

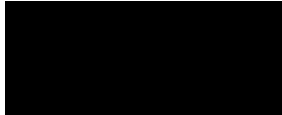
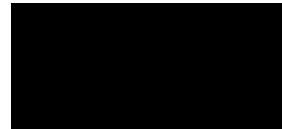
**DESK STUDY & PHASE I COAL
MINING RISK ASSESSMENT
FOR
HOYLAND COMMON, BARNSELEY,
M1 JUNCTION 36 -
BALANCING POND**



REPORT STATUS SHEET

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GENERAL NOTES

APPENDICES

APPENDIX A

DRAWINGS & FIGURES

- Site Location Plan (Drawing No. AG3080-19-06)
- Masterplan (pHp Architects Drawing No. 4400-001 P23)
- Southern Pond Cut & Fill Contours (Winvic Drawing No. 10940b)

APPENDIX B

DESK STUDY DATA

- Historical OS Maps
- Enviro+GeoInsight Report
- BGS Archive Borehole Record
- MAGIC Maps
- Coal Authority Consultants Mining Report (Ref. 51002273480001)
- Coal Authority Mine Abandonment Plans (NE290, 10651 & 5843)

1.0 INTRODUCTION

An area of land between the M1 motorway and Sheffield Road, to the south of Hoyland Common near Barnsley (the site) is to be developed by Newlands Developments (the Client). The proposals comprise the creation of a balancing pond with a bund to the south, to be utilised as part of the drainage strategy for a new development to the north.

Applied Geology was appointed by Newlands Developments to undertake a Desk Study/Phase 1 Geo-environmental Risk Assessment and a Phase 1 Coal Mining Risk Assessment (CMRA) to:

- Permit formulation of an opinion, as to the potential for hazardous substances or conditions to exist on, at or near the site at levels or in a situation likely to warrant mitigation or consideration appropriate to the intended end use proposed by the Client and as stated above.
- Establish anticipated geological conditions to assist with the design of a ground investigation.
- Assess the potential of the site for soakaway drainage and assist with the design.

More specifically, the services provided are summarised below and detailed in the following Sections.

- A site inspection and walkover survey to identify indicators (as defined in later sections) of the existence of hazardous substances or conditions on and in the vicinity of the site.
- A review of the following sources to provide data on likely ground conditions, geohazards and features which may affect development and to obtain information about the potential for hazardous substances to exist at and in the vicinity of the site:
 - Groundsure Report – obtained on the 17th April 2020
 - Barnsley Council Planning Portal
 - BGS - Published Information & Borehole Database
 - Historical Maps
 - Government Web Site – historic landfill database
 - Coal Authority Web Site and liaison with the Coal Authority
 - Coal Mining Report and Abandonment Plans
 - MAGIC Web Site
 - Archaeological Desk-based Assessment by Oxford Archaeology (ref.2019-20/2051)
- Assessment and reporting of the results of the works.

This report should be read in conjunction with the General Notes at the end of the report text.

2.0 SITE LOCATION AND DESCRIPTION

2.1 General

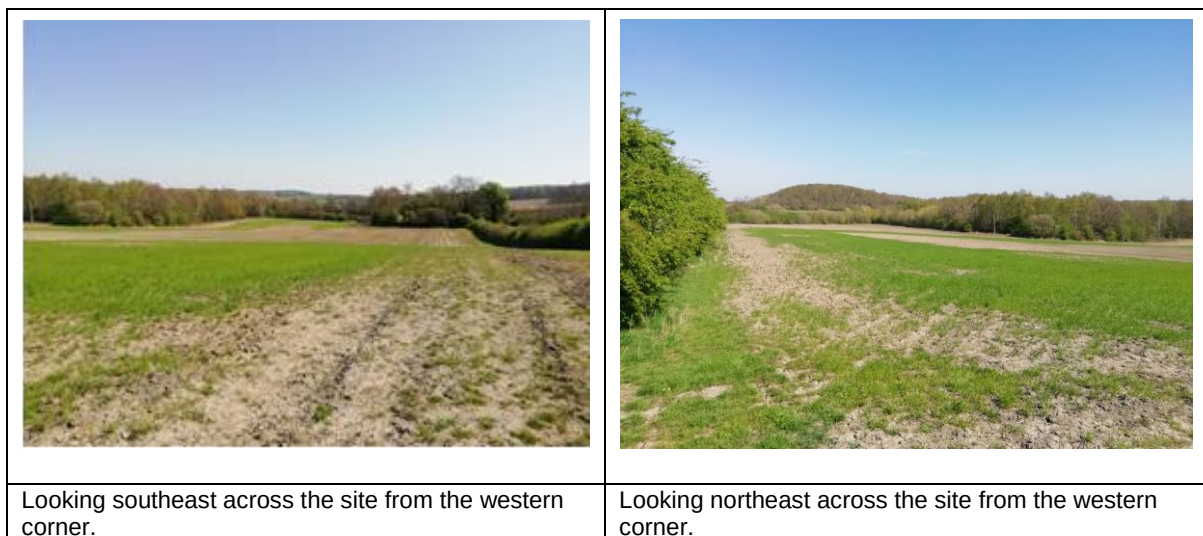
The site is located to the east of Black Lane and to the west of Sheffield Road (A6135), approximately 1km south of the village of Hoyland Common and approximately 7km south of Barnsley, in South Yorkshire. Junction 35a of the M1 is c. 1km south of the site and junction 36 is c. 1.5km to the northwest. The Ordnance Survey grid reference for the centre of the site is approximately 435932 398848, as shown on the Site Location Plan in Appendix A.

The site approximately 'L-shaped' in plan view, with maximum extents of 260m (NE-SW) and 215m (NW-SE), and covers an area of approximately 3.5ha. The north of the site is relatively flat, whereas it slopes down towards the southeast from the centre of the site.

2.2 Walkover Survey

A site inspection/walkover was undertaken by Applied Geology on the 14th April 2020. Access to the site was gained via Black Lane and the adjoining open field northwest of the site, through an opening in the site's northwestern field boundary.

At the time of inspection, the site comprised an open agricultural field with no buildings present. The ground surface consisted of a mixture of low vegetation (grass/arable crop) and bare soil, with field boundaries comprising hedges and a small wooded area along the northeast and east boundaries.



The site was bound to the southwest by Black Lane, to the northwest by an arable field, to the northeast by trees with fields beyond and to the south east by a wooded area.

It should be noted that Applied Geology Limited does not provide arboricultural surveys or specialist surveys for the detection of invasive plant species (such as Japanese Knotweed) or protected species of wildlife.

2.3 Proposed Development

The proposals comprise the creation of a balancing pond to cover the majority of the site, which will require the excavation of approximately 105,000m³ of earth and the creation of an approximately 1m high bund in the south of the site to retain the water. The maximum depth of excavation will be c.10m bgl. The drainage is proposed to run into the northeast of the site and out towards the southwest. The drainage pond is to be utilised as part of the drainage strategy for a new development to the north. Details of the proposals are shown in the Masterplan drawing supplied by the Client (pHp Architects Drawing No. 4400-001 P23 dated 4th June 2020) and the Cut and Fill Contour Drawing (Winvic dwg ref. 10940b dated 06.05.2020).

3.0 DESK STUDY INFORMATION

3.1 Site History

Historical Ordnance Survey maps were obtained in order to determine any significant past activity or land usage. Copies of these maps are presented in Appendix B of this report and are described below in Table 1.

Table 1: Site History

Map Date	On the Site	In the Vicinity of the Site
1855	The site comprises parts of three fields, with trees along the northwestern and eastern boundaries, and along the field boundaries in the centre of the site. An 'L-shaped' structure and a pond are present in the southeast of the site.	The surrounding area is predominantly agricultural, with numerous ironstone pits and bell pits to the north, west and south of the site, with the closest being adjacent to the south. A sandstone quarry is labelled c.75m southwest of the site. Thorncliffe and Elsecar Railway is adjacent to the southeast of the site and Tankersley Park Railway is c.175m north of the site at its closest point, both providing transport to and from the ironstone pits, bell pits and sandstone quarry in the area. The Tankersley Park Railway connects with the Thorncliffe and Elsecar Railway c.400m east of the site. Black Lane runs adjacent to the southwest boundary of the site. The bell pits north of the site form Swallow Wood Mine. Land c.200m to the north is labelled 'Bell Ground', with Bell Ground Cottage located within. An 'Old Hall' is shown to be in ruins c.150m northwest of the site with an associated pump. Three ponds are present c.250m south, southwest and west of the site.
1891-1894	The 'L-shaped' structure in the south of the site has been labelled as an 'Old Ironstone Pit'. The pond appears to have been infilled.	An 'Old Shaft' is present c.10m south of the site. The area adjacent to the east of the site is now shown to be a refuse heap, extending c.250m east, with air shafts labelled within, the closest being c.90m east. The Thorncliffe and Elsecar Railway and Tankersley Park Railway are no longer present. The sandstone quarry south of the site is shown as an old quarry. Swallow Wood Mine has been replaced in part by a wood named Bell Ground, which is present from c.150m northwest of the site. The Bell Pits north of the site are no longer shown. A pumping station is labelled c.155m southwest of the site. Two ponds are present close to Bell Ground Cottage. The Lidgett Colliery is shown c.400m east of the site. Brick works and an associated reservoir are present c.750m east of the site. Further bell pits are present from c.500m west of the site.

Map Date	On the Site	In the Vicinity of the Site
1903-1905	A new pond is present in the south of the site.	The Lidgett Colliery has expanded, with Wentworth and Hoyland Common Station present adjacent to Lidgett Colliery with the Chapeltown Branch Extension trending northeast to southwest (c.200m southeast of the site) currently under construction. The ironstone pits northeast of the site have been labelled as 'Old Ironstone Pits'. There is a pond c.250m east.
1929-1931	The 'Old Ironstone Pit' on site is no longer shown.	The Lidgett Colliery is no longer labelled.
1938-1948	No significant changes.	No significant changes.
1951-1956	The pond previously on site is no longer shown and a different pond is shown in the position of the old ironstone pit.	The air shafts east of the site are labelled as disused. Tanks are present c. 180m southwest of the site, associated with the pumping station.
1965-1966	No significant changes.	The ironstone pits north of the site are no longer labelled.
1970-1978	No significant changes.	No significant changes.
1980	No significant changes.	The M1 motorway has been constructed c.400m west of the site, trending northwest to southeast. Old Hall Farm has been constructed in the vicinity of the remains of the Hall.
1987-1992	The pond is no longer present on site.	The area adjacent to the east is no longer shown to be a refuse heap and has trees on it.
1993-2003	No significant changes.	No significant changes.

Summary: the site has comprised fields since at least 1855, with an ironstone pit and three ponds in various locations in the south and southeast of the site, with Black Lane forming the southwestern boundary. The immediate surrounding area has been subject to ironstone, sandstone and coal extraction, with a coal shaft 10m south of the site and numerous ironstone pits and bell pits to the north, west and south of the site. In addition, railways lines linking the pits and quarries were also present in the immediate surrounding area. During the 1970's, the M1 was constructed c.400m west of the site.

The Archaeological Desk-based Assessment undertaken by Oxford Archaeology provided by the Client outlines that the site area was previously part of the Tankersley Deer Park, and was stocked with deer until the mid-nineteenth century. An estate plan dated 1840-1841 showed that the field to the northwest of the site, (and possibly into the northwest of the site) were subject to mining, with bell pits shown to cover the area.

Although not obvious from the historical Ordnance Survey maps, it is known that large parts of the site were previously opencast mined for coal, with restoration back to agricultural use. Further details are given in Section 7.0 of this report.

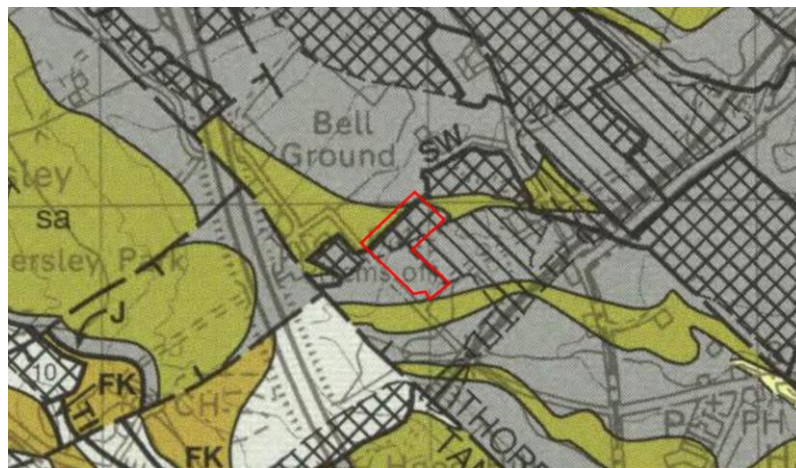
3.2 Anticipated Geology

Reference to the published 1:50,000 scale British Geological Survey (BGS) map, Sheet 87 (Barnsley) [Bedrock and Superficial Geology] dated 2008 indicates the site to be underlain by Solid Geology of the Pennine Middle Coal Measures Formation of Carboniferous age. The Pennine Middle Coal Measures Formation typically comprises interbedded grey mudstone, siltstone and sandstone with

numerous workable coal, ironstone and fireclay seams, which have been historically worked in the area. No natural Superficial Deposits are shown to be present on or in the vicinity of the site as shown below.

The Groundsure Report identifies that infilled ground is present in the northern half of the site and the presence of two coal seams (one inferred and one observed) crossing the centre of the site. These are considered to be the same seam, and is shown at the same location as the Swallow Wood Coal seam is shown to outcrop in the Coal Authority Consultants Coal Mining Report (ref. 51002273480001, dated 26/03/20). The Coal Mining Report state that the Swallow Wood Coal seam dips to the northeast by 1.4 degrees. Copies of the Groundsure Report and the Coal Mining Report are included in Appendix B.

The 1:10,000 map (extract below) shows the Swallow Wood Coal seam to outcrop along the northwestern site boundary, with opencast mining in the northern half of the site. The location of the seam on this map appears to follow the line of the seam as it would have been exposed in the opencast mine. The Swallow Wood Coal seam is identified on the geological map and in the Coal Mining Report to be 0.94m thick. The Geological Memoir 'Geology of the Country around Barnsley' dated 1947 states that the Swallow Wood Coal seam is the same as the Netherton Thick Coal seam and the Top Haigh Moor Coal seam encountered elsewhere around Barnsley.



The general sequence of coal seams below the Swallow Wood Coal, based on the BGS 1:10,000 scale maps, BGS Memoir and Coal Authority report is as follows:

Table 2: Summary of Workable Seams Beneath Site

Seam* ¹	Colliery	Approx. Depth (m bgl)* ²	Date Last Worked	Comments
Swallow Wood	Unnamed	5	1835	Possibly Swallow Wood Mine (Record held by Rockingham Colliery)
Lidgett	Lidgett	49	1894	
Tankersley-Ironstone	Tankersley	104	1879	
Top Fenton	Barley Hall	158	1945	Also Skiers Spring
Low Fenton	Barley Hall	162	1964	Also Tankersley
Parkgate	Rockingham	182	1917	
Silkstone	Rockingham	201	1915	

Notes: 1. Names of seams vary depending on source of information

2. Depths will vary due to site topography and dip of strata

The BGS online archive was checked for records of any relevant archived boreholes within the vicinity of the site. Two boreholes were shown c.180m southwest of the site (ref. SK39NE281 and SK39NE13). The logs of both boreholes were identical and the BGS have advised they are duplicates as they have been sent to them twice at different times and they therefore cannot be certain how the grid references for each borehole ID was derived. The borehole was undertaken as part of Tankersley Colliery and is labelled as 'Tankersley Park Pit'. The depth and thickness of the coal and ironstone seams encountered is summarised in Table 3 below.

Table 3: Summary of Coal and Ironstone Seams in SK39NE281/13

Seam	Depth (m bgl)	Thickness (m)
Lidgett	2.6-3.1	0.5
Joan	21.1-21.6	0.5
Tankersley- Ironstone	32.5-34.4	1.9
Flockton Thick Coal	43.1-45.4	2.3
Flockton Thin Coal	71.66-81.5	9.84
Top Fenton	97.2-98.6	1.4
Black Mine Ironstone	98.64-100.9	2.26
Low Fenton	101.25-102.7	1.45
Parkgate	119.9-122.6	2.7

3.3 Mining History/Geological Cavities

The Groundsure Report identifies two hundred and twenty-five historic underground workings within 1km of the site, predominantly for ironstone and coal. The closest were unspecified old shafts, old ironstone pits and the Lidgett colliery on site. A Coal Mining Risk Assessment is presented in Section 7.0 of this report, although brief information is presented below.

The site is within a Coal Mining Reporting Area, with much of the site within a Development High Risk Area.

The Coal Mining Report identifies five shafts on the site and five shafts within the immediate vicinity of the site, all related to coal workings. However, old bell pits in the far north/northwest of the site and off site to the northwest and the ironstone pit formerly in the south of the site on the historical maps indicate ironstone were possibly recorded as shafts, as they may have extracted both coal and ironstone.

Abandonment plan ref. NE290 shows the extent of opencast mining of the Swallow Wood Seam undertaken across much of the northern half of the site. It also shows old voids that were uncovered along the northeast boundary. The thickness of the seam is noted as 0.99m (3' 3"). The depth of the excavation is shown to have ranged between 1.5m bgl and 9.6m bgl. Opencast mining on site began in June 1956 and the area was 'resoiled' and converted back to agricultural use in September 1957.

Abandonment Plan ref. 10651 shows the Swallow Wood Mine Old Workings which occur to the immediate north of the site around Bell Ground with dates of workings ranging from 1824 to 1858. Three old shafts (depths unknown) are shown to the east of the site and an adit is shown to the southwest of the site near the Lidgett Colliery (which is marked as disused). The outcrop of the Swallow Wood Seam

(then referred to as the Haigh Moor Coal) is shown running across the site, broadly along the same route as that shown on the Coal Authority and Groundsure Reports. The plan does not indicate any depths of workings.

Abandonment plan ref. 5843 shows that underground mining of the Lidgett seam was undertaken across nearly the entire site, apart from the far south. According to the Coal Mining Report, the depth of workings of the Lidgett seam is thought to be deeper than 49m below ground level (bgl) and was last mined in 1897.

The Groundsure Report identifies that the site is not located in an area of recorded natural cavity formation, nor is it within area of known brine or gypsum extraction.

3.4 Natural Ground Stability Hazards

The GroundSure Report has classified the risk of various natural ground stability hazards, depending on the anticipated ground conditions on site. These tend to have a range of risk, given that part of the site is underlain by backfilled opencast pits and some by natural ground.

The risk of ground dissolution of soluble rocks is negligible, of shrink-swell of clays and running sand is negligible to very low, of collapsible deposits and landslides is very low and of compressible rocks is negligible to moderate.

3.5 Radon

The Groundsure Report, which sources information on radon affected areas from the BGS/Public Health England, identifies that the site is within an area where between 1% and 3% of properties are above the Action Level. Therefore, no precautions against ingress of radon into buildings would be necessary if any new buildings were constructed on site in the future.

3.6 Hydrology

It is understood that the site and the surrounding area generally drain to the south and east. Most of the nearby streams (within 250m) to the southwest, south and east of the site, appear to link up and flow towards Harley to the southeast. It is understood that the proposed outflow from the balancing ponds will connect to the watercourse to the south/southeast.

There are no surface water abstractions within 500m of the site.

According to the Groundsure Report, there is one licensed discharge consent with 500m of site, for sewage discharges (final/treated effluent) 185m east of the site into a tributary of Harley Dike.

The site is not within Fluvial Flood Zones 2 or 3. However, this report is not intended to be a full hydrological study and if a flood risk assessment is needed, additional analysis by others is recommended to confirm this aspect of the development.

3.7 Hydrogeology

The Pennine Middle Coal Measures Formation is classified by the Environment Agency as a Secondary A Aquifer.

There is one groundwater abstraction licence within 500m of the site, 275m southwest of the site for spray irrigation at Tankersley Park Golf Club.

The site is not located within a groundwater Source Protection Zone.

3.8 Environmental Searches

Information pertaining to environmental issues was obtained from the Groundsure Report. This database contains sets of data corresponding to the databases held by a number of sources including the Environment Agency, British Geological Survey, British Gypsum, The Coal Authority, Public Health England, Johnson Poole & Bloomer and Peter Brett Associates.

The Government website and Groundsure Report indicate that there are no recorded historical landfill sites within 250m of the site, although it is known that opencast pits were formerly present in the northern half of the site and off site and have since been infilled. The Groundsure Report identifies an historical waste site c.215m southwest of the site, taken from 1956-1989 maps, although this is not apparent from the historical maps Applied Geology viewed. There are no recorded active landfill sites within 250m of the site.

There is one recorded pollution incident within 250m of the site, which occurred 249m east in 2003. This involved asbestos, resulting in 'significant' impact (Category 2) to land.

The Groundsure Report states that there are no current or historic fuel filling stations within 250m of the site.

The Groundsure Report states that neither the site nor any land within 500m is currently designated as Contaminated Land under Part IIA of the Environmental Protection Act.

3.9 Current Industrial Land Uses

Four current industrial land uses have been identified within the Groundsure Report within 250m of the site. These relate to a shaft c.20m south, air shafts c.85m and 145m east, and a telecommunication mast c.200m southeast of the site.

3.10 Railways and Tunnels

There is an active railway c.175m southeast of the site. The Groundsure Report notes that the 2016 revised High Speed 2 proposed route passes approximately 110m from the eastern extremity of the site. However, the 2017 Preferred Route for the Eastern leg of Phase 2b, between the West Midlands and Leeds (assessed on 30/03/2020) shows the HS2b route as being several miles to the east of the site. It should be noted that the route had not been finalised at the time of writing this report.

3.11 Ecology

Information from environmental and ecological datasets was obtained from a review of the MAGIC (Multi-Agency Geographic Information for the Countryside) website undertaken on the 22nd April 2020 and the Groundsure Report.

There are several priority habitats within 250m of the site, including deciduous woodlands, the closest being the woodland adjacent to the east of the site. The site is within a designated farmland bird breeding area and a priority area for addressing lapwing habitat issues. The site is located in a Nitrate Vulnerable Zone and is within the South and West Yorkshire Greenbelt.

It is understood that a detailed assessment of ecological aspects is being undertaken by others for the proposed development.

3.12 Unexploded Ordnance

The Zetica on-line bomb risk map identifies the site to be within a low risk area of unexploded bombs from WWII.

3.13 Information from the Planning Portal

No pertinent information was available from Barnsley Metropolitan Borough Council's Planning Portal.

4.0 CONCEPTUAL MODEL

In developing a Conceptual Model for the site, pollutant linkages are determined by identifying likely sources of contamination from previous and current site uses, possible targets such as site users, neighbouring site users and Controlled Waters and linkages between them. These are discussed below.

4.1 Summary of Site History based on available Historical Maps

The site was previously part of the Tankersley deer park, and was stocked with deer until the mid-nineteenth century. The site has comprised fields since at least 1855, with an ironstone pit and three ponds present in the south and southeast of the site, and Black Lane forming the southwest boundary. An estate plan dated 1840-1841 showed that the field to the northwest of the site, and possibly the northwest part of the site were subject to mining, with bell pits covering the area. The immediate surrounding area has been subject to ironstone, sandstone and coal extraction, with numerous ironstone pits and bell pits to the north, west and south of the site. In addition, railways lines linking the pits and a sandstone quarry were also present in the surrounding area. During the 1970's, the M1 was constructed c.400m west of the site.

4.2 Summary of Anticipated Geology

The northern half of the site is anticipated to be underlain predominantly by backfill to the historic opencast pits, probably comprising overburden (ie. natural deposits), underlain by the Pennine Middle Coal Measures Formation. The opencast pits appear to have extracted the Swallow Wood Coal seam, with coal and ironstone seams below mined by deep mining. Old shafts are marked along the northwestern

boundary on and off site and in the south of the site. The possibility of unrecorded workings exists.

4.3 Sources

The following specific sources of contamination were identified in the desk study:

- Backfill to the former opencast pits (probably overburden materials) in the northern half of the site and off site and colliery spoil, if present, associated with potential unrecorded historic coal/ironstone workings on site;
- Ground gases from backfill material and any spoil on and off site;
- Mine gases on and off site;
- Sulphates in backfill material, any spoil or underlying natural strata on site.

There is limited potential for contaminants such as heavy metals and hydrocarbons from the former railway adjacent to the southeast of the site to have impacted the site.

Given the distance from the site, the licensed discharge consent, historical waste site, pollution incident and active railway are considered too far away to represent plausible sources of contaminants that could impact the site.

Other uses, including the telecommunication mast, are not considered to be viable sources of contamination.

4.4 Receptors

The following receptors have been identified:

- Proposed balancing pond on site and connecting water course;
- Pennine Middle Coal Measures Formation (Secondary A Aquifer);
- Buried substructure concrete (Building Materials);
- Occupiers of nearby properties.

The proposals for the site mean that a human presence will not be required on site, as such, end-users are not considered to be a plausible receptor. There are no immediate neighbours and those nearby are only likely to be at risk from migrating mine/soil gas. Any workers that may be required on site are anticipated to be subject to only short-term exposure. Similarly, the risk to construction workers is not included here due to the short-term exposure times that they will be subject to and the assumption that good hygiene practices will be adopted on site and the appropriate use of relevant PPE/RPE will be adhered to when exposed to potentially contaminated soils.

4.5 Pathways

Taking into account the proposed commercial/industrial end use, the following pathways are relevant to this development:

- Gas migration to off-site receptors;
- Leaching and/or migration through permeable horizons;
- Vertical migration through historic coal shafts on site;

- Direct contact with soil by buried concrete.

4.6 S-P-R Linkages and Assessed Risks

The Conceptual Model described above is summarised below together with the source-pathway-receptor linkages and qualitatively assessed levels of risk:

Table 4: Initial Conceptual Site Model

Source	Pathway	Receptor	Risk*
Backfill material to historic opencast pits (on and off site) and possible spoil from any historic unrecorded workings (on site).	Leaching/migration	Proposed balancing pond and connecting watercourse	Low-medium
		Aquifer	Low-medium
	Downward migration via old shafts	Aquifer	Low-medium
Ground gas from spoil from any historic unrecorded workings and backfill material to historic opencast pits (on and off site)	Migration and inhalation	Neighbours	Low
Mine gas from the Pennine Middle Coal Measures strata (on site)	Migration and inhalation	Neighbours	Low
Potential metals, other inorganic contaminants and hydrocarbons from former land uses (off site)	Migration and leaching	Proposed balancing pond and connecting watercourse	Low-negligible
Elevated sulphates in backfill material, any spoil and natural soils (on site)	Direct contact	Buried concrete	High

*** Definition of Risk Categories**

Negligible - Contaminants that might have unacceptable impact on key receptors, are unlikely to be present, or, no pathway is envisaged.

Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are likely to be minimal.

Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.

High Risk – Contaminants probably or certainly present and pathways are probably also present. Therefore, contaminants are likely to have an unacceptable impact on key receptors and remedial measures are likely to be necessary to reduce the risks to acceptable levels.

5.0 PRELIMINARY GEOENVIRONMENTAL ASSESSMENT

Based on the available information, there is considered to be an overall low to medium risk with regard to Human Health and Controlled Waters receptors.

Although significant parts of the site are anticipated to comprise opencast backfill, there is no evidence that the backfill comprised contaminated materials. An area to the north of the site has recently been investigated by Applied Geology, with the backfill material encountered as clay, mudstone, sandstone and shale derived from the overburden stripped off to access the coal seams (and possible shallow ironstone). However, such natural materials (assumed not to have been engineered

when placed into the void) may still give rise to high levels of some heavy metals, PAHs, sulphates and ground gas.

Based on the anticipated natural backfill materials/spoil, the likelihood of elevated concentrations of ground gas (methane and carbon dioxide) being present and mobilised to affect off-site receptors is considered to be low.

Mine gas (methane, carbon dioxide, carbon monoxide and hydrogen sulphide) could be present from remnant shallow unworked coal seams and/or deeper workings, which could potentially migrate to the surface via old shafts or laterally along old workings.

Although a Secondary A Aquifer, the Coal Measures strata at the site have been subject to shallow and deeper coal mining and it is not anticipated that this will be viewed as a key receptor. Given the distance from the site, the stream 145m to the east is also not considered to be a key receptor.

The other potential sources of contamination from off-site sources, include hydrocarbons and metals and other inorganic contaminants from the historic railway adjacent to the southeast of the site, and are considered to represent a low to negligible risk to the identified receptors due to the distance and the likely presence of low permeability cohesive soils.

6.0 PRELIMINARY GEOTECHNICAL ASSESSMENT

Excavations up to c.10m deep will be required to form the balancing pond. The excavated materials are intended to be used as engineered fill on the main development site to the north.

It is anticipated that the backfill materials will be variable from clays to boulder size lumps of siltstone, sandstone and ironstone. Additionally, in areas outside the former opencast limits, natural Coal Measures strata, comprising clay, mudstone, siltstone, sandstone and possibly coal and ironstone may need to be excavated. Given the anticipated depth of the opencast backfill and the area of the pond not subjected to opencast mining, a significant volume of rock strength material is anticipated to be encountered during the excavation for the pond.

The coal content and calorific value of the materials to be re-used as engineered fill will need to be investigated along with the engineering properties and material classification.

The proposed cut slopes will partly and locally wholly be within the opencast backfill and will need careful design, taking into account slope stability. The backfill may contain voids and some mitigation measures may be needed to ensure that the pond can suitably retain water to the required levels.

The Coal Measures strata are anticipated to be predominantly cohesive, ie. of low permeability. This will be of benefit for the construction of the balancing pond. Any sand/sandstone bands will probably have a higher permeability.

There may be a small amount of fill required towards the southern end of the pond to suit finished levels. This fill will need to be engineered and it is envisaged low permeability materials will be used. The fill will probably be placed on natural coal

measures strata (as opposed to opencast backfill materials) and so, with only around 1m of fill to be placed, imposed settlements are not envisaged to be a concern. However, this will need to be considered during design.

Elevated concentrations of sulphates, and potentially low (acidic) pH should be anticipated in the opencast backfill materials but may also be present in the natural Coal Measures strata and sulphate-resisting concrete is envisaged to be required for headworks, connecting pipework etc.

7.0 PRELIMINARY COAL MINING RISK ASSESSMENT

The site is located within an area designated by the Coal Authority (CA) as being of Development High Risk as a result of historic coal mining legacy. As a result, a Coal Mining Risk Assessment (CMRA) is required to identify the historic coal mining risks and any mitigation measures required prior to the proposed development of the site for a balancing pond.

Assessment has been made using 1:10,000 geological maps, The Geological Memoir 'Geology of the Country around Barnsley', the CA Interactive Maps and Consultants Coal Mining Report and CA Abandonment Plans.

7.1 Published Geology

7.1.1 Made Ground and Superficial Strata

Although the site has not been subject to any built development, significant thicknesses of disturbed ground are expected beneath the northern half of the site, associated with historic opencast coal mining and the far south of the site, associated with a former ironstone pit.

For the most part, this Made Ground is expected to comprise reworked natural strata (mainly clays, mudstone, siltstones and sandstone) derived from excavation and replacement of overburden after the removal of coal and ironstone. While this form of mining and restoration is unlikely to result in the creation of residual voids, it will not have been compacted to an engineering specification.

It is expected that the thickness of the Made Ground will not extend much further beneath the base of the Swallow Wood Seam depth, up to c.9.6m bgl, as indicated by Abandonment Plan NE290.

No Superficial Deposits are mapped on or in the vicinity of the site.

7.1.2 Solid Strata

Solid strata of the Pennine Middle Coal Measures Formation of Carboniferous age are present on site. These strata generally comprise cyclical sequences of mudstone, siltstone and sandstones within thin coal and ironstone seams. The strata sequence expected to immediately underlie the proposed site at depths likely to influence the proposed development comprise those between the Swallow Wood Coal seam and the Lidgett Coal seam. The Swallow Wood Coal seam is marked as outcropping across the centre of the site, dipping to the northeast by 1.4 degrees. The Lidgett Coal seam is anticipated at below 48m bgl at the site.

Several coal seams are reported to be present at the Lidgett Coal level, of which the thickest is normally taken to be the defining layer. At Lidgett Colliery (to the east of the site), the shaft section shows the Lidgett at a depth of approximately 66m bgl, which consists of a top leaf (0.66m thick) and a bottom leaf (0.23m thick) separated by black shale (0.15m thick) giving a total seam thickness of 1.04m.

Whilst the 1:10,000 geological map states that the Swallow Wood Coal seam is 0.94m thick, like the Lidgett Coal, the Swallow Wood Coal seam is often encountered as two or three leaves. It is also often marked by band(s) of ironstone nodules. At Tankersley Common Opencast (to the north of the site) the Swallow Wood Coal seam is recorded to be 0.84m thick. At Rockingham Colliery (to the north of the site), the shaft section shows the Swallow Wood Coal seam at a depth of about 21m bgl, where it consists of a top leaf (0.08m thick) a bottom leaf (0.74m thick) separated by claystone (clod) (0.13m thick); giving a total seam thickness of 1.25m. The Swallow Wood Coal seam is not recorded at Lidgett Colliery. The separation distance between the Lidgett and Swallow Wood at Rockingham Colliery is 66.25m.

No geological faults are shown on the published geological maps on site.

7.1.3 Coal Authority Interactive Map and Consultants Coal Mining Report

Consultation of the Coal Authority's Mining Searches Directory indicates that the site lies in an area for which a standard mining report is required for a new development. A copy of the CA Consultants Coal Mining Report is presented in Appendix B.

Reference to the CA Interactive map shows most of the site falls within a Development High Risk Area (DHRA). This means that the Local Authority is required to refer any planning application to the CA, and the CA will require the preparation of this CMRA to assess the risks posed by historical mining legacy. Closer examination of the DHRA shows that its boundaries relate to the area of unlicensed opencast mining in the northern half of the site and the area where ironstone is thought to have been mined in the far south.

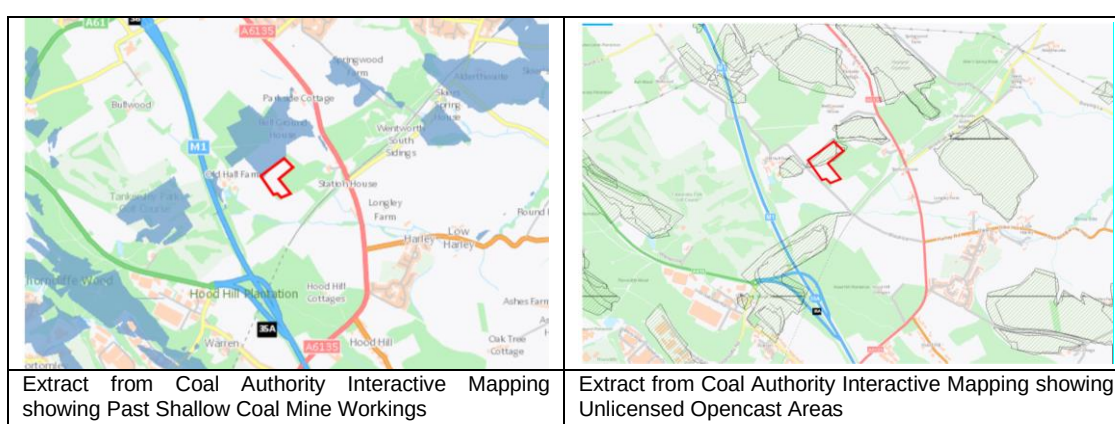


Extract from Coal Authority Interactive Mapping showing the Development High Risk Areas

Basic information on underground mining is provided by the CA Consultants Report (*ibid.*). The extent of local coal mining history is demonstrated by the fact that at least seven separate coal and ironstone seams have been mined by at least four

different collieries. A general summary is present in Table 2 of Section 3.2 of this report.

The CA Interactive mapping shows where historic coal mine workings are known or thought to have existed. At this site, the DHRA shown above relates to 'probable shallow coal mine workings', associated with the presence of the Swallow Wood Coal seam outcropping across the centre of the site and documented opencast pits. Past underground shallow coal mine working of the Swallow Wood Coal seam may have occurred in the far north of the site, where the seam was at its deepest on site, although probably only about 5m bgl, as suggested by mine abandonment plan 10651 in Appendix B. However, the CA Interactive mapping indicates that underground shallow coal mine working did not extend onto the northern part of the site, as shown below.



Ironstone is known to have been mined on site, as shown by the ironstone pit in the south of the site on the historical maps. The CA Consultants Coal Mining Report identifies the shallowest ironstone seam to be the Tankersley seam at 104m bgl, which is thought have been last mined in 1879 as part of Tankersley Colliery. The ironstone pit is therefore thought to represent shallower workings similar to that extracted by bell pits recorded nearby.

The Interactive mapping and CA Consultants Report both show the positions of recorded mine entries (shafts or adits) within influencing distance of the site. Five shafts have been identified as being on the site and five shafts are within the immediate vicinity of the site, all thought to be related to coal workings. A summary of known information relating to those within and closest to the site is provided below.

Table 5: Mineshafts and adits

CA Reference	Coordinates	General location	Mineral	Treatment/ Comments
435398-051	435926,398947	On site (NW)	Coal	No treatment records.
435398-052	435894,398915	On site (NW)	Coal	No treatment records.
435398-053	435870,398887	On site (NW)	Coal	No treatment records.
435398-062	435976,398744	On site (SE)	Coal	No treatment records.
435398-106	435924,398740	On site (S)	Coal	No treatment records.
436399-042	436012,399058	N of site	Coal	No treatment records.
436398-003	436139,398921	E of site	Coal	Filled within 0.4m of ground level with a 4m x 4m concrete cap.
435398-006	435925,398720	S of site	Coal	Capped in November 1989. Water and gas levels are

CA Reference	Coordinates	General location	Mineral	Treatment/ Comments
				monitored by the Coal Authority every 3 months.
435398-050	435871,398952	NW of site	Coal	No treatment records.
435398-054	435837,398911	NW of site	Coal	No treatment records.

The Swallow Wood Coal Seam was last worked as part of the opencast mining shown in abandonment plan ref.NE290 in 1956 and 1957. Before this the Swallow Wood Coal seam was last thought to be worked (by underground mining) immediately north of, and possibly just encroaching onto, the site in 1838-1840 (Abandonment Plan 10651). An extract from an estate plan dated 1840-1841 including in an Archaeological Desk-Based Assessment provided by the Client shows the area in which recorded shafts 435398-050, 435398-051, 435398-052, 435398-053, 435398-054 are situated is occupied by bell pits. The pits are no longer shown on the 1855 OS map. It is therefore possible that these shafts were used to extract both coal and ironstone.



Extract from Estate Plan from Archaeological Desk-Based Assessment

Shaft 435398-062 is stated as being for coal in the CA Consultants Report. However, the Interactive map names this shaft as an ironstone shaft and it is in the location of the former ironstone pit, as shown on the historical OS maps.

Shaft 435398-006 adjacent to the south of the site is shown on the Interactive map as being 53m deep and called Black Lane Pit.

While shafts 436398-003 and 436399-042 are recorded within 50m of the boundary, it is not considered that these constitute a risk to the proposed development.

Other data contained within the CA report can be summarised as follows:

- there are no managed tips within 500m of the enquiry boundary;
- there have been no site investigations or remediation works recorded within 50m of the enquiry boundary;
- the CA is not aware of any request having been made to carry out preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991;
- there have been no reports of mine gas incidents within 500m of the enquiry boundary;

- there have been no claims regarding coal mining subsidence within 50m of the property boundary;
- there are no mine water treatment schemes in the vicinity of the site;
- there are no licences for current coal mining or future underground coal mining within 200m of the site.

7.1.4 Coal Mine Abandonment Plans

The Coal Authority archives were searched and copies of five mine abandonment plans were obtained (numerous others were available but were for seams worked at significant depths below the site). A summary of the pertinent information contained on the plans is provided below and copies are included in Appendix B.

Table 6: Abandonment Plans

CA Ref:	Title	Date	Relevant Information
5843 Part A*	Lidgett, Plan of Abandonment	Not shown	• Lidgett Coal seam worked beneath virtually the whole site
10651*	Rockingham Colliery, Haigh Moor Seam	1931	• Swallow Wood Coal seam is labelled as the Haigh Moor Coal seam and in a slightly different location/orientation to on the CA documentation; • Swallowwood Mine (old workings) are present along the northwestern edge of the site and extending off site to the north.
NE169 Sheet 1 of 2	Bell Ground	1952	• No working shown on site • Site is numbered 219. • Harley and unidentified seam worked to the north of the site.
NE169 Sheet 2 of 2	Bell Ground	1932	• No information on the site; • Harley and unidentified seam worked to the north of the site.
NE290*	Bell Ground II	1958	• Swallow Wood Coal seam opencast in the north of the site; • Seam comprises two leaves – main one 0.99m thick with a thinner 0.23m thick seam approx. 0.9m deeper. • Dipping to the northeast by 1 in 30; • Depth of extraction up to 9.6m bgl; • Small fault runs through the site, orientated NE-SW with variable downthrow (only 3.3 to 4.3m) • Overburden comprises sandy shale and shale with ironstone bands.

* Copies of Plans 5843, 10651 and NE290 are included in Appendix B.

7.2 Summary of Coal Mining Issues

Based on available data, the table below summarises the potential risks associated with the mining legacy for the proposed development site.

Table 7: Coal Mining Issues Summary

Coal Mining Issue	Yes/No	Risk Assessment
Recorded underground shallow mine workings	Yes	Low Risk: possibly along the northwestern edge of the site.
Unrecorded underground shallow mine workings	No	Negligible
Recorded Mine entries (shafts and adits)	Yes	Minor risks along the north western boundary.
Unrecorded Mine entries (shafts and adits)	Yes	Very low risk across the site.

Coal Mining Issue	Yes/No	Risk Assessment
Mining geology (faults and fissures)	No	Negligible
Record of past mine gas emissions	No	Negligible
Recorded mining surface hazard	No	Negligible
Surface mining (opencast workings)	Yes	Low Risk: Uncontrolled backfill

7.2.1 Recorded Underground Shallow Mine Workings

Shallow underground mine workings of the Swallow Wood Coal seam are recorded on mine abandonment plan 10651 along the northwestern edge of the site, which may just encroach on to the site itself. Given the depth of excavation of the pond in this area, these workings are unlikely to affect the construction.

Underground mine workings of the Lidgett Coal seam are shown on mine abandonment plan 5843 Part A beneath all parts of the site. However, the depth of working is thought to be more than c.48m beneath the site. It is considered that there is sufficient thickness of solid strata between the workings and the ground surface to mitigate against the risk of void migration. No further mitigation is required. Recorded workings in coal and ironstone seams below the Lidgett are therefore also considered to present a negligible risk to surface instability.

7.2.2 Recorded Mine Entries

Eight recorded mine entries exist within, or very close to the site. However, some appear to relate to shallow bell pits or shallow shafts that were used to extract ironstone and coal and were subsequently encountered during the opencast mining activities. Two shafts located just off site have been capped and their positions known (one is still being used by the Coal Authority for groundwater monitoring purposes). Given the location of other shafts and the site proposals, it is considered unlikely that their positions will be identified physically during construction of the balancing pond. It is considered that the reliability of the position co-ordinates for these shafts is quite high and probably better than the 8m precision recommended by CIRIA (2019).

7.2.3 Unrecorded Mine Entries

The proposed development site's coal mining context is such that there will always be a low risk of unrecorded mine entries being present. At this stage, it is considered that a watching brief should be undertaken during all excavation and ground works within the development. Any anomalous features that may indicate historic mine entries should be investigated and recorded by a competent person.

7.2.4 Surface Mining (Opencast Workings)

The proposed development area has been subject to historic opencast mining in the northern half of the site. Opencast operations do not result in a residual risk to ground instability. However, variations in backfilling compaction can result in variable and unpredictable settlement when new loads are applied. This is particularly the case at highwalls, where sudden variations in thickness of Made Ground can occur. Even so, the plans for this site are not particularly sensitive to differential settlements and so the risk is deemed to be low.

The composition of the fill material may differ from the in-situ strata outside of the former opencast pits and therefore the permeability may vary. As such, this may affect the suitability of different parts of the site for a balancing pond, both in terms of permeability and stability of excavated slopes.

7.3 Conclusions

This CMRA has revealed a diverse mining heritage at the proposed development site. This has included ironstone and coal mining dating back to the beginning of the 19th Century and possibly earlier. Coal mining has included recorded deep coal mining across the whole site, possible shallow coal mining just on site following the northwest boundary, along with extensive opencast mining in the northern half of the site.

8.0 RECOMMENDATIONS

A ground investigation is recommended to confirm the anticipated ground conditions, validate the conceptual site model, investigate possible recorded and unrecorded shallow mine workings, locate the highwall associated with the former opencast pits on site, assess the permeability of the soils and assess the suitability of materials for re-use in the proposed earthworks.

A series of trial pits are envisaged to investigate the nature and lateral extent of the opencast backfill materials and obtain representative samples for permeability testing, earthworks classification testing and chemical testing. Some trial pits may be extended as trenches to identify the highwall in the vicinity of the proposed pond. Where the depth of the proposed pond is greater than that achievable by trial pitting, boreholes will be required.

If, as expected, the backfill materials comprise inert natural materials derived from the overburden, large numbers of chemical tests are not considered necessary. However, as there could be elevated concentrations of naturally occurring sulphates and possibly arsenic in the opencast backfill and in-situ Coal Measures strata, sufficient testing should be undertaken to appropriately classify the materials. Testing should comprise a general suite of contaminants and a few selected samples should be tested for pesticides and Topsoil suitability in accordance with BS3882, the latter to determine its suitability for re-use in the main proposed development site (or elsewhere).

Geotechnical laboratory testing is envisaged to comprise soil and rock classification testing, remoulded permeability testing and BRE SD1 sulphate testing.

Ground/mine gas and groundwater monitoring wells should be installed throughout the site and monitoring should be undertaken to help establish groundwater levels and the ground gas regime. Where appropriate, groundwater samples should be obtained and tested for sulphate levels and a range of commonly occurring contaminants. Permeability testing in selected standpipes should be undertaken to test the permeability of the underlying strata.

This desk study/Phase I Geo-environmental Risk Assessment and Phase I Coal Mining Risk Assessment Coal should be submitted with the Planning Application to demonstrate that the site has been adequately investigated at the pre-planning

stage and that sufficient information has been obtained to design an appropriate Phase II intrusive investigation.

On completion of the intrusive investigation, the Coal Mining Risk Assessment will be updated and submitted as part of the Ground Investigation Report (GIR).

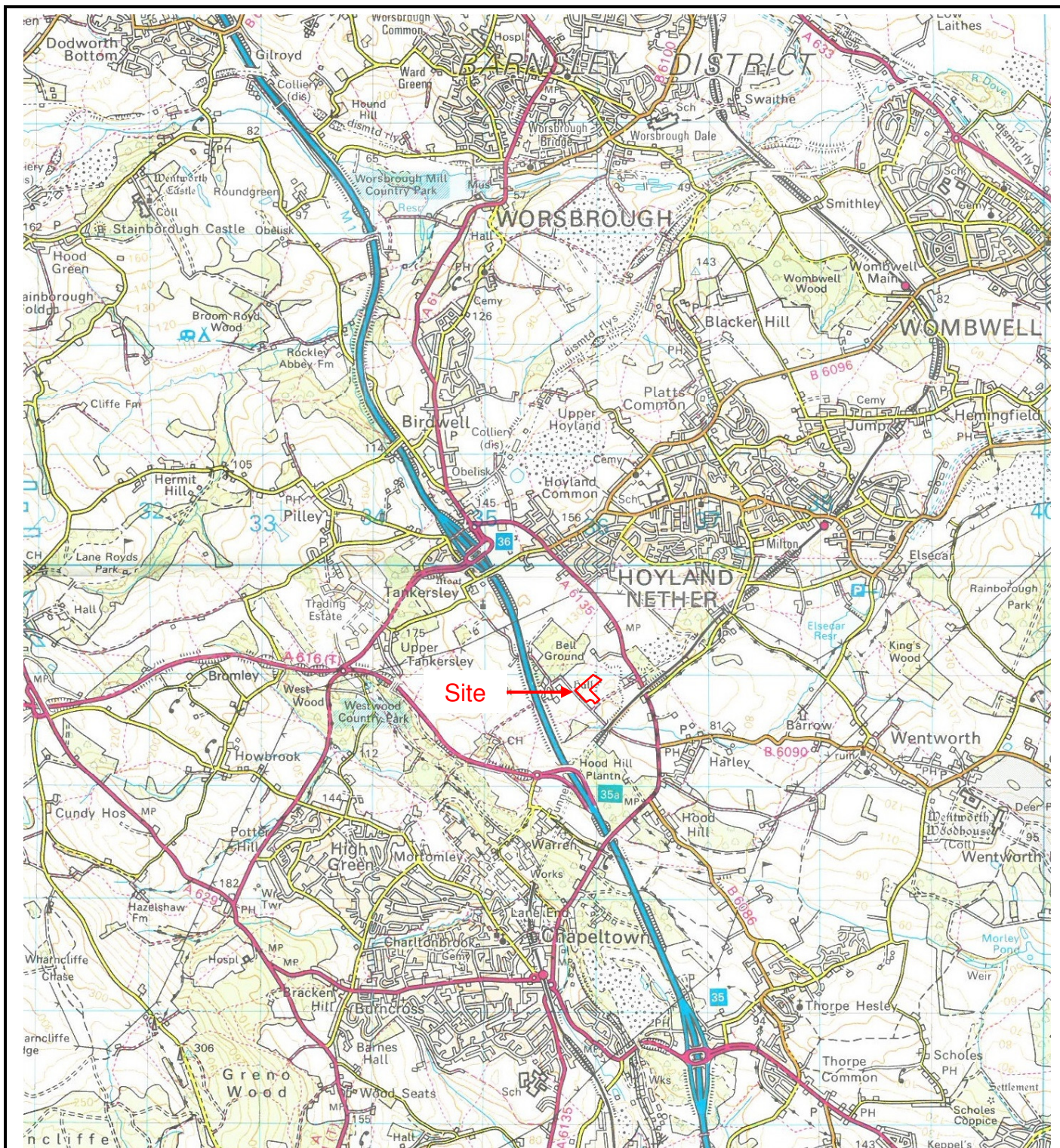
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GENERAL NOTES

- A) The assessment made in this report is based on the site terrain and ground conditions revealed by the various field investigations undertaken and also any other relevant data for the site including previous site investigation reports (if available) and desk study data. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available. It must be recognised that many of the Environmental Searches obtained during the course of the desk study are often lengthy. Applied Geology have, where appropriate and in the interests of simplicity, only reproduced the summary of the searches within the report. A full copy of all the search data is held at the Applied Geology office and is available for inspection if required.
- B) Where any data supplied by the Client or other external source, including that from previous site investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Applied Geology for inaccuracies within this data.
- C) Whilst the report may express an opinion on possible configurations of strata between or beyond the exploratory locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy.
- D) Comments on groundwater (and landfill gas) conditions are based on observations made during the course of the present and past investigations or with reference to published data unless otherwise stated. It should be noted, however, that groundwater (and landfill gas) levels vary due to seasonal (or atmospheric conditions) or other effects.
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- H) Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of this data by the supervising geotechnical or geo-environmental engineers.
- I) Unless specifically stated, the investigation has not taken into account the possible effects of mineral extraction.
- J) The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, depends on very many factors in addition to geotechnical considerations and hence its evaluation is outside the scope of this report.
- K) Applied Geology operates as a Consultancy and does not operate its own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.

APPENDIX A



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Client:

newlands
developments

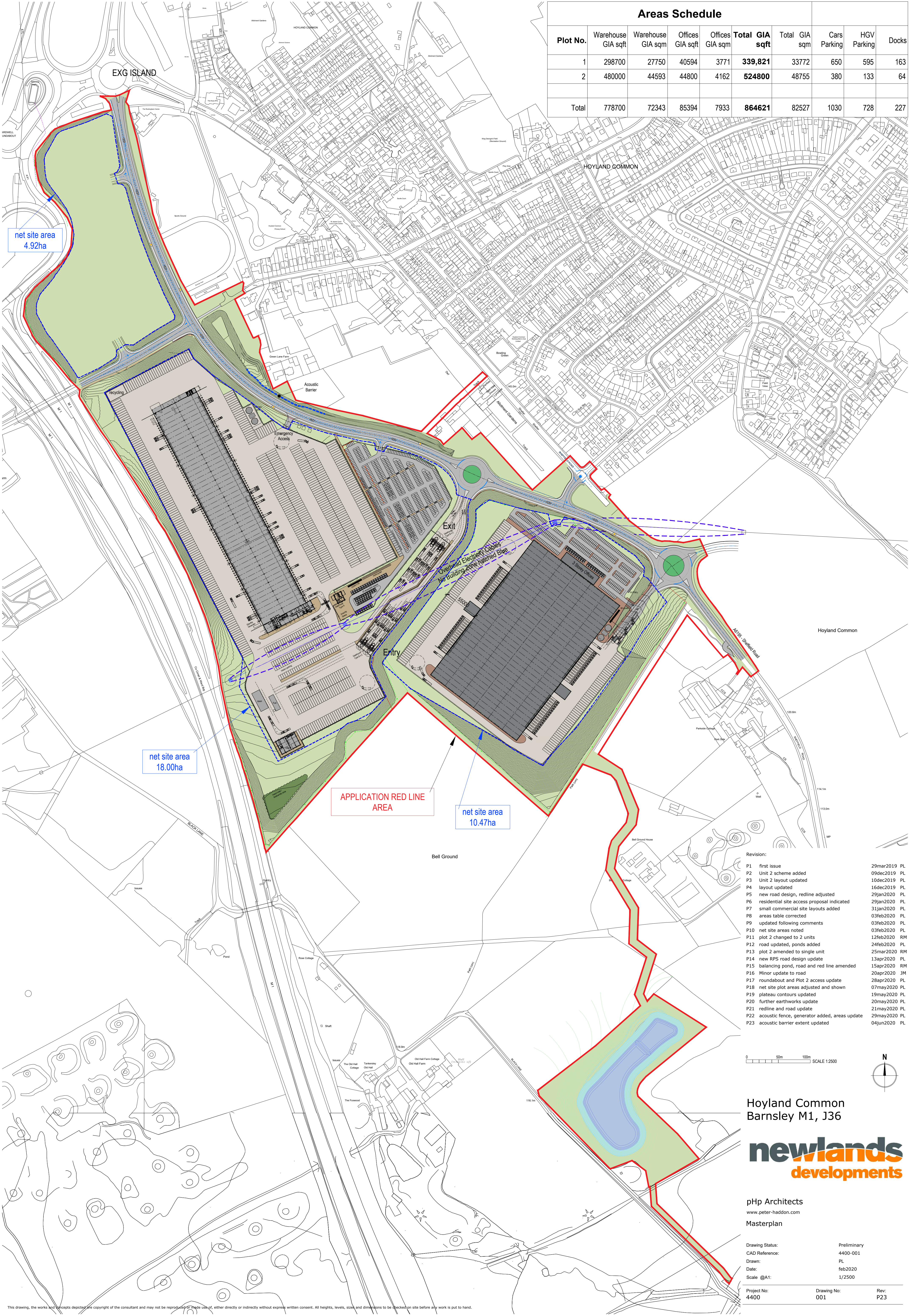
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HOYLAND COMMON, BARNSELY
M1 JUNCTION 36- BALANCING POND

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Scale: NTS	Date: 27.03.2020	NGR: 435674 398994
Drawing No: AG3080-19-06	Revision: 0	

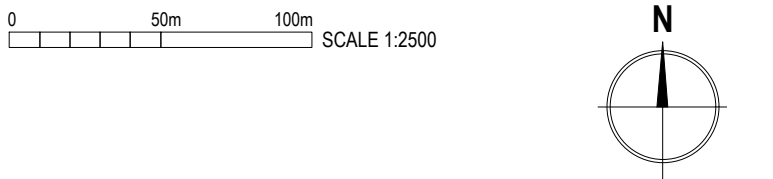
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SITE LOCATION PLAN



Areas Schedule									
Plot No.	Warehouse GIA sqft	Warehouse GIA sqm	Offices GIA sqft	Offices GIA sqm	Total GIA sqft	Total GIA sqm	Cars Parking	HGV Parking	Docks
1	298700	27750	40594	3771	339,821	33772	650	595	163
2	480000	44593	44800	4162	524800	48755	380	133	64
Total	778700	72343	85394	7933	864621	82527	1030	728	227

Revision:		
P1	first issue	29mar2019 PL
P2	Unit 2 scheme added	09dec2019 PL
P3	Unit 2 layout updated	10dec2019 PL
P4	layout updated	16dec2019 PL
P5	new road design, redline adjusted	29jan2020 PL
P6	residential site access proposal indicated	29jan2020 PL
P7	small commercial site layouts added	31jan2020 PL
P8	areas table corrected	03feb2020 PL
P9	updated following comments	03feb2020 PL
P10	net site areas noted	03feb2020 PL
P11	plot 2 changed to 2 units	12feb2020 RM
P12	road updated, ponds added	24feb2020 PL
P13	plot 2 amended to single unit	25mar2020 RM
P14	new RPS road design update	13apr2020 PL
P15	balancing pond, road and red line amended	15apr2020 RM
P16	Minor update to road	20apr2020 JM
P17	roundabout and Plot 2 access update	28apr2020 PL
P18	net site plot areas adjusted and shown	07may2020 PL
P19	plateau contours updated	19may2020 PL
P20	further earthworks update	20may2020 PL
P21	redline and road update	21may2020 PL
P22	acoustic fence, generator added, areas update	29may2020 PL
P23	acoustic barrier extent updated	04jun2020 PL



Hoyland Common
Barnsley M1, J36



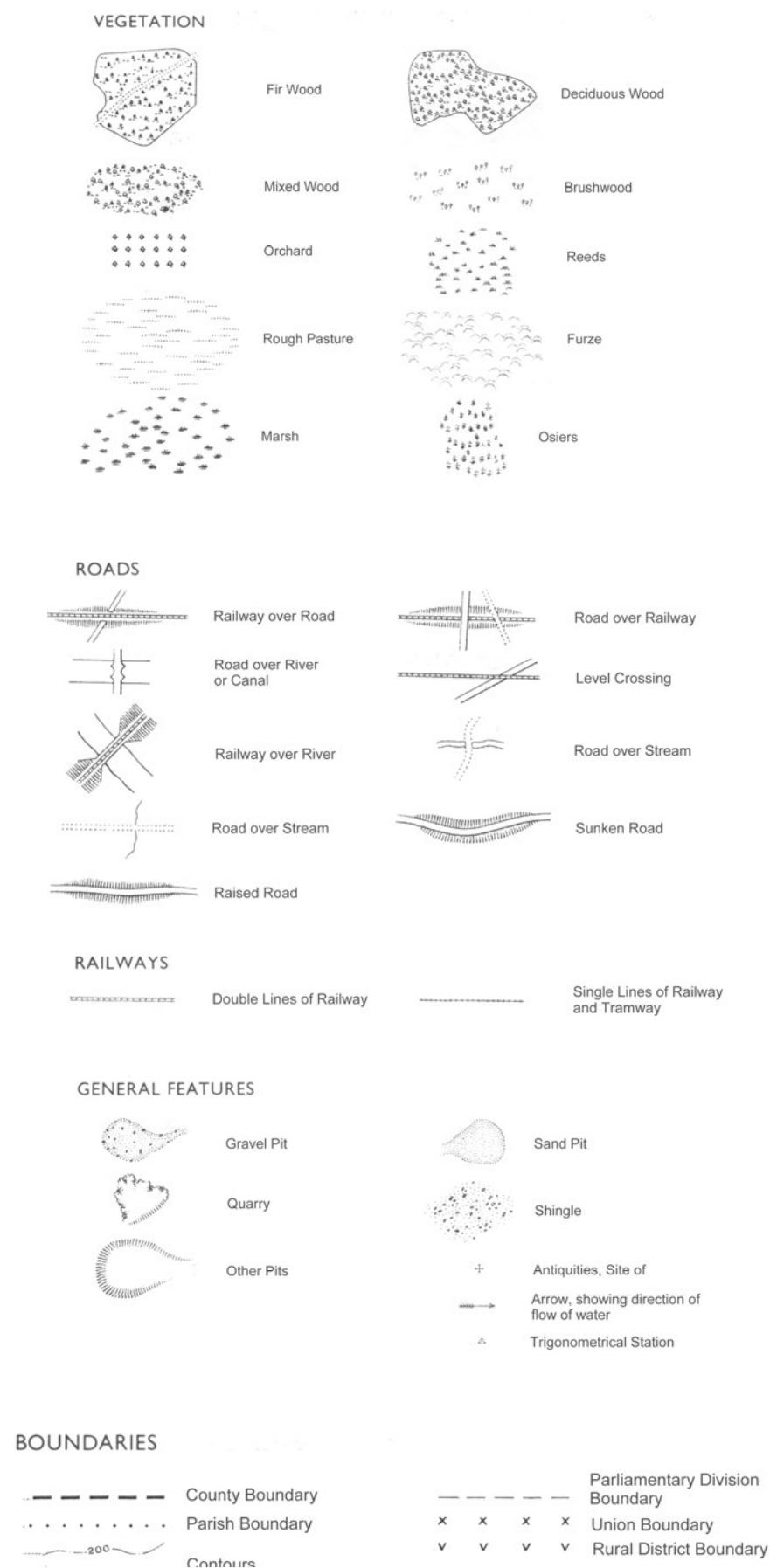
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Masterplan

Drawing Status:	Preliminary
CAD Reference:	4400-001
Drawn:	PL
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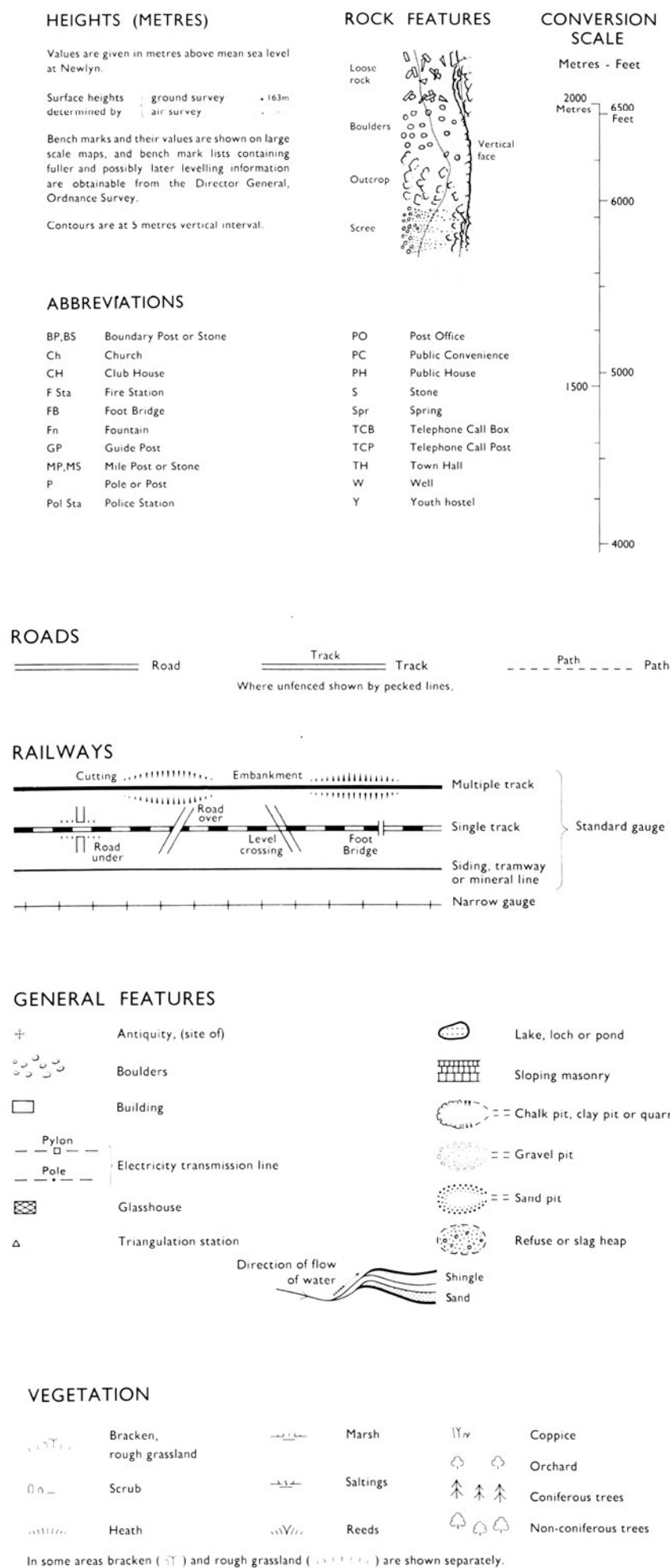
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APPENDIX B

County Series 1:10,560 scale



National Grid 1:10,000 scale



Historical Map Pack Legend

County Series & National Grid

1:10,560 scale

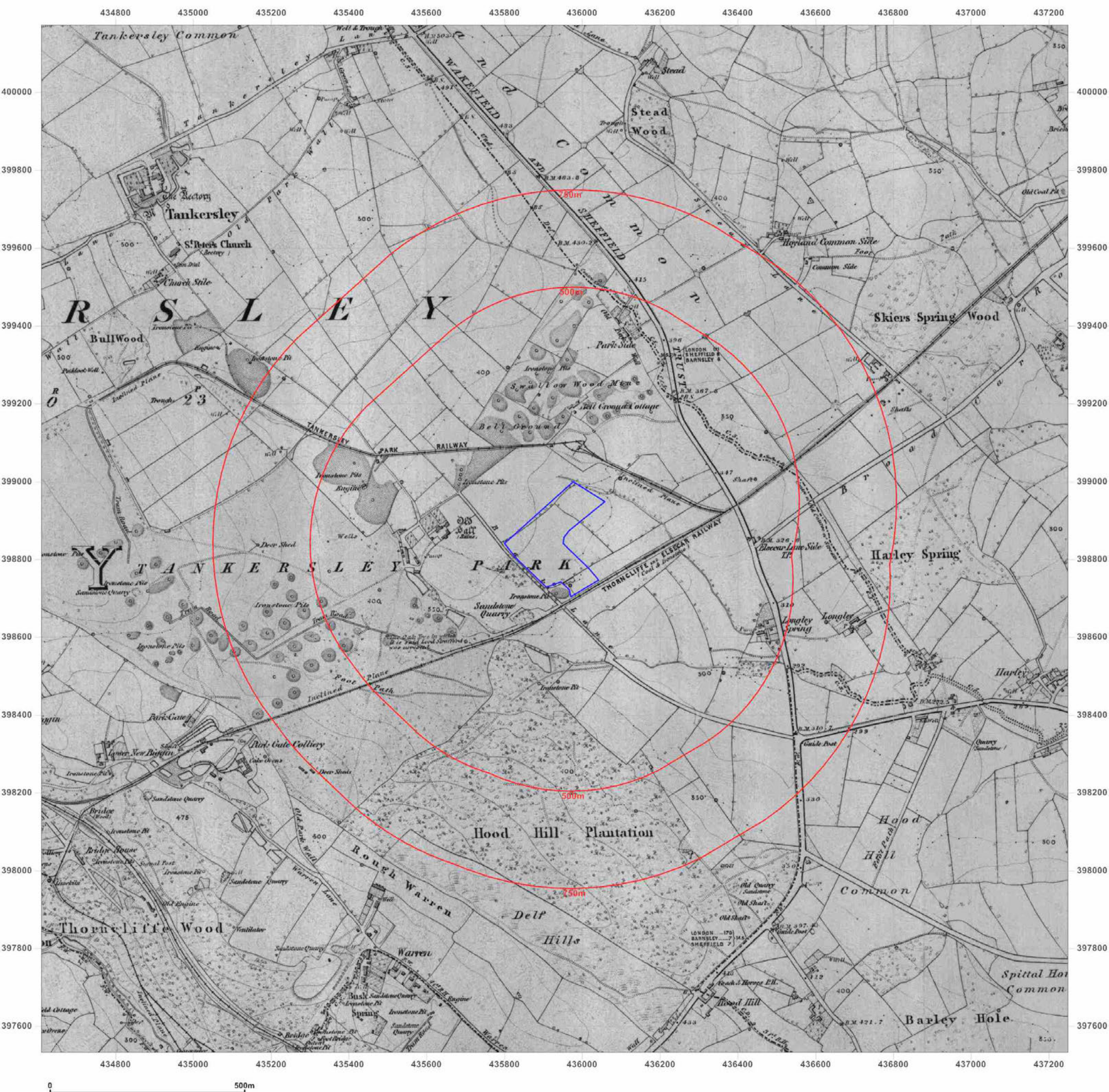
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Site Details:

Hoyland Common- Balancing Ponds

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Report Ref: EMS-605482_809329
Grid Ref: 435928, 398852

Map Name: County Series

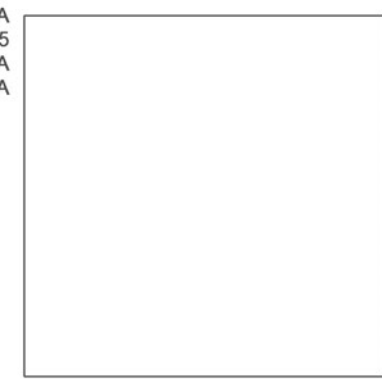
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Scale: 1:10,560

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Report Ref: EMS-605482_809329
Grid Ref: 435928, 398852

Map Name: County Series

Map date: 1891-1894

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Printed at: 1:10,560



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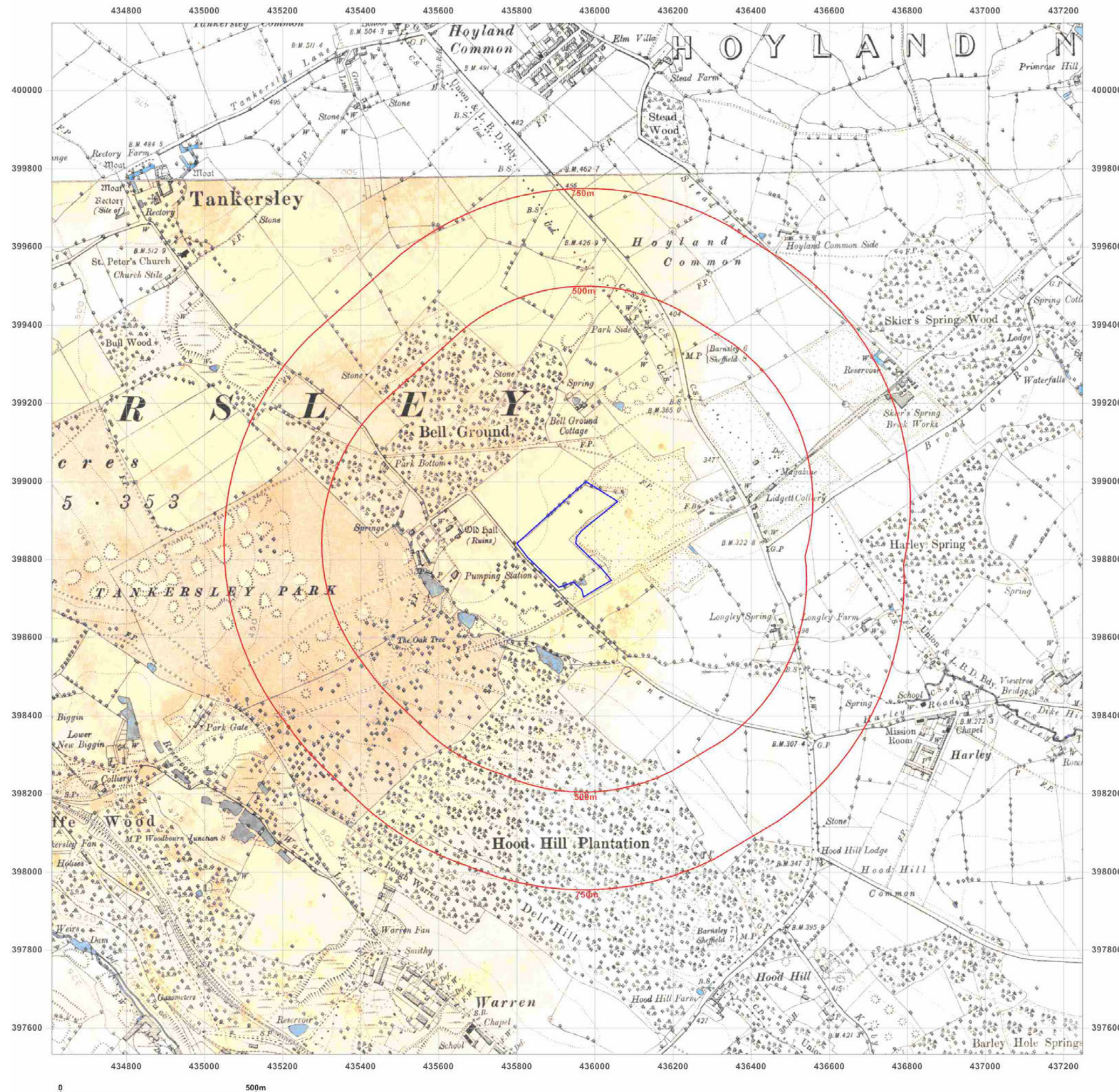


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Ponds

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Report Ref: EMS-605482_809329
Grid Ref: 435928, 398852

Map Name: County Series

Map date: 1903

Scale: 1:10,560

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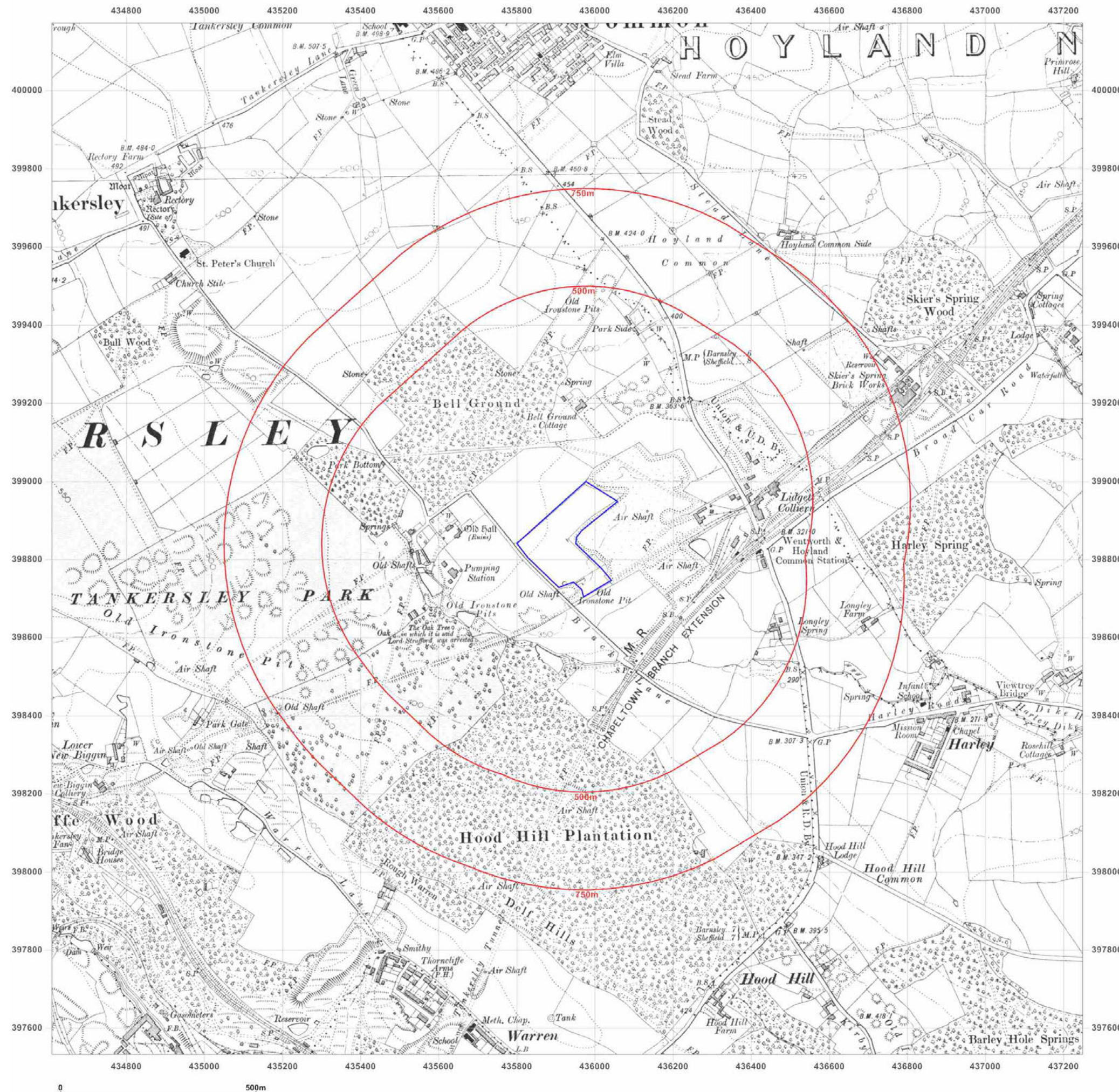


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Report Ref: EMS-605482_809329
Grid Ref: 435928, 398852

Map Name: County Series

Map date: 1938

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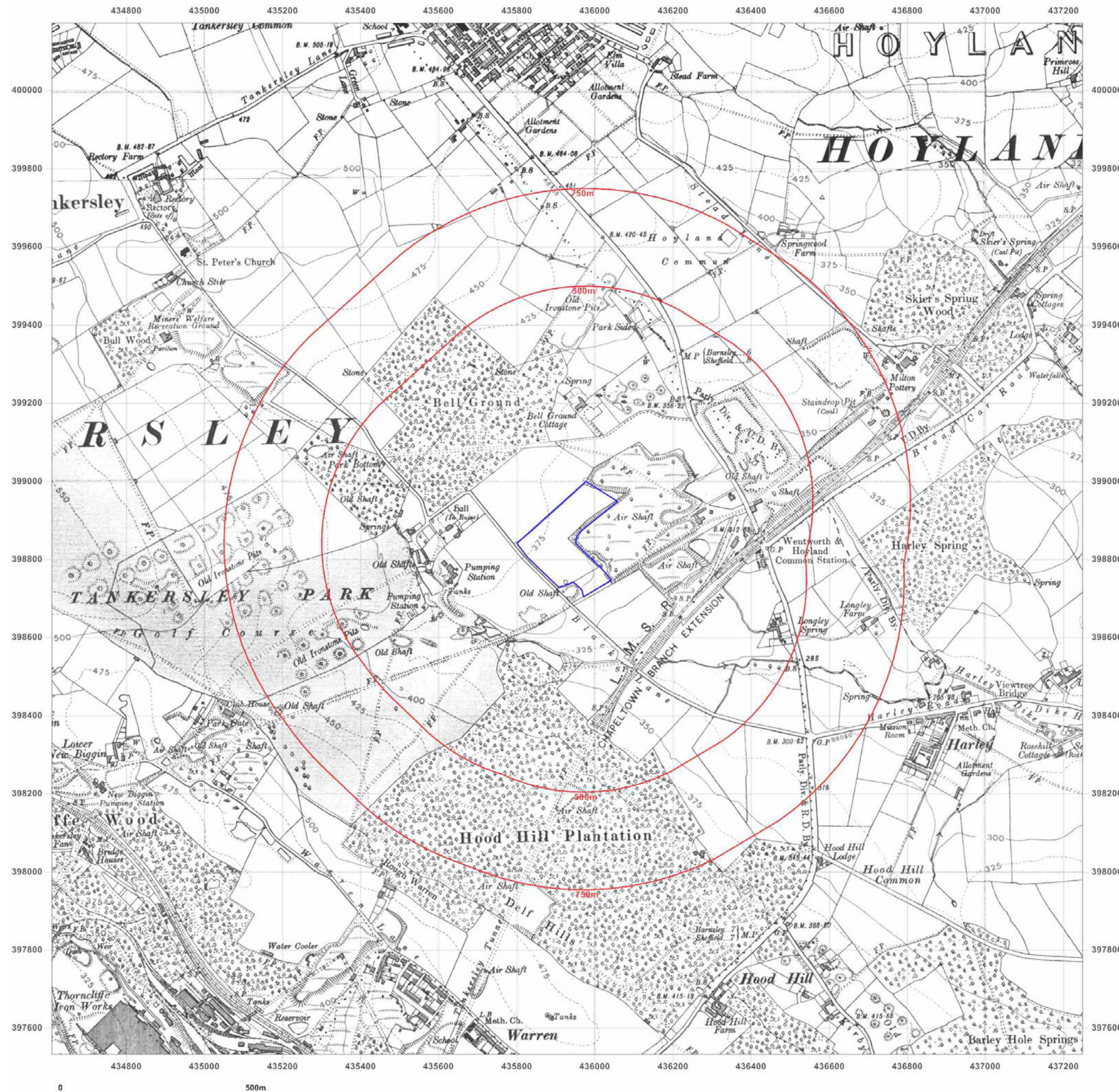


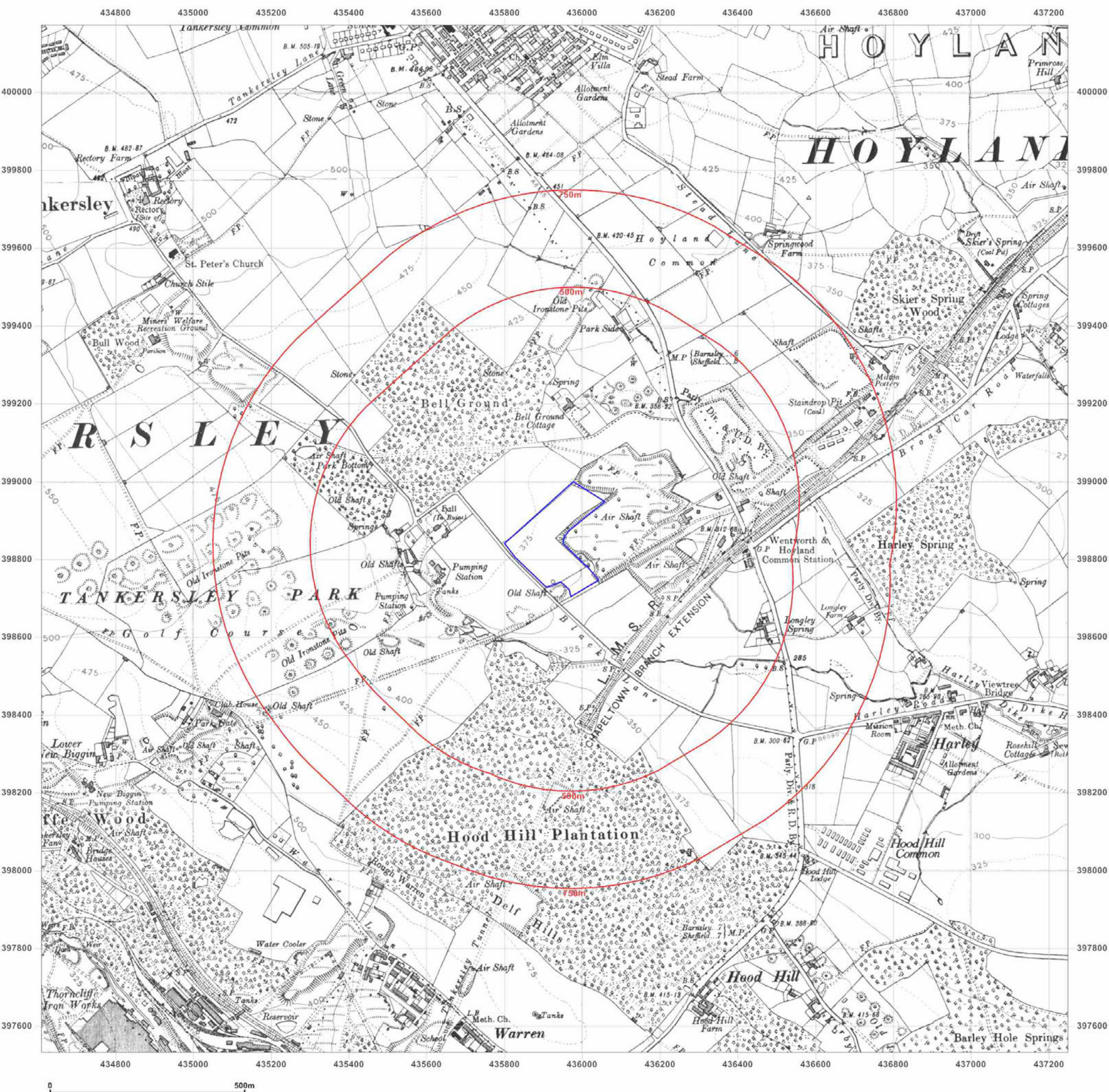
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Production date: 16 April 2020

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Site Details:

Hoyland Common- Balancing Ponds

Client Ref: EMS_605482_809329
Report Ref: EMS-605482_809329
Grid Ref: 435928, 398852

Map Name: County Series

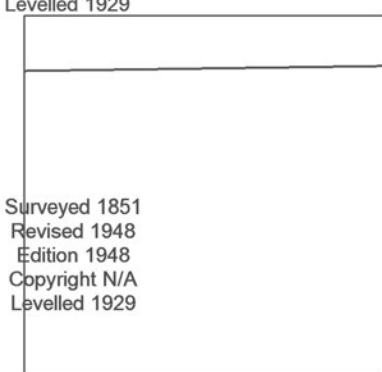
Map date: 1948

Scale: 1:10,560

Printed at: 1:10,560



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