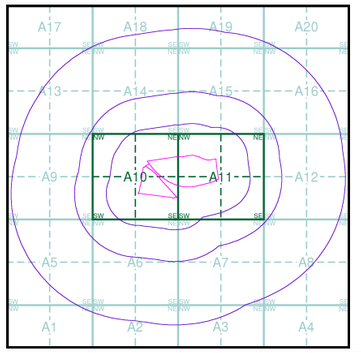
Map Name(s) and Date(s)



Historical Map - Slice A



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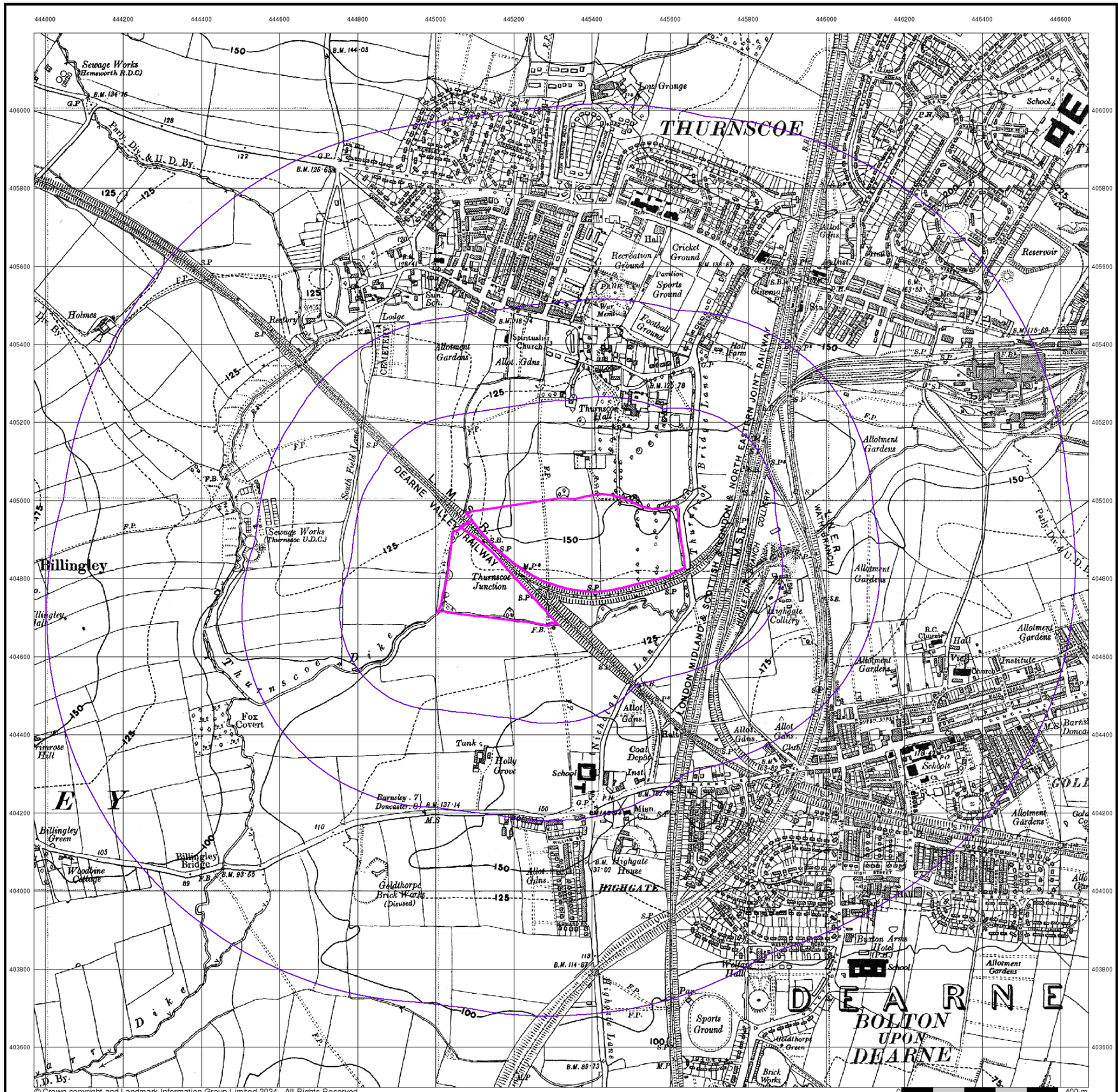

0 400 m

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Yorkshire

Published 1948

Source map scale - 1:10,560

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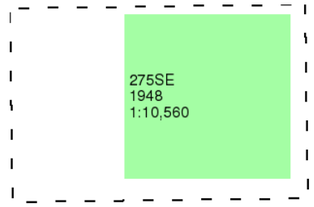
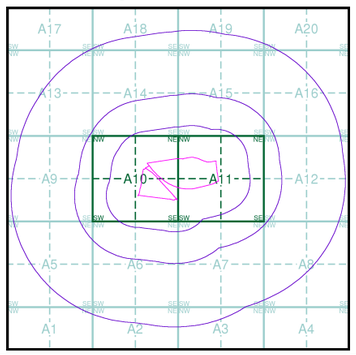


Historical Map - Slice A



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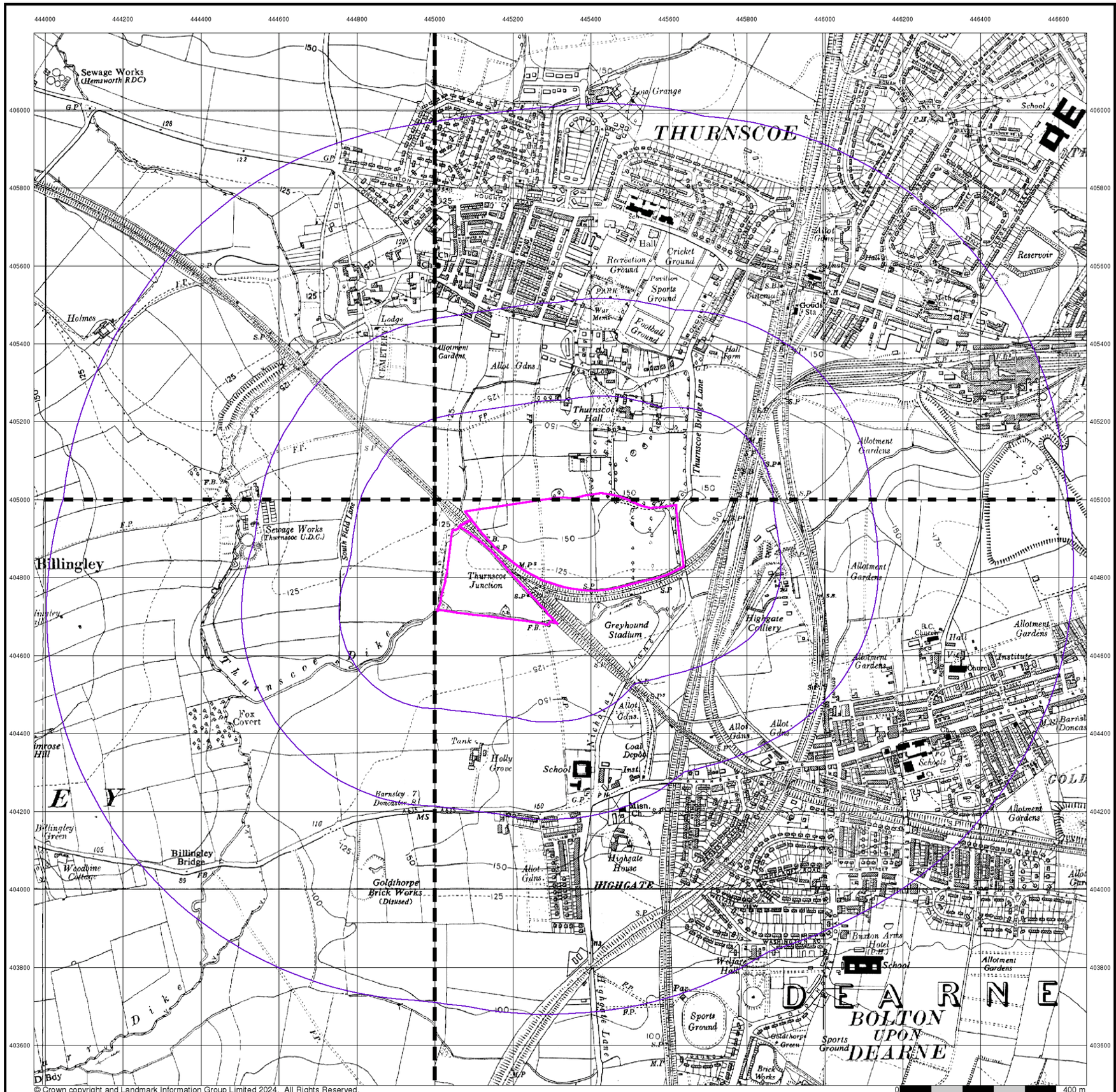

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Ordnance Survey Plan

Published 1955 - 1956

Source map scale - 1:10,000

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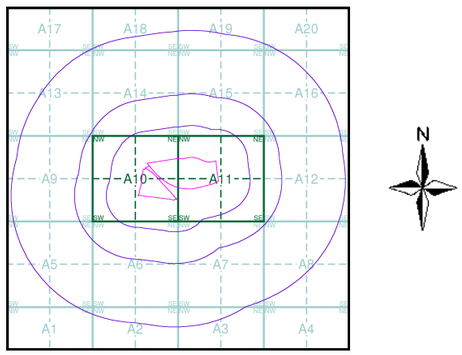
Map Name(s) and Date(s)

SE40NW 1955 1:10,560	SE40NE 1956 1:10,560
SE40SW 1956 1:10,560	SE40SE 1956 1:10,560

Historical Map - Slice A



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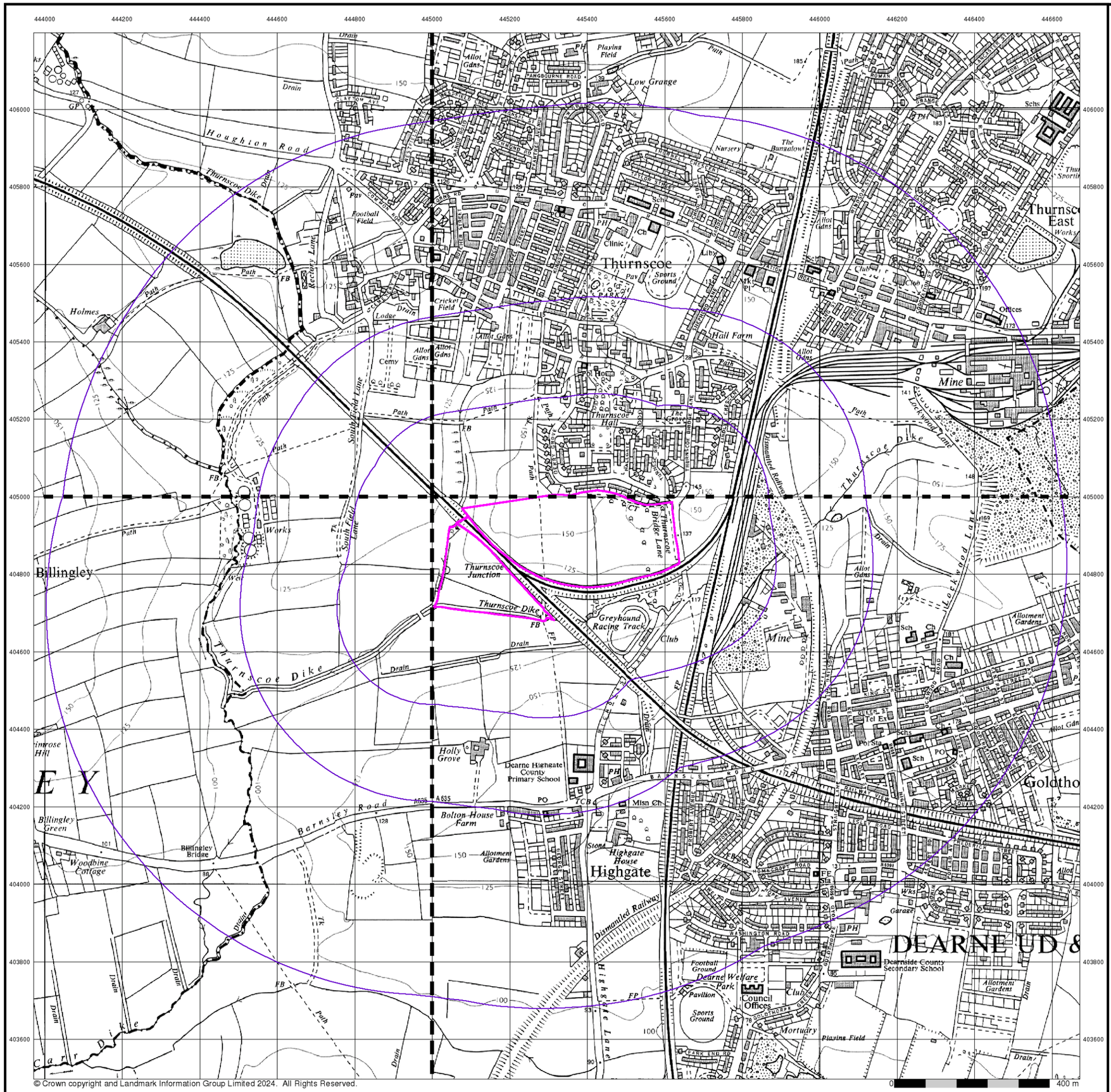

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Ordnance Survey Plan

Published 1966 - 1967

Source map scale - 1:10,000

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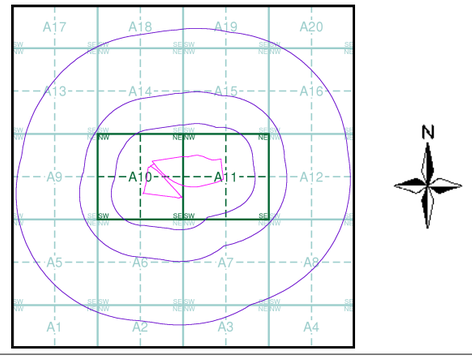
Map Name(s) and Date(s)

SE40NW 1967 1:10,560	SE40NE 1966 1:10,560
SE40SW 1967 1:10,560	SE40SE 1966 1:10,560

Historical Map - Slice A



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Ordnance Survey Plan

Published 1976

Source map scale - 1:10,000

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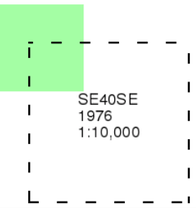
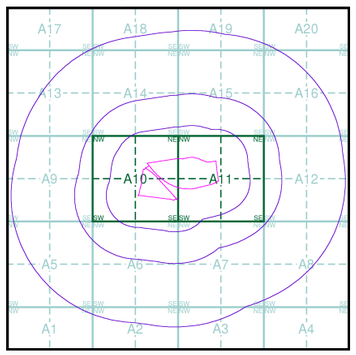


Historical Map - Slice A



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