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**CAPITOL PARK – PHASE 2, BARNSELY, SOUTH YORKSHIRE**

**CARNELL MANAGEMENT SERVICES LTD**

**FLOOD RISK ASSESSMENT**

**11933-WMS-ZZ-XX-RP-39301-S8-P1**

**MAY 2019**

**Contract:** Capitol Park – Phase 2, Barnsley, South Yorkshire**Document Title:** Flood Risk Assessment**Our Ref:** 11933-WMS-ZZ-XX-RP-39301-S8-P1**Prepared by:** W. P. Dixon BSc (Hons) MSc FGS**Date:** May 2019**RECORD OF AMENDMENTS TO DOCUMENT**

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**Verified by:** A.C.Gibson BEng CEng MICE MCIHT MIRSE**Date:** May 2019

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## **1.0 INTRODUCTION**

### **1.1 Background**

1.1.1 William Saunders have been appointed by Carnell Management Services Ltd to undertake a Flood Risk Assessment to support a light industrial development at Capitol Park, Barnsley. For a location plan see Appendix A.

1.1.2 During the preparation of this report, William Saunders have approached representatives of Yorkshire Water Ltd, the Environment Agency and the Lead Local Flood Authority (Barnsley Metropolitan Borough Council) and have reviewed the Strategic Flood Risk Assessment and Flood Risk Mapping Study.

### **1.2 Proposed Development**

1.2.1 The proposed development comprises the construction of 2 no. light industrial units and associated external works, see Appendix A.

### **1.3 Objectives and Methodology**

1.3.1 The objectives of this Report are to:

- Determine the likely sources of flooding,
- Assess the development proposals in the context of the National Planning Policy Framework,
- Propose an appropriate surface water drainage strategy,
- Determine appropriate mitigation and/or protection measures.

1.3.2 In order to achieve the objectives the following have been assessed:

- Flood risk within the site and beyond its boundaries,
- Pre and post development storm water run-off and means of storm water disposal,
- Storm events up to the 1000-year return period with an allowance for climate change.

### **1.4 Policy Background**

1.4.1 This Flood Risk Assessment (FRA) is compliant with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance.

- 1.4.2 The NPPF sets out the Government's national policies on different aspects of land use planning in England including flood risk. Supporting guidance is also available in the Planning Practice Guidance.
- 1.4.3 The NPPF Planning Practice Guidance sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk to the site itself and off site to the wider catchment area. It also states that alternative sources of flooding, other than fluvial (river flooding), should also be considered when preparing a Flood Risk Assessment. Assessments of flood risk should also take into account climate change.
- 1.4.4 Flood Zone mapping available from the Environment Agency identifies areas potentially at risk of flooding from fluvial or tidal sources without taking into account the presence of flood defences or structures.
- 1.4.5 Review of the Environment Agency's Flood Map for Planning, figure 1, indicates that the site is located within Flood Zone 1 (land assessed as having an annual probability of river or sea flooding, without flood defences, of less than 1 in 1000 (<0.1%). There are no areas of flood zones 2 or 3 within 1km of the site.
- 1.4.6 The requirements of the NPPF are such that a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

## **1.5 Climate Change**

- 1.5.1 The NPPF requires that climate change is taken into account when assessing the flood risk for developments. Tables 1 and 2 of the NPPF-PPG provide sensitivity ranges which may provide an appropriate precautionary response to the uncertainty about climate change impacts on river flows and peak rainfall intensities.

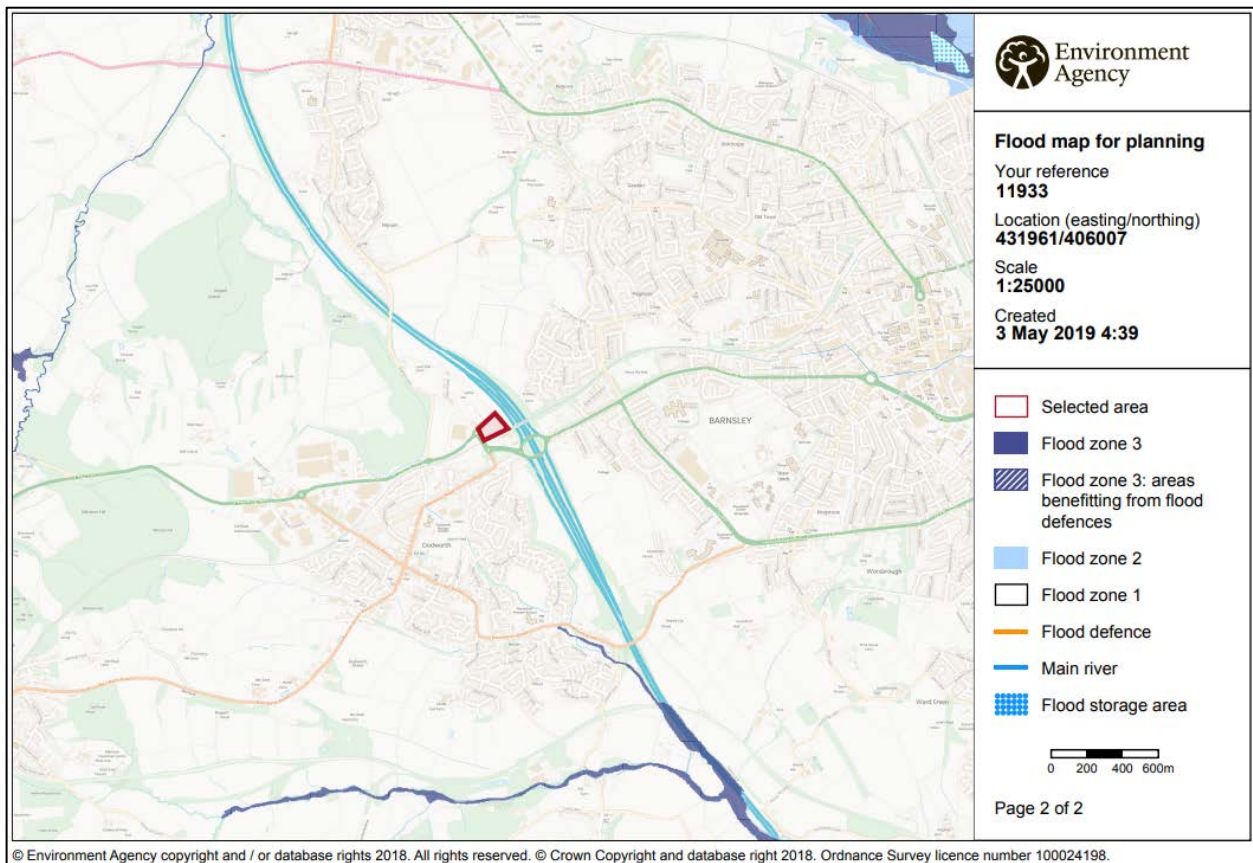


Figure 1. Environment Agency Flood Map for Planning 1:25,000-scale (Environment Agency).

1.5.2 As the development falls within Flood Zone 1 and is classed as less vulnerable, the 'central' climate change allowance has been used. This means an allowance of 10 - 20% has been made for climate change in respect of river flows, in line with EA guidance. In respect of peak rainfall intensity both 'central' and 'upper end' increases of 20 - 40% should be used to understand the range of impact.

| River basin district | Allowance category | Total potential change anticipated for '2020s' (2015 to 39) | Total potential change anticipated for '2050s' (2040 to 2069) | Total potential change anticipated for '2080s' (2070 to 2115) |
|----------------------|--------------------|-------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| Humber               | Upper end          | 20%                                                         | 30%                                                           | 50%                                                           |
|                      | Higher central     | 15%                                                         | 20%                                                           | 30%                                                           |
|                      | <b>Central</b>     | <b>10%</b>                                                  | <b>15%</b>                                                    | <b>20%</b>                                                    |

Table 1 – Table 1 of the NPPF-PPG. Peak river flow allowances by river basin district (using 1961 to 1990 baseline).

| <b>Applies across all of England</b> | <b>Total potential change anticipated for 2010 to 2039</b> | <b>Total potential change anticipated for 2040 to 2059</b> | <b>Total potential change anticipated for 2060 to 2115</b> |
|--------------------------------------|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|
| <b>Upper end</b>                     | 10%                                                        | 20%                                                        | 40%                                                        |
| <b>Central</b>                       | 5%                                                         | 10%                                                        | 20%                                                        |

Table 2 – Table 2 of the NPPF-PPG. Peak rainfall intensity allowance in small and urban catchments (using 1961 to 1990 baseline).

## 1.6 Strategic Flood Risk Assessment

- 1.6.1 The site is covered by the Barnsley Metropolitan Borough Council Level 1 Strategic Flood Risk Assessment (SFRA Level 1 – September 2010). The SFRA provides a summary of the catchments, relevant policies, current flood risks, the potential impacts of climate change, flood risk management practices and policy recommendations.
- 1.6.2 The site is referenced in the “Employment Land Review” Barnsley Metropolitan Borough Council 2010. The site is part of the referenced site ES18 or DO3/1.

## 1.7 Compliance with NPPF Policy

- 1.7.1 There is a requirement for a site-specific flood risk assessment as the site falls within Flood Zone 1 and is over 1 hectare. Existing sources of flood risk have been assessed, including ground water and urban drainage systems.

## **2.0 EXISTING SITE CONDITIONS**

### **2.1 Site Location**

- 2.1.1 The site consists of the south-eastern plot of the Capitol Park complex, Dodworth, Barnsley. The plot entrance is south of the end of Capitol Court.
- 2.1.2 The site is approx. 160m north of Dodworth and 2.5km west of Barnsley centre. The M1 Junction 37 slip road is approx. 45m north-east and a rail line is present immediately beyond the southern boundary.
- 2.1.3 The site is approximately 1.15 hectares in area. The National Grid Reference for the site is 431948E, 406009N or SE319060, the postcode is S75 3TZ. A location plan and proposed site plan are given in Appendix A.

### **2.2 Site Description**

- 2.2.1 The development site comprises undeveloped, levelled plot on the business park. The site has been recently surfaced in compacted hardcore and used as a construction site car park.
- 2.2.2 Existing business units are present on the rest of Capitol Park, to the north is a similar light-industrial development, to the north-west a large office block with larger warehousing/distribution units beyond. South of the site beyond the rail line is a hotel.
- 2.2.3 The site lies at around 149m AOD and is almost flat apart from a linear mound of <0.5m towards the centre of the site. The eastern and southern boundaries rapidly fall away from the general site level (up to 2.7m and generally 4m respectively), the western boundary rapidly rises by around 2m to meet the road level at the adjacent roundabout on Whinby Road.

### **2.3 Local Watercourses**

- 2.3.1 The closest watercourse is a drain approx. 300m to the west, this watercourse along Higham Lane is at the eastern base of a localised hill and has a very small catchment. Initially it trends NW-SE but changes course to flow away from the site towards Whinby Road where it is taken southwards by an extended culvert.

## **2.4 Underlying Geology**

### **2.4.1 Artificial Geology**

British Geological Survey 1:50,000 scale map sheet 87 (solid & drift edition) indicates there is geologically significant area of worked ground immediately north-west of the site, this corresponds to the M1 cutting.

### **2.4.2 Superficial Geology**

British Geological Survey 1:50,000 scale mapping indicates the site is not underlain by superficial deposits, Appendix B.

### **2.4.3 Bedrock Geology**

British Geological Survey 1:50,000 scale mapping indicates the bedrock beneath the site is comprised of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation (Carboniferous). A wedge-shaped deposit of sandstone of the Haigh Moor Rock may be present in the central north-western area of the site, Appendix B.

No geological faulting is present on site.

2.4.4 Borehole records from a ground investigation for the recent Carnell Management Services development on Capitol Park cover the area to the north, with the boundary of the investigation being the northern boundary of this site. These boreholes indicate the presence of firm clay or gravelly made ground over extremely weak, highly weathered mudstone, in places the mudstone was directly beneath topsoil.

## **2.5 Groundwater**

2.5.1 Borehole records from a ground investigation for the recent Carnell Management Services development on Capitol Park cover the area to the north, with the boundary of the investigation being the northern boundary of this site. Groundwater was not encountered in standpipes which were sunk to 5m bgl and monitored for 3 months.

2.5.2 Analysis of the Source Protection Zone (SPZ) maps published by the EA shows that the site does not lie inside or within 1 km of an EA SPZ with regard to the protection of the quality of groundwater that is abstracted for potable supply, see figure 2 and Appendix B.

- 2.5.3 The site is within a designated nitrate vulnerable zone for surface water, see figure 2 and Appendix B.
- 2.5.4 The bedrock beneath the site (Pennine Middle Coal Measures Formation) is classified as a Secondary A aquifer, see figure 2 and Appendix B. Secondary A aquifers are defined by the EA as:
- ‘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. These are generally aquifers formerly classified as minor aquifers.’
- 2.5.5 There are no superficial deposits beneath the site, Appendix B.
- 2.5.6 The groundwater vulnerability is classed as ‘Minor Aquifer Low,’ Appendix B. Soils are classified as having a low leaching potential. These are *‘Soils in which pollutants are unlikely to penetrate the soil layer because water movement is largely horizontal or they have large ability to attenuate diffuse pollutants. Lateral flow from these soils contribute to groundwater recharge elsewhere in the catchment.’*
- Areas with low vulnerability groundwater resources are described by the Environment Agency as, *“areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.”*
- The east of the site is on the boundary of an area classed as being ‘Minor Aquifer High’, in terms of groundwater vulnerability due to soils being classed as urban, figure 2.
- 2.5.7 The site is split between being classified as not susceptible to groundwater flooding and having a limited potential for groundwater flooding to occur, Appendix B.

|                                                                                                                                                                                                |                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 03/05/2019<br>Site Check Report Report generated on Fri May 03 2019<br>You selected the location: Centroid Grid Ref: SE31950601<br>The following features have been found in your search area: |                                                                                                                                                                                                                       |
| <b>Nitrate Vulnerable Zones 2017 Designations (England)</b>                                                                                                                                    |                                                                                                                                                                                                                       |
| Nitrate Vulnerable Zone ID                                                                                                                                                                     | 278                                                                                                                                                                                                                   |
| Nitrate Vulnerable Zone Name                                                                                                                                                                   | River Deame NVZ                                                                                                                                                                                                       |
| Type of Nitrate Vulnerable Zone                                                                                                                                                                | Surface Water                                                                                                                                                                                                         |
| Status of NVZ since 2013 designations                                                                                                                                                          | Existing                                                                                                                                                                                                              |
| Unique Reference number                                                                                                                                                                        | S278                                                                                                                                                                                                                  |
| <b>Aquifer Designation Map (Bedrock) (England)</b>                                                                                                                                             |                                                                                                                                                                                                                       |
| Typology                                                                                                                                                                                       | Secondary A                                                                                                                                                                                                           |
| <b>Groundwater Vulnerability Map (England)</b>                                                                                                                                                 |                                                                                                                                                                                                                       |
| Classification                                                                                                                                                                                 | MINOR_H                                                                                                                                                                                                               |
| Classification                                                                                                                                                                                 | MINOR_L                                                                                                                                                                                                               |
| <b>Geological Descriptions (England)</b>                                                                                                                                                       |                                                                                                                                                                                                                       |
| Name                                                                                                                                                                                           | Yorkshire - South (Barnsley, Sheffield, Rotherham and Doncaster Districts)                                                                                                                                            |
| Hyperlink                                                                                                                                                                                      | <a href="http://www.naturalengland.org.uk/ourwork/conservation/geodiversity/englands/counties/area_ID42.aspx">http://www.naturalengland.org.uk/ourwork/conservation/geodiversity/englands/counties/area_ID42.aspx</a> |
| <b>Soilscape (England)</b>                                                                                                                                                                     |                                                                                                                                                                                                                       |
| Reference                                                                                                                                                                                      | 17                                                                                                                                                                                                                    |
| Name                                                                                                                                                                                           | SLOWLY PERMEABLE SEASONALLY WET ACID LOAMY AND CLAYEY SOILS                                                                                                                                                           |
| Main Surface Texture Class                                                                                                                                                                     | LOAMY                                                                                                                                                                                                                 |
| Natural Drainage Type                                                                                                                                                                          | IMPEDED DRAINAGE                                                                                                                                                                                                      |
| Natural Fertility                                                                                                                                                                              | LOW                                                                                                                                                                                                                   |
| Characteristic Semi-natural Habitats                                                                                                                                                           | SEASONALLY WET PASTURES AND WOODLANDS MAINLY, BUT NOT EXCLUSIVELY, ON THE UPLAND FRINGE                                                                                                                               |
| Main Land Cover                                                                                                                                                                                | GRASSLAND WITH SOME ARABLE AND FORESTRY                                                                                                                                                                               |
| Hyperlink                                                                                                                                                                                      | <a href="#">/Metadata_for_magic/soilscape_summary.pdf</a>                                                                                                                                                             |

Figure 2. Hydrogeological site check performed on <https://magic.defra.gov.uk/MagicMap.aspx>

## 2.6 Existing Flood Defences

- 2.6.1 The Environment Agency's Flood Map for Planning indicates there are no formal flood defences in the area, there are no significant watercourses.
- 2.6.2 The Environment Agency have confirmed there are no Environment Agency maintained raised defences in this area.

## 2.7 Existing Drainage

- 2.7.1 The site is considered to be brownfield and is known to have existing public foul and surface water drainage systems installed in the highways; tails are prepared for connection. It is proposed that the development will be connected to the existing drainage network which has been designed appropriately to take flows from this site. This drainage network is detailed in a section 104 plan provided by Yorkshire Water.

- 2.7.2 The section 104 plan indicates the presence of a 150mm diameter foul sewer in Capitol Court, a stub is indicated within the site entrance.
- 2.7.3 The section 104 plan indicates the presence of a surface water sewer in Capitol Court. Along Capitol Court this is 450mm diameter becoming 525mm before the roundabout, between the roundabout and the junction with Capitol Close this becomes 750mm diameter. It then becomes 900mm diameter as it enters the existing junction to the south-west of Capitol Close, then 1050mm before entering a box culvert. The outlet of the box culvert is a 1050mm pipe which is reduced to 225mm before entering the surface water sewer in Whinby Road.
- 2.7.4 Foul and surface water sewers both flow beneath the western site towards the south-west where there is a box culvert providing storage in the region of 3500m<sup>3</sup>.
- 2.7.5 The section 104 plan indicates the presence of a stub within the site entrance which connects to the 450mm diameter surface water sewer, the allowable impermeable catchment area to the stub is 7725m<sup>2</sup>.

## **2.8 Existing and Historic Flood Risk**

- 2.8.1 The Environment Agency's Flood Map for Planning indicates that the site is located within Flood Zone 1 (low risk) (land assessed as having an annual probability of river or sea flooding, without flood defences, of less than 1 in 1000 (<0.1%)). There are no areas of flood zones 2 or 3 within 1km of the site.
- 2.8.2 The Environment Agency have no records of historic fluvial/tidal flooding affecting the site. The EA have stated, "*to the best of our knowledge there is no known flood history for this site.*"
- 2.8.3 Pluvial risk is very low (<0.1% annual probability of occurrence) across the entire site.
- 2.8.4 The site has a limited potential for groundwater flooding to occur or is not susceptible to groundwater flooding.
- 2.8.5 Foul and surface water sewers in the carriageway of Capitol Court may have potential to impact the site.

## 2.9 Potential Sources of Flood Risk

2.9.1 The Environment Agency's flood map indicates that the most likely source of flooding is pluvial flooding from extreme rainfall events with other possible sources being:

- Fluvial;
- Tidal;
- Groundwater;
- Flooding from existing sewers;
- Surface water flooding from off-site sources;
- Surface water flooding from on-site sources;
- Reservoirs.

These are discussed in greater detail in Section 3.0.

2.9.2 Table 3 below indicates the level of potential risk associated with the flood sources and the impacts of the development upon the adjacent area.

| Flood Source                                 | Potential Risk |        |     |          |      | Description                                                                                                                                                           |
|----------------------------------------------|----------------|--------|-----|----------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                              | High           | Medium | Low | Very Low | None |                                                                                                                                                                       |
| Fluvial                                      |                |        |     | X        |      | The site is located in Flood Zone 1. There are no areas of flood zones 2 or 3 within 1km of the site. There is a drain approx. 300m west with a very small catchment. |
| Tidal                                        |                |        |     |          | X    | The site is inland and significantly above the level of tidal flooding.                                                                                               |
| Canals                                       |                |        |     |          | X    | There are no canals present in the area.                                                                                                                              |
| Groundwater                                  |                |        |     | X        |      | The site has a limited potential for groundwater flooding to occur or is not susceptible to groundwater flooding.                                                     |
| Reservoirs                                   |                |        |     |          | X    | The site is not within an area at risk of flooding from reservoir failure.                                                                                            |
| Sewers                                       |                |        | X   |          |      | There are existing sewers in the carriageway of Capitol Court.                                                                                                        |
| Pluvial runoff                               |                |        |     | X        |      | The entire site is classed as very low risk. Adjacent land does not add to flood risk.                                                                                |
| Effect of development on the wider catchment |                |        | X   |          |      | Overall impermeable surfacing will be increased by a small proportion, existing drainage has been designed to allow for a stated impermeable area on the site.        |

Table 3: Initial Potential Flood Sources and Risks

### 3.0 ASSESSMENT OF FLOOD RISK

#### 3.1 Fluvial Flooding

3.1.1 The Environment Agency Flood Map for Planning indicates the entire site is within Flood Zone 1, the annual probability of flooding from fluvial sources, without flood defences, is less than 1 in 1000 (<0.1%). There are no areas of flood zones 2 and 3 within 1km of the site, see figures 1 and 3.

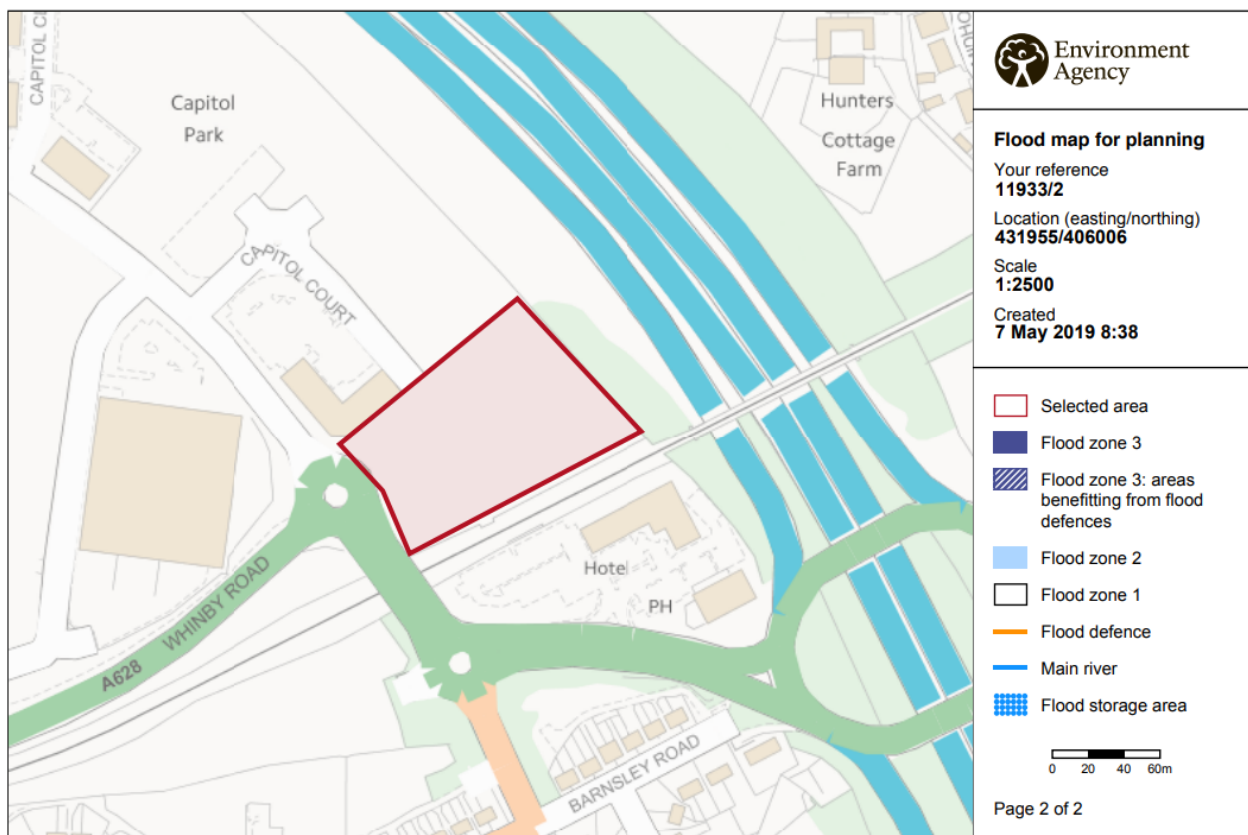


Figure 3. The Flood Map for Planning 1:2,500-scale (Environment Agency).

3.1.2 The catchment of the drain 300m west of the site appears to be very small. It drains the south-eastern part of a hillside and flows away from the site. It is taken beneath Whinby Road and into Dodworth through an extended culvert. If this were to back up the topography suggests the site is unlikely to be affected by resulting flooding, the southern slope of the land near the drain would mean water would flow away from the area before reaching the site.

3.1.3 The site is not within an Environment Agency flood alert or warning area.

Environment Agency Product 4 Information

- 3.1.4. Environment Agency Product 4 data was requested for the area, Appendix C.
- 3.1.5 The Environment Agency Flood Map for Planning indicates no areas of Flood Zones 2 or 3, no flood defences, no areas benefitting from flood defences and no flood storage areas.
- 3.1.6 The Environment Agency flood history map indicates no recorded flood events in the area.

Strategic Flood Risk Assessment Mapping

- 3.1.7 Barnsley Metropolitan Borough Council SFRA mapping 2010 indicates the site is not at risk of flooding from fluvial sources.

**3.2 Tidal Flooding**

- 3.2.1 The site lies at around 149m AOD, the site is not at risk of tidal flooding.

**3.3 Groundwater Flooding**

- 3.3.1 Groundwater flooding occurs when the water table rises above the ground surface or enters below ground voids, such as basements and cellars.
- 3.3.2 The Barnsley Metropolitan Borough Council SFRA, 2010, does not refer to the area when stating areas at particular risk of groundwater flooding.
- 3.3.3 British Geological Survey data indicates the site is split between being classified as not susceptible to groundwater flooding and having a limited potential for groundwater flooding to occur.
- 3.3.4 Borehole records from a ground investigation for the recent Carnell Management Services development on Capitol Park cover the area to the north with the boundary of the investigation being the northern boundary of this site. Groundwater was not encountered in standpipes which were sunk to 5m bgl and monitored for 3 months. 5 rotary boreholes were sunk to 20-22m bgl and did not encounter groundwater.

- 3.3.5 The M1 cutting, immediately to the north-east of the site, is not believed to have been affected by groundwater flooding. This section of motorway is approx. 5m below the site.
- 3.3.6 Records from the site investigation for the development of Capitol Park indicate groundwater was not struck in any of the trial pits which went to a maximum depth of 3.3m. Boreholes from 1962 from the construction of the M1 struck groundwater at roughly 11m. It should be noted that these measurements were taken at the ground level at the time, which has since been altered.
- 3.3.7 It is considered that the risk of groundwater flooding to the surface and shallow sub-surface structures is very low.
- 3.3.8 If groundwater flooding were to occur on the surface, ground levels will be profiled to direct any flood water away from the built environment and towards the nearest positively drained area.

#### **3.4 Flood Risk from Sewers**

- 3.4.1 Sewer flooding occurs when the sewerage system's capacity is exceeded and water surcharges from gullies and manholes.
- 3.4.2 Sewers were installed for the development of Capitol Park circa 2005 and have been designed with appropriate capacity to serve any proposals on Capitol Park with allowable impermeable areas for each plot shown in Appendix D. The site is at the upstream end of both the foul and surface water sewers so adjacent areas cannot directly cause surcharging of the manholes closest to the site.
- 3.4.3 Referring to the topographical surveys for this development site as well as the previous Carnell Management Services development suggests any surcharge of the existing sewers would be contained within the highway of Capitol Court.
- 3.4.4 The risk of sewer flooding is considered to be low. Sewers have been recently designed to accommodate the development and levels suggest any sewer flooding is likely to remain in the confines of the highway.

### 3.5 Pluvial Flood Risk

#### 3.5.1 On Site Surface Water:

3.5.1.1 According to Environment Agency mapping the entire site is indicated to be at very low risk of pluvial flooding (<0.1% annual probability of occurrence), figure 4.

#### 3.5.2 Off Site Surface Water:

3.5.2.1 Existing off-site pluvial risk is generally very low (<0.1% annual probability of occurrence) in the vicinity of the site. An area of low (0.1-1% annual probability of occurrence) to medium (1-3.3% annual probability of occurrence) risk is indicated in the carriageway of Capitol Court north-west of the site's entrance, the depth is indicated to be up to 300mm in a 1 in 1000-year event, figure 4.

3.5.2.2 It is considered that off-site areas do not add to the flood risk at the site.

#### 3.5.3 Strategic Flood Risk Assessment Mapping

3.5.3.1 Barnsley Metropolitan Borough Council SFRA mapping 2010 indicates the site is not at significant risk of flooding from pluvial sources.

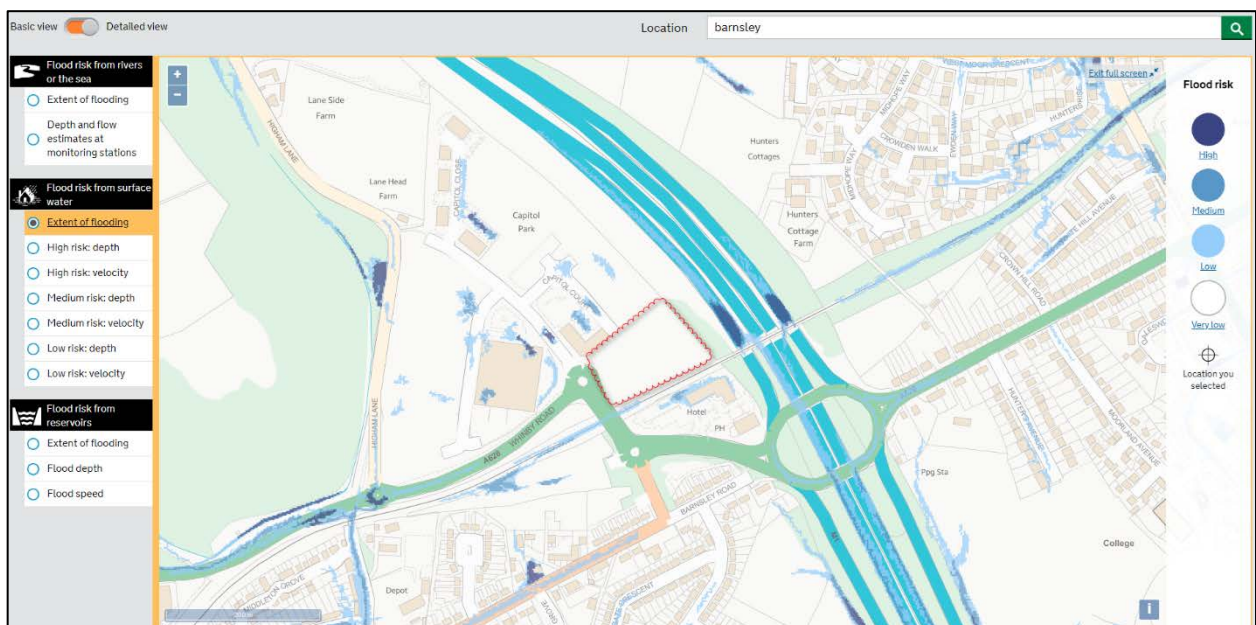


Figure 4. Current pluvial risk to the site (Environment Agency).

### **3.6 Flooding Risk from Reservoirs**

- 3.6.1 The EA's online mapping indicates that the site is not in an area at risk of flooding from reservoir failure, Appendix C.

### **3.7 Historic Flooding**

- 3.7.1 The Lead Local Flood Authority have stated they have no records of flooding (of any kind) affecting the site, Appendix C.

### **3.8 Flooding Resulting from Proposed Development**

- 3.8.1 The site is currently undeveloped, and surfaced in a mixture of permeable surfacing and compacted hardcore. The proposed development will increase the impermeable surface area which in turn will lead to an increased rate and volume of surface water runoff. This has the potential to increase flood risk to the site and adjacent developments. The provision of a suitable surface water drainage system and attenuation devices will ensure that the development does not result in any increase in the risk of on-site or off-site pluvial or sewerage flooding.
- 3.8.2 The sewage systems installed circa 2005 were designed for further developments on the site and has adequate capacity for drainage with a total allowable impermeable of area of 7725m<sup>2</sup> on the site. If this impermeable area is exceeded appropriate attenuation will be provided. As such there will be no adverse impact upon the existing drainage systems and no increased downstream flood risk.

### **3.9 Sequential and Exception Tests**

- 3.9.1 The site is located in EA Flood Zone 1 and has no critical drainage problems, as such no sequential test is required for the development.
- 3.9.2 The site is also referenced in the "Employment Land Review" Barnsley Metropolitan Borough Council 2010. The site is part of the referenced site ES18 or DO3/1.

- 3.9.3 Under the NPPF it is a requirement to locate development proposals in an area of lowest flood risk. As such various types of development have been classified as to their vulnerability, with the NPPF-PPG setting out the type of development that is acceptable within each of the risk zones.
- 3.9.4 The site consists of land in flood zone 1 and as discussed previously, will not be affected by a 1 in 100-year event plus climate change fluvial event or a 1 in 1000-year fluvial event.
- 3.9.5 The proposals are for a light-industrial development.
- 3.9.6 It is therefore considered that the site sequentially acceptable for the proposed development and no assessment of alternative sites is required. The sequential test also details that the most vulnerable development is located in areas of lowest flood risk, flood risk across the site is considered to be uniform. The vulnerability classes of the proposed light-industrial developments are all 'less vulnerable', table 4, therefore no significance should be placed on the location of individual units within the site in regards to flood risk.

| <b>Less vulnerable</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• <i>Police, ambulance and fire stations which are not required to be operational during flooding.</i></li> <li>• <i>Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; <b>offices; general industry, storage and distribution</b>; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.</i></li> <li>• <i>Land and buildings used for agriculture and forestry.</i></li> <li>• <i>Waste treatment (except landfill* and hazardous waste facilities).</i></li> <li>• <i>Minerals working and processing (except for sand and gravel working).</i></li> <li>• <i>Water treatment works which do not need to remain operational during times of flood.</i></li> <li>• <i>Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.</i></li> </ul> |

Table 4. Extract from Table 2 of the NPPF-PPG (Flood Risk Vulnerability Classification).

- 3.9.7 The development site is within the Environment Agency's Flood Zone 1, the land use is classified as 'less vulnerable', under the NPPF there is not a requirement to carry out an exception test, table 5.

| Flood Risk Vulnerability Classification |                                     | Essential Infrastructure | Highly vulnerable | More vulnerable | Less vulnerable | Water-compatible |
|-----------------------------------------|-------------------------------------|--------------------------|-------------------|-----------------|-----------------|------------------|
| EA Flood Zone                           | 1                                   | ✓                        | ✓                 | ✓               | ✓               | ✓                |
|                                         | 2                                   | ✓                        | Exception test    | ✓               | ✓               | ✓                |
|                                         | 3a                                  | Exception test           | x                 | Exception test  | ✓               | ✓                |
|                                         | 3b                                  | Exception test           | x                 | x               | x               | ✓                |
| ✓                                       | Development is appropriate          |                          |                   |                 |                 |                  |
| x                                       | Development should not be permitted |                          |                   |                 |                 |                  |

Table 5. Extract from Table 3 of the NPPF-PPG (Flood Risk Vulnerability and Flood Zone 'Compatibility').

### 3.10 Development Suitability

- 3.10.1 It is considered, taking into account the flood risk issues discussed in Section 3.0, the proposed development is considered suitable in accordance with the considerations of the National Planning Policy Framework subject to the implementation of recommended mitigation measures.

## **4.0 FLOOD RISK MITIGATION**

4.0.1 Section 3.0 has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA sets out the mitigation measures which are to be incorporated within the proposed development to address and reduce the risk of flooding to within acceptable levels.

### **4.1 Proposed Ground Levels**

4.1.1 The site has been levelled circa 2005, the site lies at ~149m AOD and is relatively flat. Proposed ground levels will closely resemble these existing levels.

4.1.2 Proposed ground levels in areas of proposed hard surfacing will be profiled to direct pluvial runoff and overland flows away from the built development and towards the nearest positively drained area.

### **4.2 Proposed Floor Levels**

4.2.1 Floor levels will be determined at a later stage. These will be influenced by the detailed drainage and levels strategies.

4.2.2 Floor levels should be set at least 150mm above surrounding finished ground levels to minimise risk of pluvial flooding.

### **4.3 Safe Access and Egress**

4.3.1 Safe access and exit is required to enable the evacuation of people from the development, provide the emergency services with access to the development during a flood and enable flood defence authorities to carry out any necessary duties during the period of flood.

4.3.2 The requirements for safe access and exit from developments in flood risk areas are as follows in decreasing order of preference:

- Safe dry route for people and vehicles,
- Safe dry route for people,

- If a dry route is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause a risk to people,
- If a dry route is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles. However, the public should not drive vehicles in floodwater.

4.3.3 R&D Technical Report FD2320/TR2 – Flood Risk Assessment Guidance for New Development advises a safe access and exit route is developed based on flood levels for suitable annual probabilities (1% and 0.1% annual probabilities for fluvial flooding or the 0.5% and 0.1% for tidal/coastal flooding).

4.3.4 The site is not indicated to be affected by these flood events.

#### **4.4 Surface Water Drainage Strategy**

4.4.1 See site-specific drainage strategy produced by William Saunders.

#### **4.5 Foul Water Drainage Strategy**

4.5.1 See site-specific drainage strategy produced by William Saunders.

#### **4.6 Proposed Sustainable Drainage Measures**

4.6.1 See site-specific drainage strategy produced by William Saunders.

#### **4.7 Summary of Attenuation Requirements**

4.7.1 Yorkshire Water have stated that there are no restrictions on discharge rates from the site, the drainage restrictions are based solely on defined allowable areas to each connection point.

4.7.2 Attenuation will only be required if the proposed impermeable area exceeds the allowable impermeable area. Attenuation may also be required to restrict discharge from the site to the return period the sewer has been designed to cater for.

4.7.3 The drainage system will be designed so that a 1 in 30-year event is contained beneath the ground with no flooding and a 1 in 100-year event (accounting for climate change) is contained within the site with no flooding to the built environment.

4.7.4 For further information on attenuation requirements see the site-specific drainage strategy produced by William Saunders.

#### **4.8 Floodplain Compensatory Storage**

4.8.1 The development is not located in the Environment Agency's flood zone 3 and therefore a development on the site will not reduce the storage volume of the 1 in 100-year floodplain. No compensatory storage is required.

#### **4.9 Proposed Resistance / Resilience Measures**

4.9.1 No flood resilience measures are considered necessary.

#### **4.10 Miscellaneous**

4.10.1 Proposed drains within the site are to be designed in accordance with the latest industry standards. Thus, it is proposed to follow the guidelines of Building Regulations Document H and BSEN 752 which will ensure sufficient velocities are achieved in the sewers that will reduce to a minimum the deposition of silt and prevent excessive detention. However as with any sewerage some routine maintenance will be required.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

- 5.1 The Environment Agency Flood Map for Planning indicates the entire site is within Flood Zone 1, the annual probability of flooding from fluvial and tidal sources, without flood defences, is less than 1 in 1000 (<0.1%). There are no areas of flood zones 2 and 3 within 1km of the site. The site is not in an area at risk of flooding from reservoir failure. Groundwater flood risk is considered to be very low. Overall pluvial flood risk is considered to be very low. The risk of sewer flooding is considered to be low.
- 5.2 The closest watercourse is a drain at the eastern base of a localised hill approx. 300m to the west, this watercourse has a very small catchment and is not considered to pose a flood risk to the site.
- 5.3 The identified risks and mitigation measures are summarised in table 6 below:

| Flood Source    | Risk     | Mitigation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fluvial & Tidal | Very low | The Environment Agency Flood Map for Planning indicates the entire site is within Flood Zone 1, the annual probability of flooding from fluvial and tidal sources, without flood defences, is less than 1 in 1000 (<0.1%). There are no areas of flood zones 2 and 3 within 1km of the site.                                                                                                                                                                                                                           |
| Canals          | Very low | There are no canals present in the area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Groundwater     | Very low | The site is split between being classified as not susceptible to groundwater flooding and having a limited potential for groundwater flooding to occur. Groundwater was not encountered during the previous site investigation to depths of 5m bgl over a prolonged period. Any flooding at the surface would be mitigated by raising floor levels a minimum of 150mm above surrounding ground level and profiling ground levels away from the built environment.                                                      |
| Sewers          | Low      | There are modern sewers in the carriageway of Capitol Court which have been designed to cater for a development such as this one, the site is at the upstream end of the sewer system. The topography suggests any surcharge would remain in the carriageway of Capitol Court. Residual risk is mitigated by raising floor levels a minimum of 150mm above surrounding ground levels and profiling ground levels away from the built environment.                                                                      |
| Pluvial runoff  | Low      | The entire site is indicated to be at very low risk of pluvial flooding (<0.1% annual probability of occurrence). The topography suggests off-site areas will not add to the flood risk at the site. The risk of the pluvial flooding on the site will be mitigated through the provision of additional surface water drainage, the drainage systems will be designed to contain a 1 in 3.3% event and allow no flooding to the built development or adjacent off-site areas in a 1%+CC event. Further mitigation will |

|                       |     |                                                                                                                                                                                                                                                                                                                                             |
|-----------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       |     | be provided by raising floor levels a minimum of 150mm above surrounding ground level and profiling ground levels away from the built environment.                                                                                                                                                                                          |
| Impact of development | Low | The development will not impact on flood risk in the wider catchment. There will be an increase in the impermeable surface area. The existing sewage system is understood to have sufficient capacity to drain the proposed development. Appropriate restrictions will be placed on surface water discharges leaving the site if necessary. |

Table 6. Summary of flood risk to the site.

- 5.4 The development will not increase flood risk to the site itself or wider catchment area as a result of suitable management of surface water runoff discharging from the site.
- 5.5 Subject to the implementation of recommended mitigation measures, the proposed development is considered suitable in accordance with the considerations of National Planning Policy Framework.

## **APPENDIX A**

### **Site Location Plan**

### **Development Proposals**



NOT TO SCALE



SCALE 1:50000

NGR: 431948, 406009

In accordance with CDM Regulations 7, 11 and 18, any significant risks (as defined in the Approved Code of Practice paragraph 133) relating to the design features shown on this drawing have been identified and are annotated thus: 

☒ No significant risks have been identified.

☐ Significant risks have been identified - refer to notes on drawing for information on residual risks and any control measures to be employed.

Refer to the current Designer's Risk Assessment sheets for further details.

|                      |                 |      |          |
|----------------------|-----------------|------|----------|
| Designer's Signature |                 | Date |          |
| Rev.                 | Description     | Vfd  | Date     |
| 1                    | - Initial Issue | AG   | April 19 |
| 2                    |                 |      |          |
| 3                    |                 |      |          |

|                            |            |                                    |              |
|----------------------------|------------|------------------------------------|--------------|
| Project                    |            | Capitol Park Phase 2,<br>Barnsley  |              |
| Client                     |            | Carnell Management<br>Services Ltd |              |
| Title                      |            | Site Location                      |              |
| Drawing Status             |            | Information                        |              |
| Project Ref.               | Drawn      | Date                               | Scale        |
| 11933                      | WD         | Apr 19                             | As shown @A4 |
| Drawing/Document Reference |            |                                    |              |
| Project                    | Originator | Zone                               | Level Type   |
| 11933                      | WMS        | ZZ                                 | XX           |
| DR                         |            | C-30001                            | S1-P1        |

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This drawing is subject to Client & Planning Approval. Building Areas are footprint areas.

As outlined in section 2.3 of the CITB Industry Guidance to Designers, insignificant risks can usually be ignored, as can risks arising from routine construction activities, unless the design compounds or significantly alters these risks. In accordance with CDM Regulations 8, 9 and 11, any significant risks relating to the design features shown on this drawing have been identified and are annotated thus: **!**

☒ No significant risks have been identified.

☐ Significant risks have been identified - refer to notes on drawing for information on residual risks and any control measures to be employed.

Refer to the current Designer's Risk Assessment sheets for further details.

| Designer's Signature |                                | Date |       |
|----------------------|--------------------------------|------|-------|
| Rev.                 | Description                    | Vf'd | Date  |
| P1                   | Issued for information         | SW   | 03/19 |
| P2                   | Layout updated. Based on topo. | SW   | 03/19 |
| P3                   | Layout updated.                | SW   | 03/19 |

|                                                                      |            |      |       |      |           |         |            |      |
|----------------------------------------------------------------------|------------|------|-------|------|-----------|---------|------------|------|
| Project Proposed Development,<br>Capitol Park, Dodworth.<br>Phase 2. |            |      |       |      |           |         |            |      |
| Client Carnell Management Services.                                  |            |      |       |      |           |         |            |      |
| Title Site Plan Option 3.                                            |            |      |       |      |           |         |            |      |
| Drawing Status INFORMATION.                                          |            |      |       |      |           |         |            |      |
| WmS Project Ref.                                                     |            |      | Drawn |      | Date      |         | Scale      |      |
| 11933                                                                |            |      | SW    |      | Mar. 2019 |         | 1:500 @ A3 |      |
| Drawing/Document Reference                                           |            |      |       |      |           |         |            |      |
| Project                                                              | Originator | Zone | Level | Type | Role      | Number  | Status     | Rev. |
| 11933                                                                | - WMS      | - ZZ | - ZZ  | - DR | - A       | - 10003 | - S2       | - P3 |

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## **APPENDIX B**

### **Environmental Data**

-

**British Geological Survey Data**  
**Envirocheck Environmental Data**

# Geology 1:50,000 Maps Legends

## Artificial Ground and Landslip

| Map Colour | Lex Code | Rock Name                 | Rock Type                  | Min and Max Age         |
|------------|----------|---------------------------|----------------------------|-------------------------|
|            | WMGR     | Infilled Ground           | Artificial Deposit         | Cenozoic - Cenozoic     |
|            | WGR      | Worked Ground (Undivided) | Void                       | Holocene - Holocene     |
|            | MGR      | Made Ground (Undivided)   | Artificial Deposit         | Holocene - Holocene     |
|            | SLIP     | Landslide Deposit         | Unknown/Unclassified Entry | Quaternary - Quaternary |

## Superficial Geology

| Map Colour | Lex Code | Rock Name | Rock Type     | Min and Max Age         |
|------------|----------|-----------|---------------|-------------------------|
|            | ALV      | Alluvium  | Clay and Silt | Flandrian - Flandrian   |
|            | HEAD     | Head      | Diamicton     | Quaternary - Quaternary |

## Bedrock and Faults

| Map Colour | Lex Code | Rock Name                              | Rock Type                         | Min and Max Age           |
|------------|----------|----------------------------------------|-----------------------------------|---------------------------|
|            | HMR      | Haigh Moor Rock                        | Sandstone                         | Duckmantian - Duckmantian |
|            | PMCM     | Pennine Middle Coal Measures Formation | Mudstone, Siltstone and Sandstone | Bolsovia - Duckmantian    |
|            | PMCM     | Pennine Middle Coal Measures Formation | Sandstone                         | Bolsovia - Duckmantian    |
|            | BNR      | Barnsley Rock                          | Sandstone                         | Duckmantian - Duckmantian |
|            | KNR      | Kent's Rock                            | Sandstone                         | Duckmantian - Duckmantian |
|            | PLCM     | Pennine Lower Coal Measures Formation  | Sandstone                         | Langsettian - Langsettian |
|            | PLCM     | Pennine Lower Coal Measures Formation  | Mudstone, Siltstone and Sandstone | Langsettian - Langsettian |
|            | PKR      | Parkgate Rock                          | Sandstone                         | Langsettian - Langsettian |
|            | ER       | Emley Rock                             | Sandstone                         | Langsettian - Langsettian |
|            |          | Rock Segments                          |                                   |                           |
|            |          | Faults                                 |                                   |                           |

## Geology 1:50,000 Maps

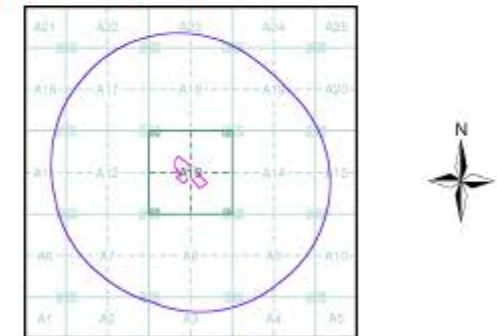
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published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

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

## Geology 1:50,000 Maps Coverage

|                      |               |
|----------------------|---------------|
| Map ID:              | 1             |
| Map Sheet No:        | 087           |
| Map Name:            | Barnsley      |
| Map Date:            | 2008          |
| Bedrock Geology:     | Available     |
| Superficial Geology: | Available     |
| Artificial Geology:  | Not Available |
| Faults:              | Not Supplied  |
| Landslip:            | Available     |
| Rock Segments:       | Not Supplied  |

## Geology 1:50,000 Maps - Slice A



## Order Details:

|                          |                |
|--------------------------|----------------|
| Order Number:            | 116447586_1_1  |
| Customer Reference:      | 11548/12       |
| National Grid Reference: | 431830, 406150 |
| Slice:                   | A              |
| Site Area (Ha):          | 2.82           |
| Search Buffer (m):       | 1000           |

## Site Details:

Site at 431830, 406120

## Artificial Ground and Landslip

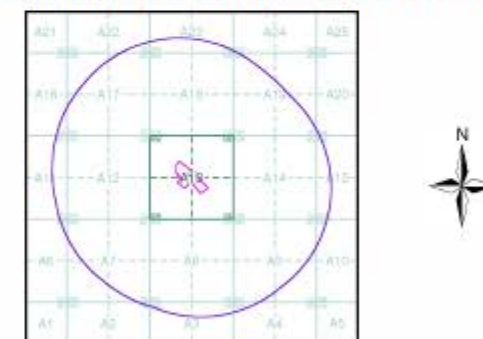
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions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

Artificial ground includes:

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

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

## Artificial Ground and Landslip Map - Slice A

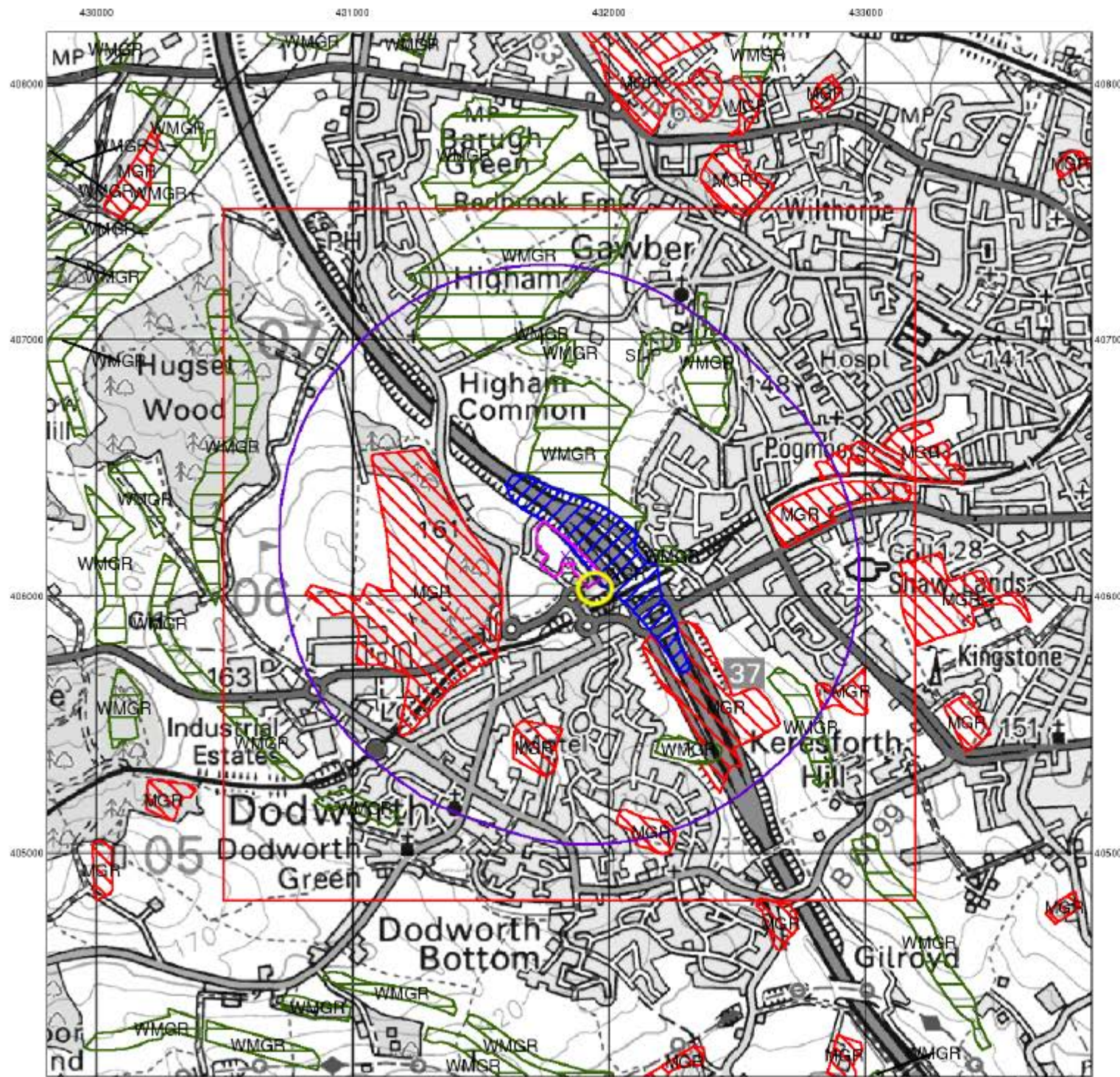


### Order Details:

Order Number: 116447586\_1\_1  
 Customer Reference: 11648/12  
 National Grid Reference: 431830, 406150  
 Slice: A  
 Site Area (Ha): 2.82  
 Search Buffer (m): 1000

### Site Details:

Site at 431830, 406120



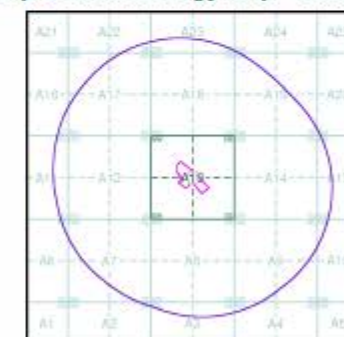
## Superficial Geology

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

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

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

## Superficial Geology Map - Slice A

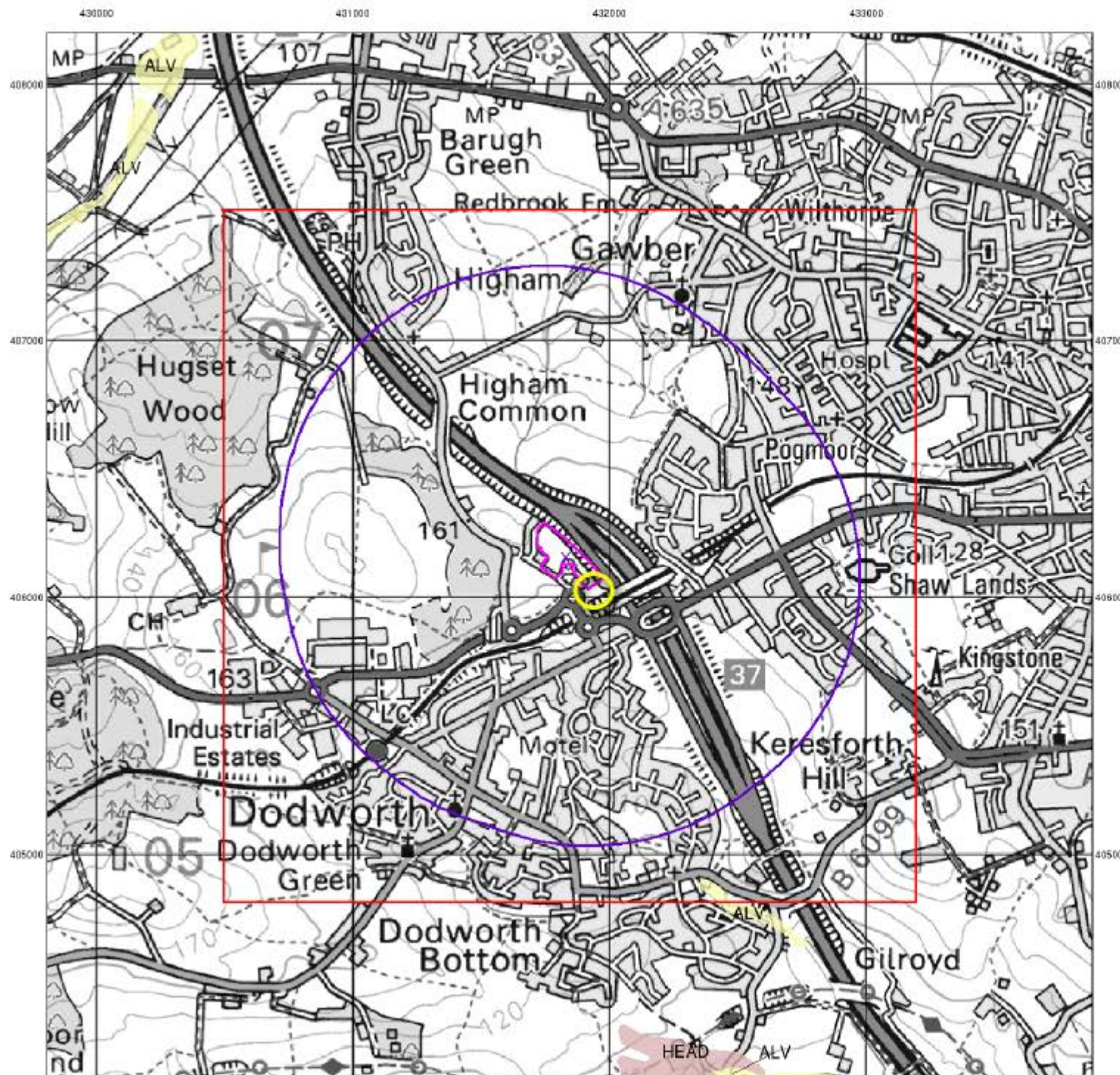


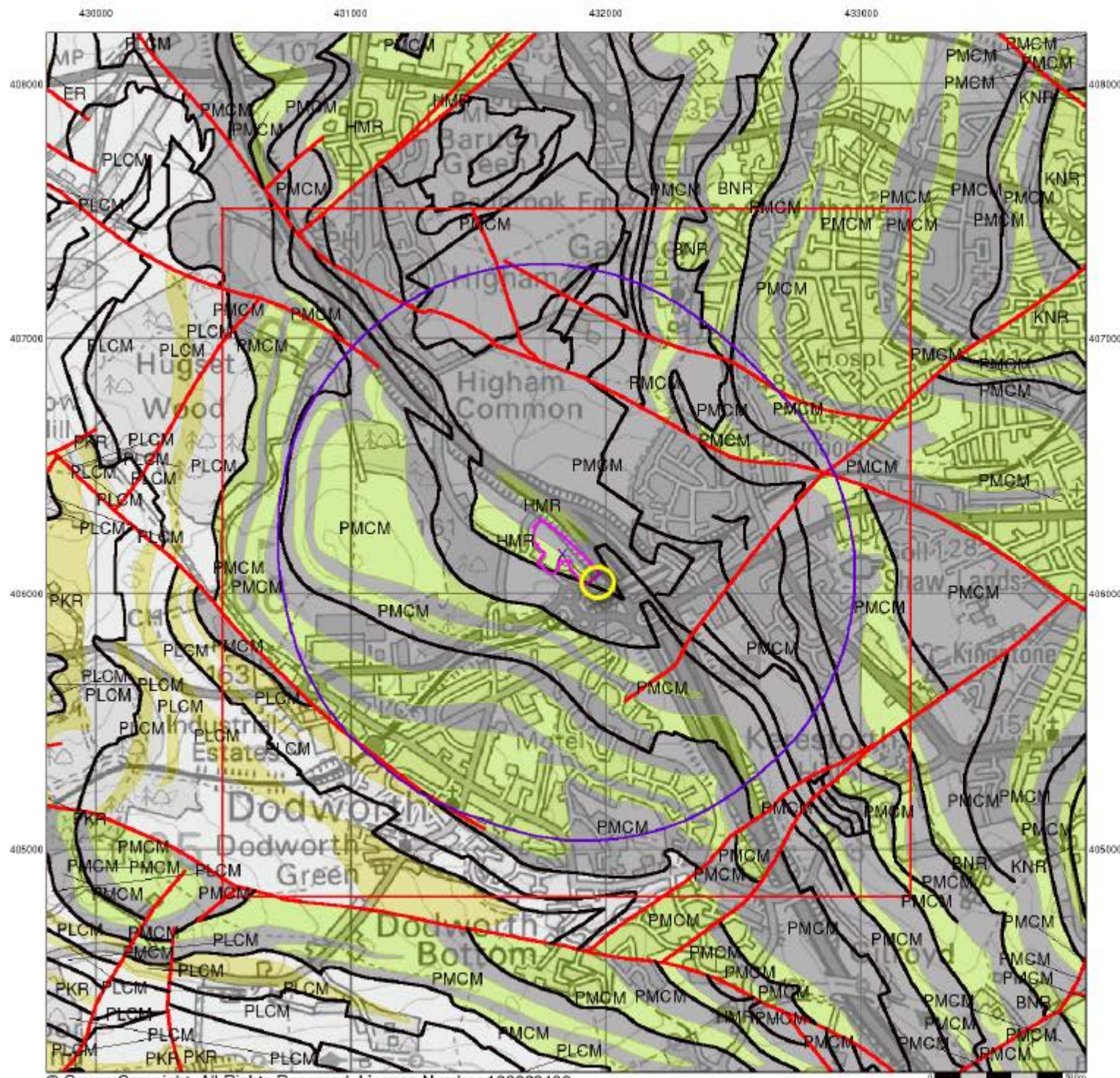
## Order Details:

Order Number: 116447586\_1\_1  
 Customer Reference: 11548/12  
 National Grid Reference: 431830, 406150  
 Slice: A  
 Site Area (Ha): 2.82  
 Search Buffer (m): 1000

## Site Details:

Site at 431830, 406120





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## Bedrock and Faults

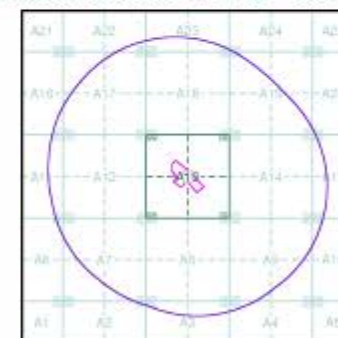
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

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

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

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

## Bedrock and Faults Map - Slice A



## Order Details:

Order Number: 116447586\_1\_1  
 Customer Reference: 11548/12  
 National Grid Reference: 431830, 406150  
 Slice: A  
 Site Area (Ha): 2.82  
 Search Buffer (m): 1000

## Site Details:

Site at 431830, 406120

## Groundwater Vulnerability

### General

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

### Agency and Hydrological

#### Geological Classes

Major Aquifer  
(Highly Permeable)

Minor Aquifer  
(Variably Permeable)

Non Aquifer  
(Negligibly Permeable)

Water or Sea

Drift Deposit

#### Soil Classes

High (H) 1, 2, 3, U

Intermediate (I) 1, 2

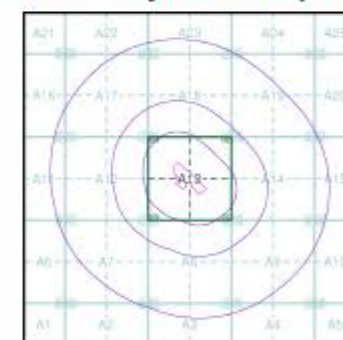
Low

High (H) 1, 2, 3, U

Intermediate (I) 1, 2

Low

### Site Sensitivity Context Map - Slice A

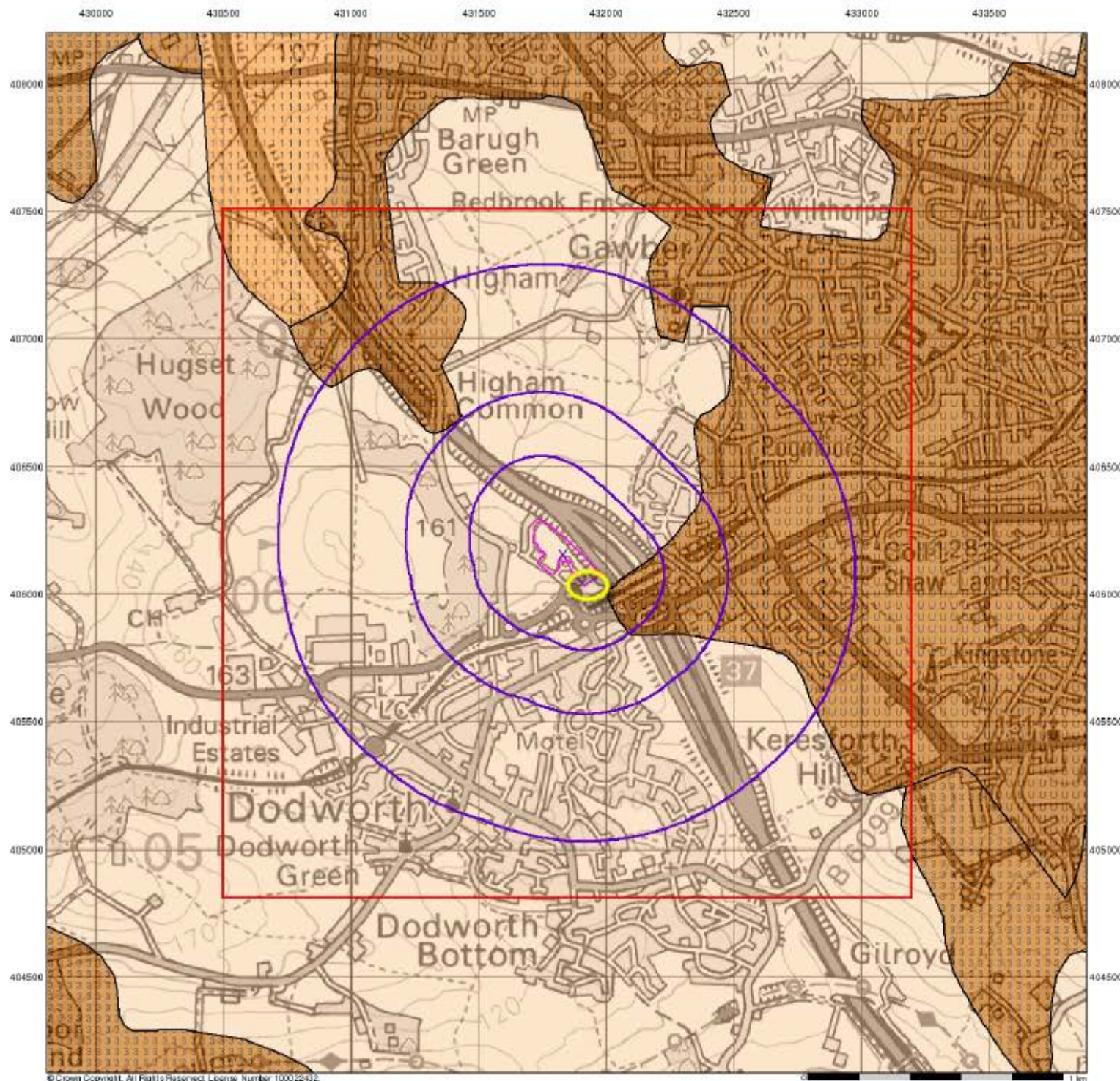


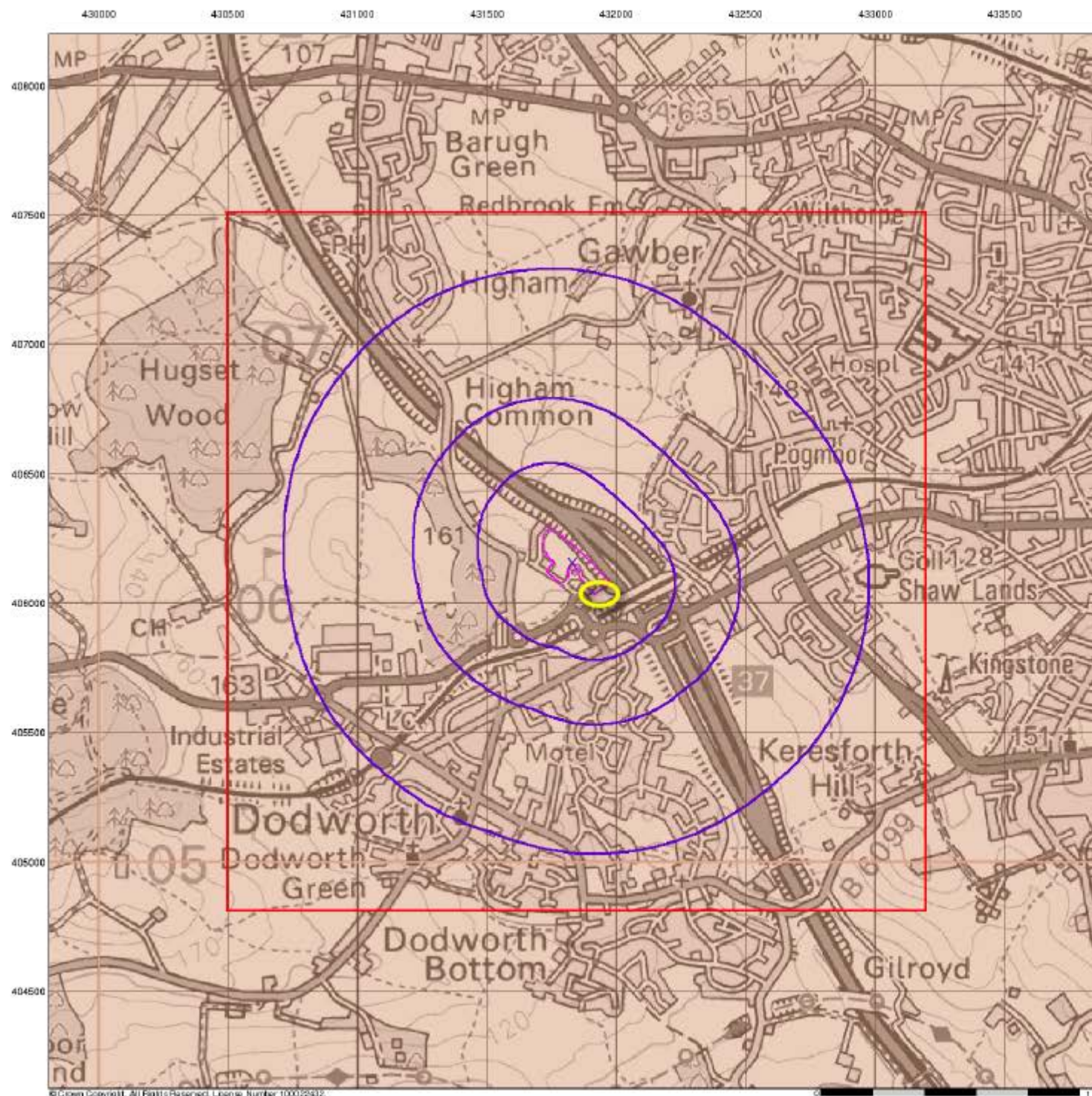
### Order Details

Order Number: 116447586\_1\_1  
 Customer Ref: 11548/12  
 National Grid Reference: 431830, 406150  
 Slice: A  
 Site Area (Ha): 2.82  
 Search Buffer (m): 1000

### Site Details

Site at 431830, 406120





## Bedrock Aquifer Designation

### General

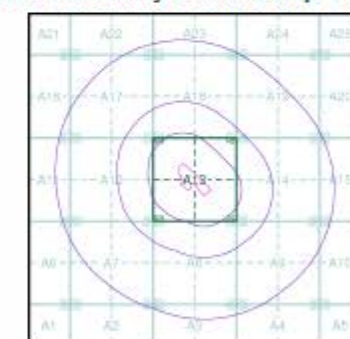
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Site
- Map ID

### Agency and Hydrological

#### Geological Classes

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

### Site Sensitivity Context Map - Slice A



### Order Details

Order Number: 116447586\_1\_1  
 Customer Ref: 11548/12  
 National Grid Reference: 431830, 406150  
 Slice: A  
 Site Area (Ha): 2.82  
 Search Buffer (m): 1000

### Site Details

Site at 431830, 406120