



NPPF: Flood Risk Assessment & Outline Drainage Strategy

Land off Patshull Road, Albrighton

Boningale Developments Ltd

SHF.710.011.HY.R.001.A



Contact Details:

Samuel House
1st Floor
5 Fox Valley Way
Stocksbridge
Sheffield
S36 2AA

tel: 0114 321 5151
www: enzygo.com

Land off Patshull Road, Albrighton

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Author:	Scott Dawson BSc (Hons), MSc, MCIWEM, C.WEM – Associate Director
Approver:	Matt Travis BSc (Hons), MSc, MCIWEM, C.WEM, C.Env, C.Sci – Managing Director

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Registered Office Gresham House, 5-7 St. Pauls Street, Leeds, England, LS1 2JG

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Executive Summary

This report presents a Flood Risk Assessment in accordance with the National Planning Policy Framework and National Planning Practice Guidance: Flood Risk and Coastal Change ID: 7 guidance¹, for a proposed outline residential development located on land off Patshull Road, Albrighton, Wolverhampton, WV7 3BH. This report replaces the Eastwood and Partners Ltd Flood Risk Assessment previously submitted. The new assessment was required to ensure detailed consideration of all sources of flooding, in particular that related to surface water risk, in light of comments received from Shropshire Council Lead Local Flood Authority.

The report assesses the flood risk and how this could be managed to allow the Site to be developed in support of the outline planning application. The FRA also includes an assessment of the surface water and foul drainage requirements.

A summary of the baseline Site condition is included below:

- The 47-hectare (ha) Site is comprised of agricultural (arable) land, underlain by saturated gravelly silty sandy soils and shallow bedrock with low infiltration potential.
- The Site is divided into two general development parcels:
 - Parcel 1 slopes in a general southeasterly direction. A pond is located on the southern boundary capturing flows from the west. The eastern side of Parcel 1 slopes towards a ditch draining Site flows across the A464.
 - Parcel 2 has a divided hydrological catchment with the far north-west of this parcel draining to a ditch that enters a culvert, thought to flow south along Patshull Road and across the A464 Holyhead Road to the south of the Site. The remainder of Parcel 2 drains in a south-easterly direction via overland flow, with exceedance in extreme events likely flowing over the A464 Holyhead Road highway.

The risk of flooding is assessed as follows:

- The risk of fluvial flooding is assessed as negligible. There is, however, a residual risk of fluvial flooding from Watercourses 1, 2 and 3 and Ditches 1-3.
- The risk of surface water flooding is assessed as low to high risk where there is surface water ponding and overland flow pathways. A direct rainfall modelling exercise has confirmed the surface water risk and guided control measures to reduce flood risk.
- The risk of flooding from all other sources is assessed as negligible.

Flood risk from identified sources can be reduced to a negligible or low and acceptable level through the following approach:



Subject to the proposed avoidance measures, the Sequential Test should not be required:

- Provide a 5m easement free from development along either side of the onsite/bounding ditches and watercourses. This easement would provide access for inspection and maintenance purposes, including vehicle access.
- Provide a development free easement around the onsite ponds.

¹ <https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

- Adoption of a surface water management strategy (see Section 6) to deal with modelled surface water ponding and reduce saturation of shallow geology which currently results in perched groundwater at depths of <2mbgl.
- Implementation of proposed interception ditches designed to capture surface water flow pathways entering the western Site parcel (Parcel 1) from the northern and western boundaries and route the 1 in 1000-year flows in-channel to Watercourse 2.
- Upgrade the culvert connection for Watercourse 2 to allow better conveyance of water across the A464 Holyhead Road.
- Limited land raising (land reinforcement) in areas of Parcel 1 to ensure flow pathway water stays in new cut interception ditches.
- Undertake maintenance activities to keep the ditches/culverts clear from debris and overgrown vegetation to maintain the conveyance of the channels.

Further to the above, the FRA has recommended further measures in line with statutory requirements / following best practice. The FRA has explored mitigation and management measures, to provide betterment. A summary is included in the table below.

The proposed residential use is classified as more vulnerable. More vulnerable uses are considered acceptable in terms of flood risk in Flood Zone 1 (low risk). There is, however, a risk of flooding from other sources. Subject to the implementation of the above avoidance and control measures, the Sequential Test should be passed, and the Exception Test would not be required.

Source of Flooding	Risk of Flooding	Risk Without Measures	Recommended Measures	Risk to Development with Measures
Fluvial – Watercourses 1 -2, Ditches 1-4.	Negligible for most of the Site with residual risk from Watercourse 1, Watercourse 2 and Ditches 1-4	Negligible for most of the Site with residual risk from Watercourse 1-2 and Ditches 1-4.	Avoid	Negligible
Tidal	Negligible	Negligible	N/A	Negligible
Groundwater - Secondary B Aquifer (Bedrock) and Secondary (undifferentiated) Aquifer (Superficial)	Negligible	Negligible	N/A	Negligible
Surface Water - Poor permeability and Site topography	Negligible for most of the Site but Low to high where there is surface water ponding and overland flow pathways.	Negligible for most of the Site but Low to high where there is surface water ponding and overland flow pathways.	Control	Negligible
Sewers and Mains – None identified	Negligible for most of the Site but Low for flow pathways associated with surcharged/overland flows.	Negligible for most of the Site but Low for flow pathways associated with surcharged/overland flows.	Avoid	Negligible

Source of Flooding	Risk of Flooding	Risk Without Measures	Recommended Measures	Risk to Development with Measures
Infrastructure Failure – Pond Failure	Negligible for most of the Site and low where the ponds are located	Negligible for most of the Site and low where the ponds are located	Avoid	Negligible

- The FRA has considered the potential impact of the development on surface water runoff rates, given the increase in impermeable areas post-development. These rates have been calculated, and it has been demonstrated that surface water can be managed, such that flood risk to and from the Site following development will not increase. This will be achieved through restricted discharge rates (i.e. QBAR) and appropriately sized detention basins/geocellular storage for each drainage sub-catchment, with outfalls to watercourses within ownership (Watercourses 2, 3 and 4).
- It is proposed that pumped foul flows will discharge to the Ø150mm combined gravity/lateral drain sewer flowing northeast beneath Cross Road to the north of the Site. It is likely upgrades to the existing network would be required; details of which can be addressed at reserved matters stage.

The FRA demonstrates the proposed development would be operated with minimal risk from flooding and would not increase flood risk elsewhere. The development should therefore not be precluded on the grounds of flood risk, as well as surface water and foul drainage.

1.0 Introduction

1.1 Background

- 1.1.1 Enzygo Ltd was commissioned by Boningale Developments Ltd to carry out a site-specific Flood Risk Assessment (FRA), including an outline surface water drainage strategy, in support of an outline planning application for a proposed residential development. The Site is located on land off Patshull Road, Albrighton, Wolverhampton, WV7 3BH (the 'Site').
- 1.1.2 This report replaces the Eastwood and Partners Ltd Flood Risk Assessment previously submitted. The new assessment was required to ensure proper consideration of all sources of flooding, in particular that related to surface water risk, in light of comments received from Shropshire Council, the Lead Local Flood Authority.
- 1.1.3 The proposal is for a residential development, with associated care home, local centre, secondary school and neighbourhood play area on the 47-hectare (ha) Site. A copy of the proposed layout is included in Appendix 1.
- 1.1.4 A site-specific FRA assesses the current and future flood risk to and from a development site. It demonstrates how flood risk will be managed now and over the development's lifetime, taking climate change, drainage, and the vulnerability of its intended users into account.
- 1.1.5 The objectives of a site-specific FRA are to:
- Assess whether a proposed development is likely to be affected by current or future flooding from a range of sources.
 - Assess whether the development will increase flood risk elsewhere.
 - Decide on measures to deal with these effects and risks and assess their appropriateness.
 - Provide enough evidence for the local planning authority to apply (if necessary) the Sequential Test.
 - Decide whether the development will be safe and will pass the Exception Test if applicable.
- 1.1.6 In England, planning applications for development need an FRA² for most developments including:
- In Flood Zones 2 and 3 including minor development and change of use.
 - Sites of 1ha or larger in Flood Zone 1.
 - Sites of less than 1ha in Flood Zone 1, including change of use to a more vulnerable class (for example from commercial to residential), and where they could be affected by sources of flooding other than rivers and the sea.
 - Land in Flood Zone 1 in a Critical Drainage Area (CDA) as notified by the Environment Agency (EA).
 - Land in Flood Zone 1 identified in a Strategic Flood Risk Assessment (SFRA) as being at increased flood risk in future.

² Department for Environment, Food & Rural Affairs and Environment Agency (published March 2014 and update February 2017). Flood Risk Assessments if You're Applying for Planning Permission [<https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications>].

- 1.1.7 An FRA is required for this development, as initial screening using EA online indicative flood mapping shows the Site is in Flood Zone 1 (low risk) but is more than 1ha and is at risk of surface water flooding.
- 1.1.8 The purpose of this FRA is to assess the risk of flooding to the proposed development and where possible recommend measures to demonstrate that future users of the development would remain safe throughout its lifetime, that the development would not increase flood risk on Site and elsewhere and, where practicable, would reduce flood risk overall.

1.2 Scope

- 1.2.1 Government policy on development and flood risk is set out in the National Planning Policy Framework (NPPF)³ and is supported by National Planning Practice Guidance: Flood Risk and Coastal Change [NPPG ID7]⁴.
- 1.2.2 NPPF paragraphs 157-179 set out the need for an appropriate assessment of flood risk at all levels of the planning process and require the application of a sequential risk-based approach to assess the suitability of land for development in flood risk areas⁵.
- 1.2.3 The FRA should also make allowances for climate change⁶ to minimise vulnerability and provide resilience to flooding and coastal change in the future. The allowances are predictions of anticipated change in:
- Peak river flow by river basin district.
 - Peak rainfall intensity.
 - Sea level rise.
 - Offshore wind speed and extreme wave height.
- 1.2.4 The allowances are based on climate change projections and different scenarios of carbon dioxide emissions to the atmosphere. There are different allowances for different periods of time over the next century.
- 1.2.5 Site-specific FRAs are categorised according to level⁷. Simple Level 1 Screening studies give a general indication of the potential flood risk to a site and identify whether more detailed Level 2 assessment is required or not. A Level 2 assessment is a qualitative appraisal to develop understanding of flood risk to a site and the effects of the site on flooding elsewhere including recommended measures (see Section 5 - Avoid, Control, Mitigate, Manage). Level 3 assessments are more detailed quantitative studies, for example modelling to establish flood levels at a site in the absence of EA or other data or providing detailed outline drainage designs.
- 1.2.6 This report is a Level 2 qualitative FRA, which includes a Level 3 assessment of the surface water drainage requirements for the proposed development.

³ Ministry of Housing, Communities & Local Government (published March 2012 and updated December 2023). National Planning Policy Framework [<https://www.gov.uk/government/publications/national-planning-policy-framework--2>].

⁴ Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (published March 2014 and updated August 2022). Planning Practice Guidance ID7-020-20220825; Flood Risk & Coastal Change [<https://www.gov.uk/guidance/flood-risk-and-coastal-change>].

⁵ <https://www.gov.uk/guidance/national-planning-policy-framework/14-meeting-the-challenge-of-climate-change-flooding-and-coastal-change#footnote59>

⁶ Environment Agency (published February 2016 and updated May 2022). Flood Risk Assessments: Climate Change Allowances [<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>].

⁷ CIRIA (October 2004) CIRIA C624 - Part C, Chapter 6, Section 6.1 to 6.3.

1.3 Aims

- 1.3.1 This FRA aims to provide enough flood risk information to satisfy the requirements of the NPPF, PPG ID7 and regional/local government plans and policies. It describes the potential for the Site to be impacted by flooding, the impacts of the proposed development on flooding elsewhere near the Site, and the recommended measures that could be incorporated into the development to manage the identified risks.

1.4 Planning Context

National Policy

- 1.4.1 The FRA was prepared in accordance with the NPPF and NPPG ID7.

Regional/Local Policy

- 1.4.2 The FRA considers the following policies within the Shropshire Council Local Plan (2016 to 2038)⁸:

- Policy DP19: Water Resources and Water Quality.
- Policy DP20: Water Efficiency
- Policy DP21: Flood Risk
- Policy DP22: Sustainable Drainage Systems

Strategic Flood Risk Assessment (SFRA)

- 1.4.3 The FRA has reviewed the guidance within the Shropshire Council Strategic Flood Risk Assessment (SFRA) report and associated mapping⁹.

- Level 1 SFRA: 2018s0765 - Shropshire Level 1 Strategic Flood Risk Assessment Final Report (October 2018)¹⁰.
- Level 2 SFRA: Shropshire Council Level 2 Strategic Flood Risk Assessment Final Report (July 2020)¹¹.

- 1.4.4 Below is a summary of our review which justifies the requirement of site-specific assessment of all sources of flooding as part of this FRA (refer to Section 4):

- The SFRA is a Level 1 Screening study. One of the aims of the SFRA (Section 1) is to “*be used in decision-making and to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.*”
- The Site is not within the assessed area of the Level 2 SFRA.
- The mapping of key flooding sources (fluvial/tidal, groundwater, surface water) is based on the following data sources, with caveats on limitations detailed below:

⁸ Draft Shropshire Local Plan (2016 – 2038) Examination | Shropshire Council

⁹ https://www.shropshire.gov.uk/media/15717/5_e7_locked.pdf

¹⁰ <https://www.shropshire.gov.uk/planning-policy/local-planning/local-plan-review/strategic-flood-risk-assessment-level-1-appendix-a/>

¹¹ <https://www.shropshire.gov.uk/media/20774/sfra-level-2-report-ev09601.pdf>

- Fluvial/Tidal - Flood Map for Planning (Rivers and Sea) Flood Zone 3¹²

Where outlines are not informed by detailed hydraulic modelling, the Flood Map for Planning is based on generalised modelling to provide an indication of flood risk. Whilst the generalised modelling is generally accurate on a large scale, they are not provided for specific sites or for land where the catchment of the watercourse falls below 3km². For this reason, the Flood Map for Planning is not of a resolution to be used as application evidence to provide the details of possible flooding for individual properties or sites and for any sites with watercourse on, or adjacent to the site. Accordingly, for site-specific assessments it will be necessary to perform more detailed studies in circumstances where flood risk is an issue. Where Flood Map for Planning is based on generalised modelling, developers should undertake a more detailed analysis and assessment of the flood risk at the planning application stage.

- Groundwater - BGS Groundwater Flooding¹³

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater Flooding (AStGWF) dataset. The AStGWF dataset is strategic-scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicated that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and does not take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The AStGWF data should be used only in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

- Surface Water - Risk of Flooding from Surface Water Extent¹⁴

Mapping of surface water flood risk in Shropshire has been taken from the Environment Agency's Risk of Flooding from Surface Water (RoFfSW) mapping, which is a slightly more detailed resolution than that published online by the Environment Agency. Surface water flood risk is subdivided into the follow four categories:

- **High:** An area has a chance of flooding greater than 1 in 30 (3.3%) each year.
- **Medium:** An area has a chance of flooding between 1 in 100 (0.1%) and 1 in 30 (3.3%) each year.
- **Low:** An area has a chance of flooding between 1 in 1,000 (0.1%) and 1 in 100 (1%) each year.
- **Very Low:** An area has a chance of flooding of less than 1 in 1,000 (0.1%) each year.

1.4.5 In summary, the SFRA uses macro-scale data, which is broad-brush indicator of potential flood risk sources. It identifies the Flood Risk Management Hierarchy, whereby a site-specific FRA is undertaken to understand the micro-scale data for a review of more detailed / refined data sources (see Section 2.1-2.2 and Section 4).

¹² <https://www.data.gov.uk/dataset/bed63fc1-dd26-4685-b143-2941088923b3/flood-map-for-planning-rivers-and-sea-flood-zone-3>

<https://www.data.gov.uk/dataset/cf494c44-05cd-4060-a029-35937970c9c6/flood-map-for-planning-rivers-and-sea-flood-zone-2>

¹³ <https://www.bgs.ac.uk/datasets/groundwater-flooding/>

¹⁴ <https://www.data.gov.uk/dataset/95ea1c96-f3dd-4f92-b41f-ef21603a2802/risk-of-flooding-from-surface-water-extent-3-3-percent-annual-chance>

Guidance Documents / Best Practice

1.4.6 This FRA also considers the following flood risk and drainage guidance documents:

- Local Flood Risk Management Strategy - Summary¹⁵
- Preliminary Flood Risk Assessment (May 2011)¹⁶

1.5 Report Structure

1.5.1 This report is structured as follows:

- Section 2 identifies the sources of information that were consulted.
- Section 3 describes the existing Site.
- Section 4 outlines the baseline flood risk from all sources.
- Section 5 details the recommended measures against identified flood risk sources.
- Section 6 assesses the surface water drainage requirements of the proposed development.
- Section 7 assesses the foul drainage requirements of the proposed development.
- Section 8 presents a summary and conclusions.

¹⁵ [Local flood risk management strategy | Shropshire Council](#)

¹⁶ [Preliminary flood risk assessments | Shropshire Council](#)

2.0 Sources of Information

2.1 Sources of Information

2.1.1 The following information was consulted:

- Ordnance Survey mapping (Drawings 0001 and 0002).
- Detailed topographic survey (Appendix 2).
- EA online mapping (Flood Map for Planning¹⁷, Long Term Flood Risk Assessment for Locations in England¹⁸, Catchment Data Explorer¹⁹ and Main River Map²⁰).
- EA Reduction in Risk of Flooding from Rivers and Sea online mapping²¹.
- Online mapping for Climate Change Allowances for Peak River Flow and Peak Rainfall in England online mapping²².
- National Soils Resources Institute (NSRI): Soilsdscapes online mapping²³.
- British Geological Survey [BGS] Geology Viewer online mapping²⁴.
- British Geological Survey [BGS] Borehole Records online mapping²⁵.
- Landmark's Promap: Flood Data package (see Drawings).
- Geosmart 1 in 100-year groundwater flood risk map (see Drawings).
- DEFRA's Magic Map for identifying Designated Sites²⁶.
- River Levels UK for identifying Flood Alert and Flood Warning areas²⁷.
- Direct rainfall modelling report produced by Enzygo (available in wider planning documents) – SHF.710.011.HY.R.002.A

2.2 Consultation and Discussion with Regulators

2.2.1 Consultation and discussions were undertaken with the relevant water regulators.

Environment Agency

2.2.2 The Environment Agency (EA) is a statutory consultee on flood risk and planning and is directly responsible for the prevention, mitigation, and remediation of flood damage for main rivers and coastal areas; and it has a strategic overview for all forms of flooding.

¹⁷ <https://flood-map-for-planning.service.gov.uk/>

¹⁸ <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

¹⁹ <http://environment.data.gov.uk/catchment-planning/>

²⁰ <https://environment.maps.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386>

²¹ [ArcGIS - My Map](#)

²² <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

²³ <https://www.landis.org.uk/soilsdscapes/>

²⁴ <https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/>

²⁵ <https://www.bgs.ac.uk/information-hub/borehole-records/>

²⁶ <https://magic.defra.gov.uk/magicmap.aspx>

²⁷ <https://riverlevels.uk/flood-map#.XclKwPn7RPZ>

2.2.3 EA Standing Advice²⁸ and the NPPF/PPG ID: 7 was consulted and reviewed.

2.2.4 Correspondence with the EA is included in Appendix 5.

Lead Local Flood Authority

2.2.5 Shropshire Council as the Lead Local Flood Authority (LLFA) is responsible for local flood risk management in their area and for maintaining a register of flood risk assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater, and ordinary watercourses.

2.2.6 Correspondence from the LLFA on the application (24/02108/OUT) is included in Appendix 4.

Local Planning Authority

2.2.7 Shropshire Council is the Local Planning Authority (LPA) in this area.

Water Utility

2.2.8 Drainage and sewerage services in the UK are provided by a number of water and sewerage companies. Severn Trent Water is responsible for sewerage within the area of the Site.

2.2.9 All sewerage undertakers maintain the 'DG5 register' of properties and external areas (such as gardens, highways, open spaces) which have suffered flooding from public foul/combined sewers. It does not include flooding caused by blockages.

2.2.10 Severn Trent asset plans are / and pre-development enquiry response is included in Appendix 3.

2.3 Site Walkover

2.3.1 Enzygo staff carried out a walkover of the Site during October 2024. Observations made were used to inform the Site description.

²⁸ Environment Agency and Department for Environment, Food & Rural Affairs (published April 2012 and updated February 2022). Preparing a Flood Risk Assessment: Standing Advice [<https://www.gov.uk/guidance/flood-risk-assessment-standing-advice>].

3.0 Site Location and Description

3.1 Location

- 3.1.1 The Site is located on land off Patshull Road, Albrighton, Wolverhampton, WV7 3BH.
- 3.1.2 The Site is centred on National Grid Reference (NGR) 380644 03313.
- 3.1.3 The 47ha Site location is shown in Drawing 0001 and in more detail in Drawing 0002.

3.2 Land Use

- 3.2.1 The land use is comprised of multiple agricultural (arable) fields, with Patshull Road orientated north to south splitting the Site in half (Figures 3.1 and 3.2). For ease of description of features within this report, areas will either be split into 'Parcel 1' or 'Parcel 2' which are west and east of Patshull Road respectively. The entire Site will be referred to as the 'Site'.

Figure 3.1: Aerial Image of the Site

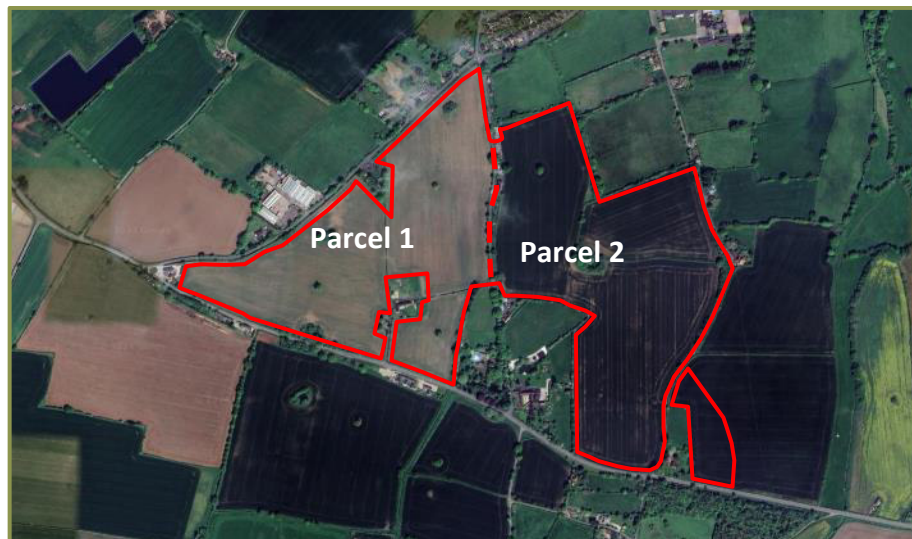


Image © 2024 Digital Globe.

- 3.2.2 Parcel 1 is bounded by Cross Road to the north, and agricultural land and residential buildings of Albrighton beyond, Patshull Road to the east, and Parcel 2 beyond; and the A464 to the south. Parcel 2 is bounded by Watercourse 1 to the north, and agricultural land and Cross Road beyond; Newhouse Lane to the east; the A464 to the south; and Patshull Road to the west with Parcel 1 beyond. Summary imagery of land use provided in Figure 3.2.
- 3.2.3 Vehicle access is currently from Patshull Road which is orientated north to south through the centre of the Site.

Figure 3.2: Images of the Site

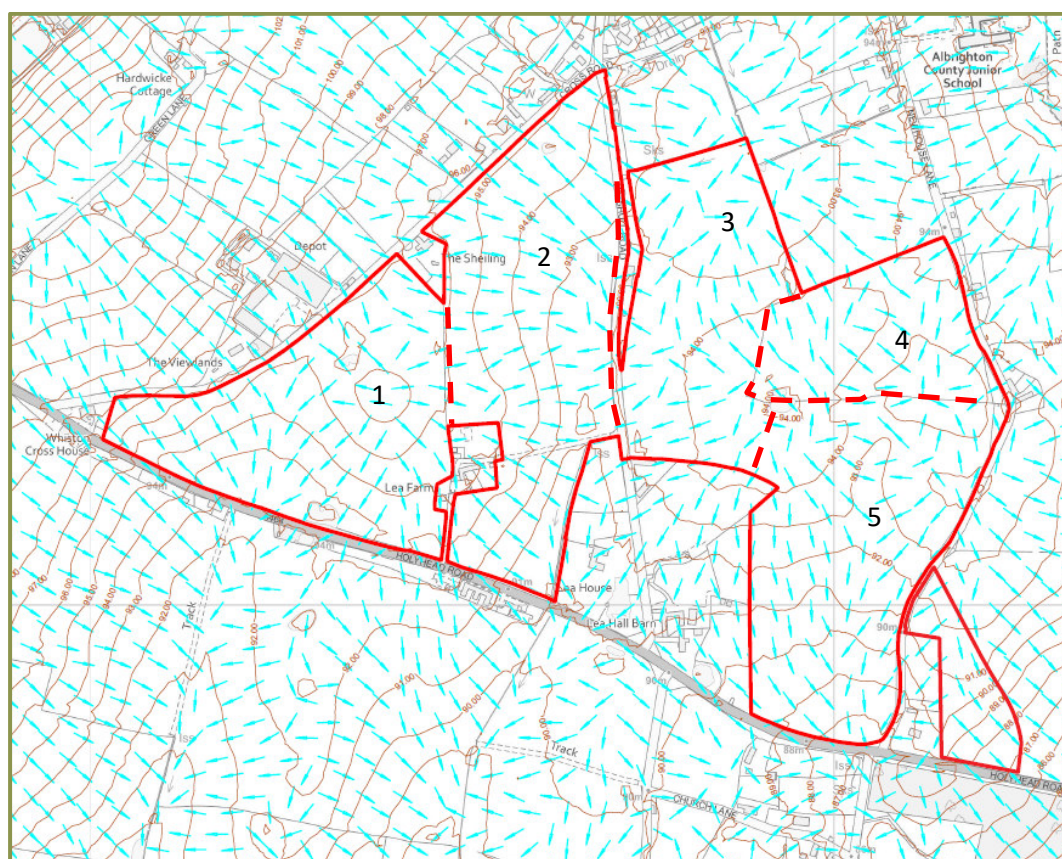
Left: Parcel 1. View looking west across the Site with Patshull Road to east behind photographer. Right: Parcel 1. View looking northeast across the Site with Holyhead Road and Pond 2 to southwest behind photographer.



Left: Parcel 2. View looking east across the Site with Patshull Road to west behind photographer. Right: Parcel 2 View looking south across the Site in the eastern extent of the Site

3.3 Topographic Information

- 3.3.1 A detailed topographic survey was carried out during April 2024 and a copy is included in Appendix 2.
- 3.3.2 Flow pathway analysis was undertaken in KeyTERRA-FIRMA (KTF) software to understand watershed catchments (Drawing 0007). A summary of the Site topography is included in Figure 3.3 and described below.
- 3.3.3 The Site generally falls southeast from 95 metres Above Ordnance Datum (m AOD) along the northwestern boundary to 83m AOD in the southeast corner. The fall of 12m over 920m gives a gradient of 1:76.
- 3.3.4 A summary of the topography for the land parcels is included in Table 3.3.

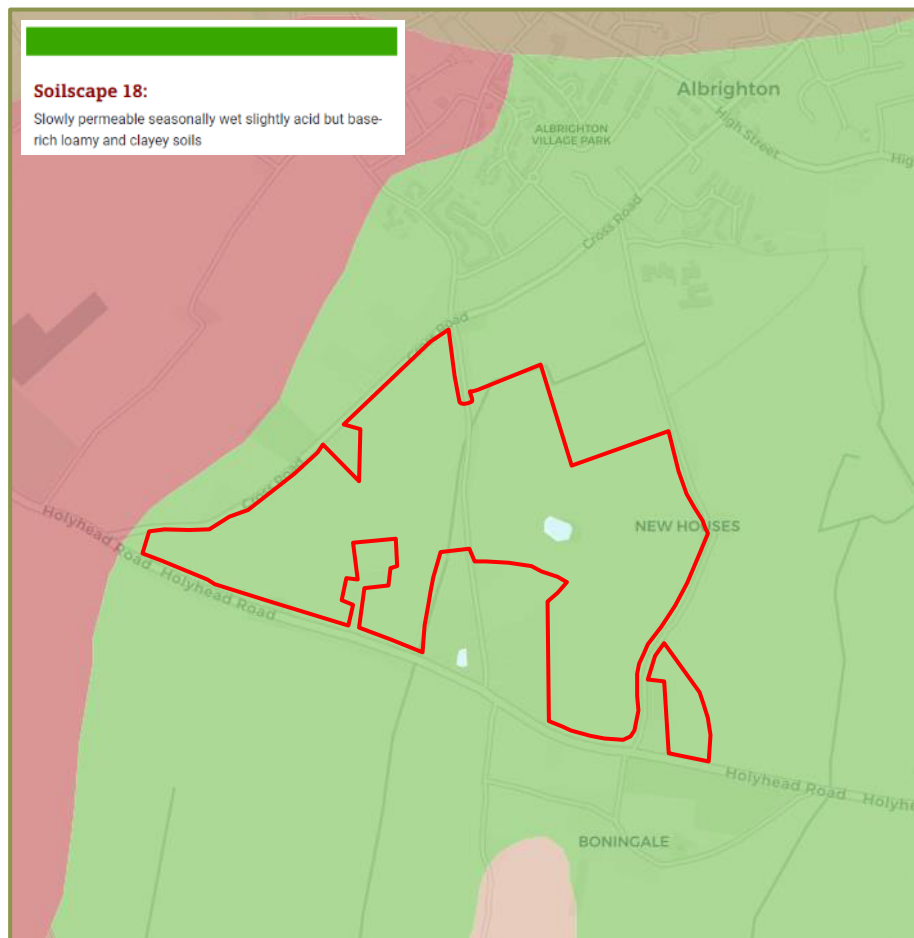
Figure 3.3: Summary of Site Topography**Table 3.1: Summary of Site Topography**

Land Parcel Reference	Direction of Fall	Maximum Elevation (m AOD)	Minimum Elevation (m AOD)	Distance (m)	Average Gradient Across Land Parcel
1	South-west	97.19	92.60	230	1:50
2	East/ southeast	95.55	91.92	225	1:62
3	Undulating, generally west and northwest	94.86	92.06	330	1:117
4	West	94.03	91.83	220	1:100
5	Southeast	94.46	83.49	450	1:41

3.4 Soils and Geology

Soils Mapping

- 3.4.1 The online NSRI Soils mapping (Figure 3.4) shows the Site is underlain by slowly permeable seasonally wet loamy and clayey soils. The soils mapping is indicative and there may be localised variation.

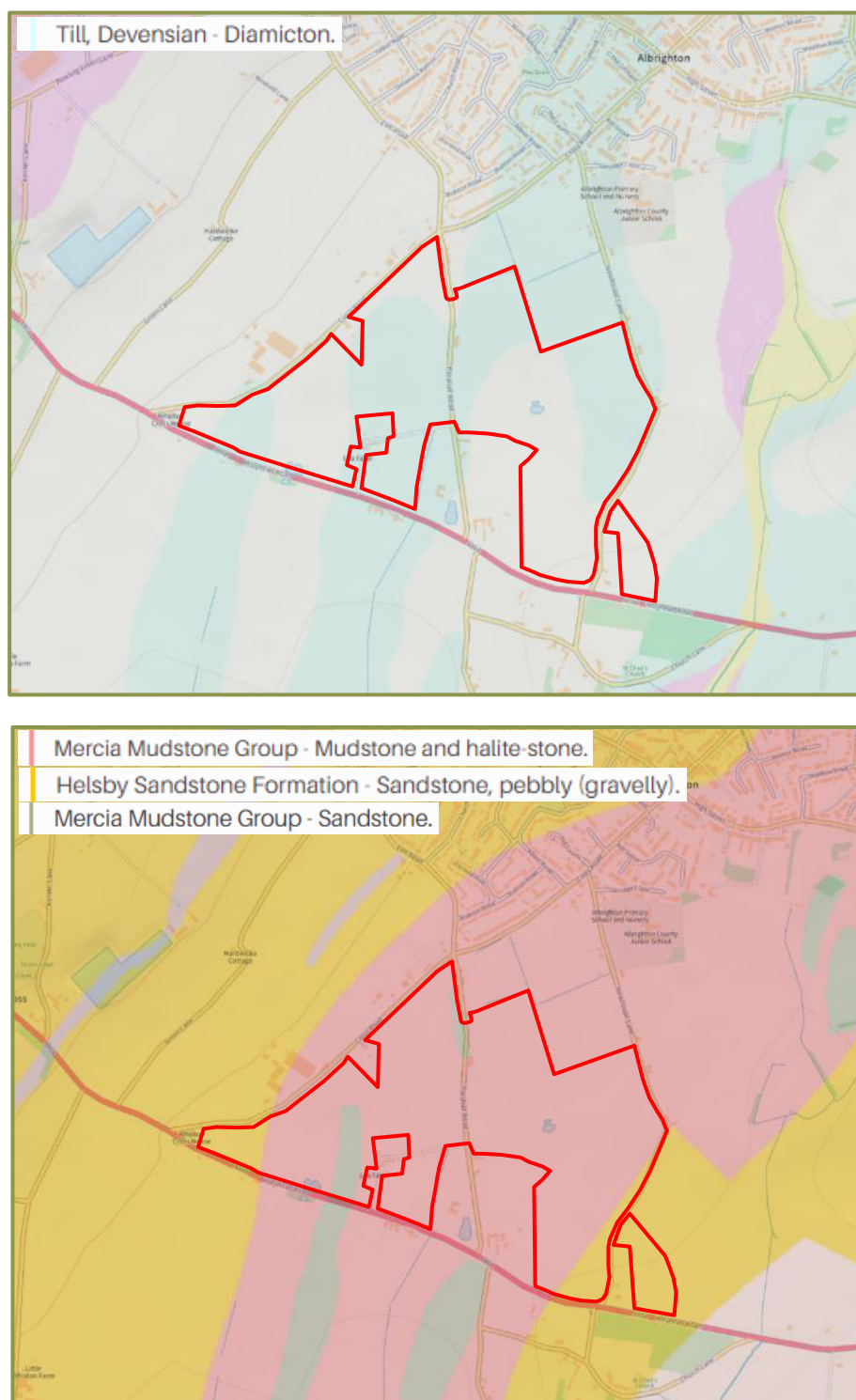
Figure 3.4: Soils Mapping

Soils Data © Cranfield University (NSRI) and for the Controller of HMSO [2024].

Geology Mapping

- 3.4.2 The online BGS Geology Viewer (Figure 3.5) shows there are bands of Till stretching north to south in the western extent, the centre, and the eastern extent of the site (superficial deposits). The rest of the Site is not underlain by superficial deposits.
- 3.4.3 The bedrock beneath most of the Site is Mercia Mudstone Group – Mudstone and halite-stone. In the western extent and eastern extent of the Site the bedrock beneath the Site is Helsby Sandstone Formation – Sandstone, pebbly (gravelly). There is an area of Mercia Mudstone Group – Sandstone (bedrock) that extends from the south boundary of the Site into the centre of the Site.
- 3.4.4 The geology mapping is indicative and there may be localised variation.

Figure 3.5: Geology Mapping

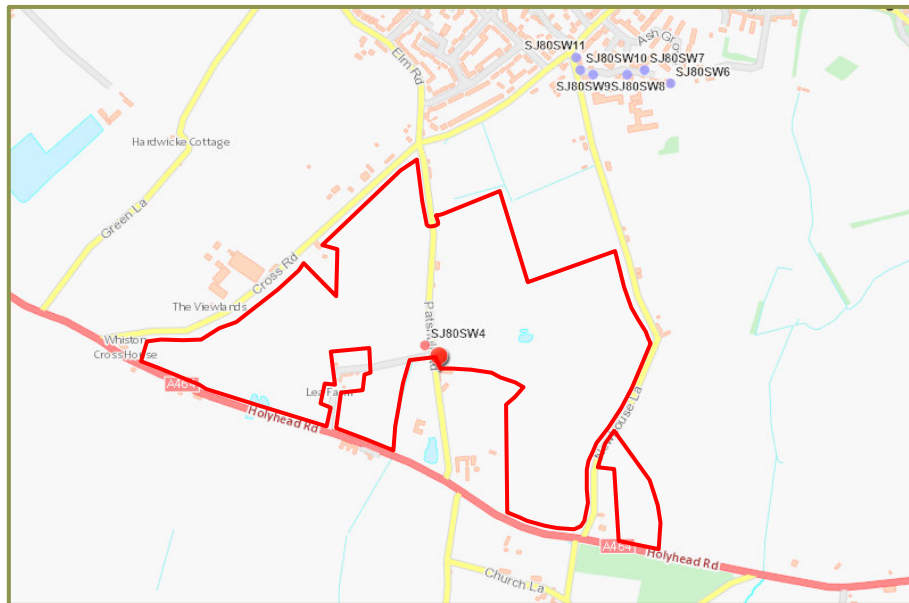


Top: Superficial deposits. Bottom: Bedrock geology. Contains British Geological Survey materials © NERC [2024].

BGS Borehole Records

- 3.4.5 The BGS Borehole Records online mapping (Figure 3.6) shows one borehole in the centre of the site (REF: SJ80SW4) and 6 boreholes approximately 250m northeast of the site (REF: SJ80SW11, REF: SJ80SW10, REF: SJ80SW9, REF: SJ80SW8, REF: SJ80SW7, REF: SJ80SW6).
- 3.4.6 The borehole records (Appendix 6) confirm the geology as depicted by the Geology of Britain mapping (Table 3.1).

Figure 3.6: Borehole Mapping



Contains British Geological Survey materials © NERC [2024].

Table 3.1: BGS Borehole Data

Reference	Summary of Strata	Depth (m bgl)	Groundwater Depth (m bgl)
SJ80SW4	0.00– 2.00m = Sandy Siltstone 2.00 – 3.20m = Clay Mudstone 3.20 – 3.50m = Sandstone 3.50 – 3.60m = mudstone 3.60 – 40.40m = Sandstone 40.40 – 40.60m = no extraction 40.60 – 41.80m = Sandstone 41.80 – 42.20m = no extraction 42.20 – 42.70m = Sandstone 42.70 – 45.20m = no extraction 45.20 – 45.70m = Sandstone 45.70 – 48.10m = no extraction	94	N/A

Contains British Geological Survey materials © NERC [2024].

Soakaway Testing

- 3.4.7 Soakaway testing was undertaken in accordance with DG365 'Soakaway Design' methodology guidance, on the 10th and 11th October 2024. A copy of the Soakaway Testing Results and the Soakaway Pit Location Plan is included in Appendix 7.

- 3.4.8 A total of 7 soakaway test pits were established cross the Site, with focus on the topographic low point, where SuDS attenuation features would be positioned (Figure 3.7).
- 3.4.9 The borehole records confirm the soils and geology as depicted by the soils and geology mapping.

Figure 3.7: Soakaway Pit Location Plan

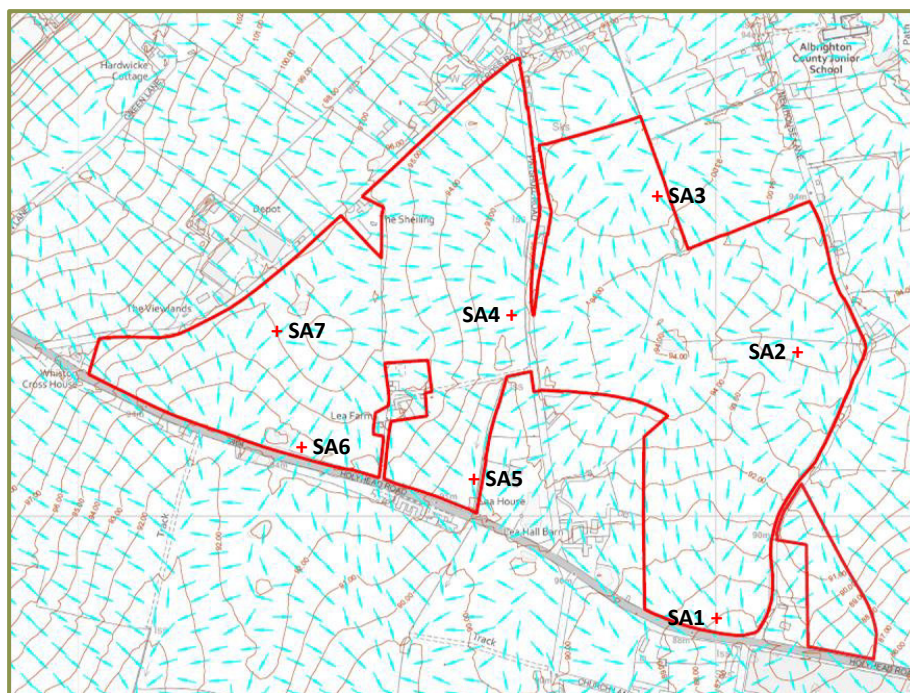


Table 3.2: Soakaway Data

Soakaway Test	Depth (m)	Soil	Test number	Soil Infiltration Rate (m/s)
SA1	2.0	Clayey sand and sandy clay	Test 1	Insufficient soakage
SA2	2.1	Clayey sand and sandy clay	Test 1	Insufficient soakage
SA3	2.1	Clayey sand and sandy clay	Test 1	Insufficient soakage
SA4	1.2	Silty sand	Test 1	Insufficient soakage
SA5	2.0	Silty sand	Test 1	Insufficient soakage
SA6	2.0	Sandy clay	Test 1	Insufficient soakage
SA7	2.0	Clayey sand and sandy clay	Test 1	Insufficient soakage

3.5 Hydrogeology

Infiltration Potential

- 3.5.1 The SuDS Infiltration Potential Mapping (Drawing 0005) shows the Site is in the mapped extent indicative of high potential, moderate potential and low potential which is likely to be associated with the underlying superficial deposits and bedrock geology.
- 3.5.2 The clayey soils and geology are indicative of low infiltration potential.
- 3.5.3 Groundwater ingress was encountered in the nearby BGS borehole record at 48m bgl.
- 3.5.4 Soakaway testing demonstrated low infiltration potential. Groundwater ingress was not encountered in any of the trial pits. However, the following section discusses investigations for groundwater levels at the Site. Infiltration is not a viable discharge arrangement for the

proposed development. This information should address comments (point 1 – infiltration to ground) raised in LLA correspondence (Appendix 4).

Groundwater Monitoring

- 3.5.5 Groundwater monitoring will be undertaken between October 2024 and March 2025 whereby six-monthly return monitoring visits during the winter will occur. The results to date are included in Appendix 7.
- 3.5.6 A location plan of the monitoring wells (BH1 to BH4) is included in Figure 3.8 and groundwater monitoring results to date are included in Table 3.3.
- 3.5.7 Monitoring wells were located to provide site coverage and also target the geological changes across the Site. The boreholes were advanced using percussion drilling methods to depths of 5m below ground level (bgl).

Figure 3.8: Monitoring Well Location

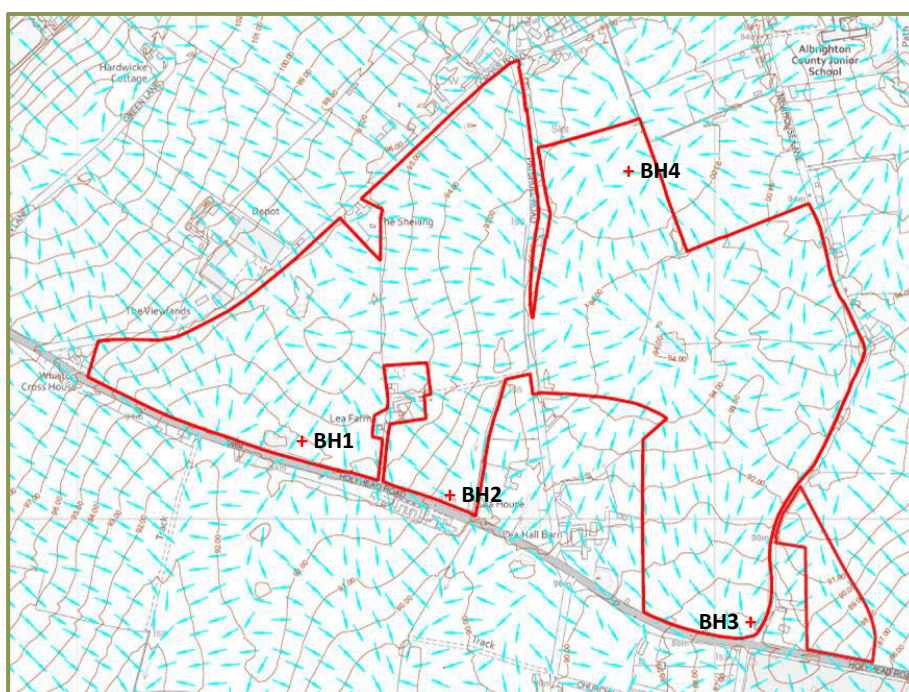


Table 3.3: Borehole Log Summary including Groundwater Level

Exploratory Hole	Stratum Summary	Groundwater Level m bgl
		18.10.24
BH1	Made Ground 0.0 to 0.4mbgl Gravelly silty sand 0.4 to 2.0 mbgl Mudstone 2.0 to 5.0 mbgl	1.35
BH2	Made Ground 0.0 to 0.2mbgl Gravelly silty sand 0.2 to 2.0 mbgl Mudstone 2.0 to 5.0 mbgl	0.66
BH3	Made Ground 0.0 to 0.4mbgl Gravelly silty sand 0.4 to 2.5 mbgl Mudstone 2.5 to 5.0 mbgl	0.71
BH4	Made Ground 0.0 to 0.4mbgl Gravelly silty sand 0.4 to 2.0 mbgl	1.22

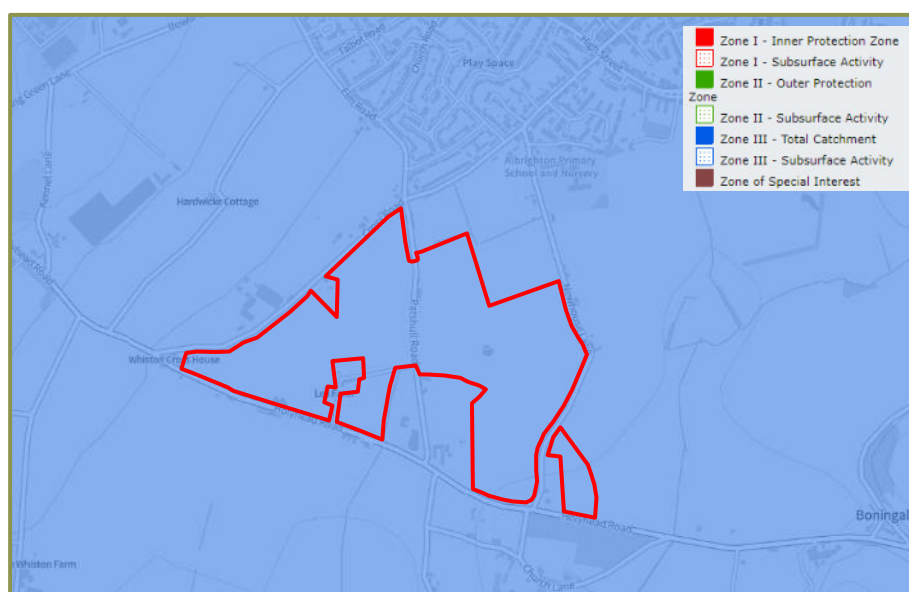
	Mudstone 2.0 to 5.0 mbgl	
--	--------------------------	--

- 3.5.8 The borehole logs confirm the BGS geology mapping/borehole records with a layer of mudstone located at 2mbgl with gravelly silty sand deposits atop the mudstone. This creates a possibility of perching of groundwater from infiltrating surface water to saturation point.
- 3.5.9 The results show groundwater between depths of 0.66m bgl and 1.35m bgl.
- 3.5.10 These groundwater levels suggest perching of groundwater above the mudstone deposits. Adequate mitigation of the surface water flood risk onsite will negate any risk from groundwater sources.

Defra Magic Map

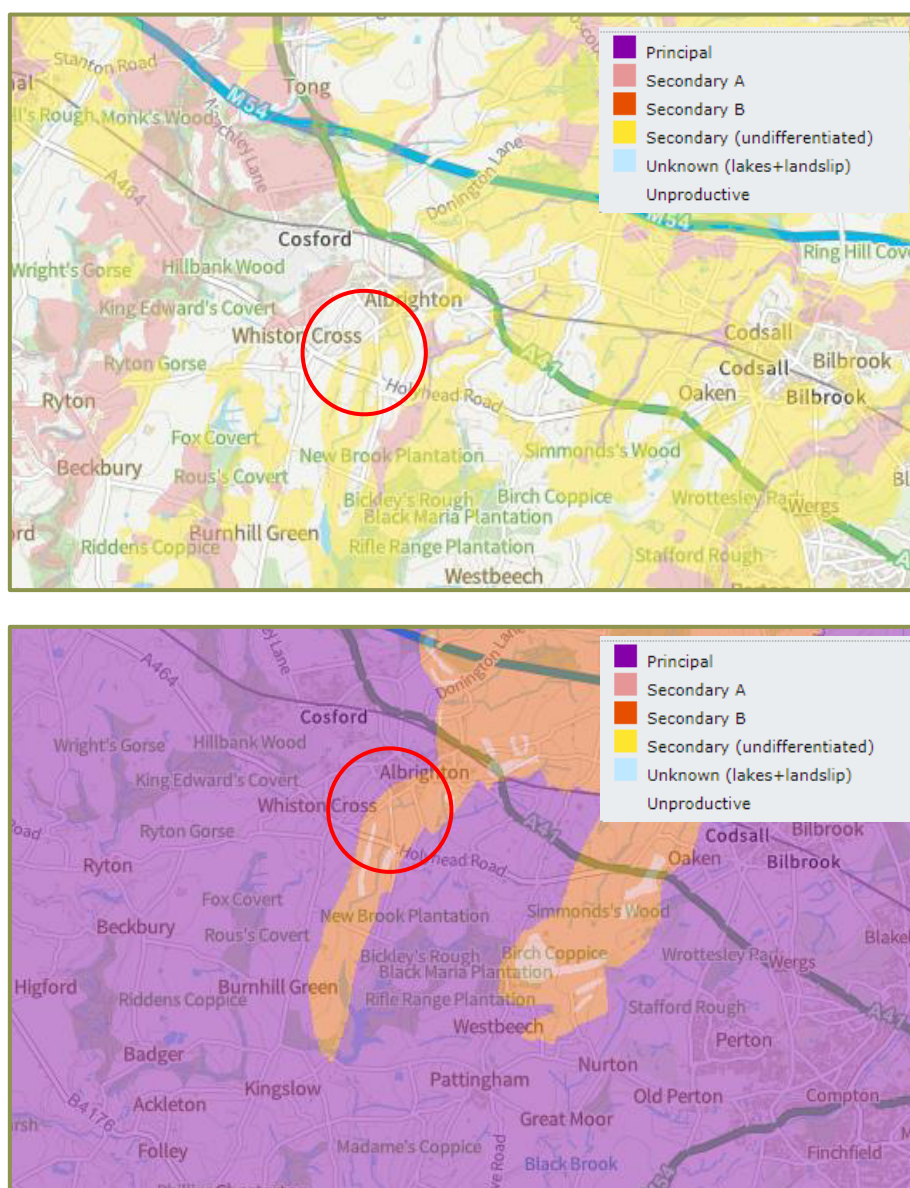
- 3.5.11 The online Defra Magic Map mapping (Figure 3.9) shows the Site is located in a groundwater Source Protection Zone (SPZ). The Site is located within the 'Total Catchment' (Zone 3).
- 3.5.12 These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. Where infiltration-based SuDS are proposed to manage surface water from a development, then direct discharge into groundwater would not be permissible. Therefore, the elevation of the groundwater table with respect to the base of the soakaway is critical, and there must be an unsaturated zone in the aquifer unit.

Figure 3.9: Source Protection Zone Map



From Magic Map. Contains Environment Agency information © Environment Agency and database right [2024].

- 3.5.13 The Site is located above a Secondary B Aquifer (Bedrock designation), and the Site is located above a Secondary (undifferentiated) Aquifer in the superficial. (Figure 3.10).

Figure 3.10: Aquifer Designation Map

Top: Aquifer Designation (superficial deposits). Bottom: Aquifer Designation (bedrock). From Magic Map. Contains Environment Agency information © Environment Agency and database right [2024].

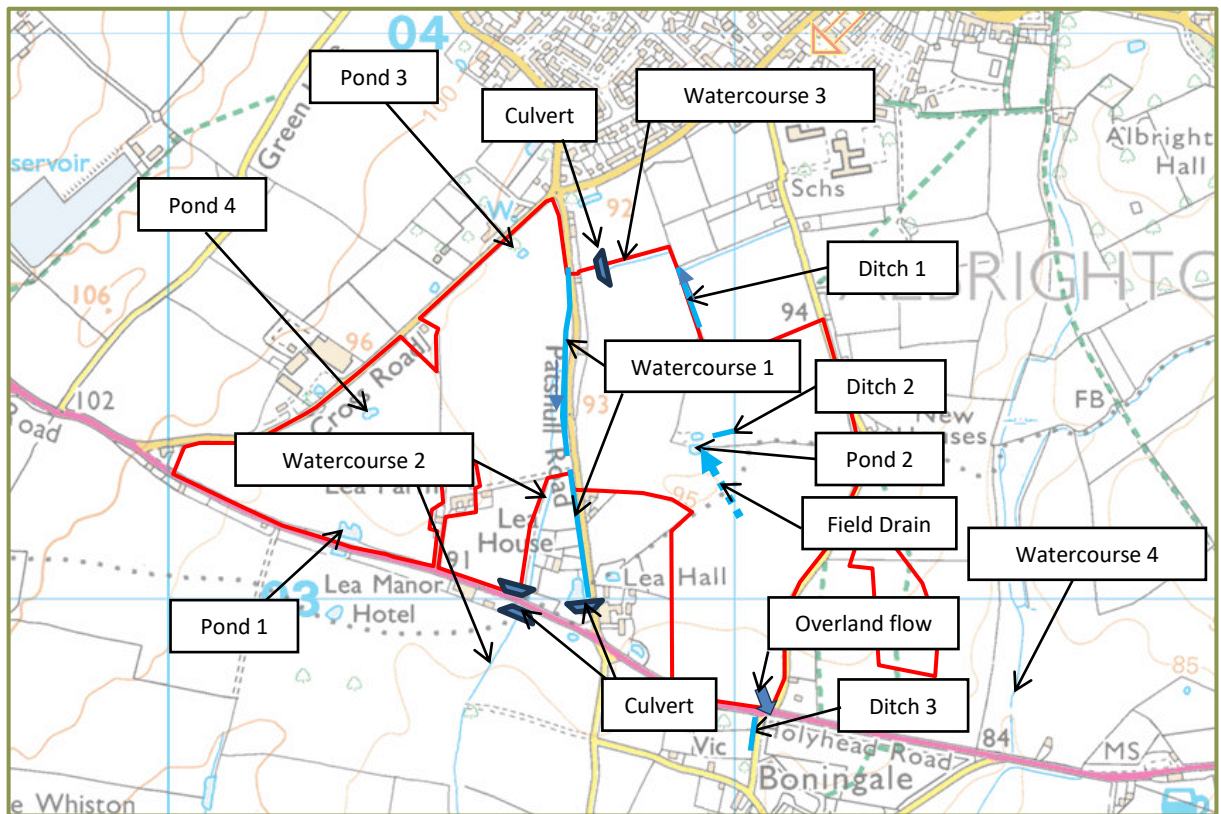
3.6 Catchment Hydrology

OS Mapping and Site Walkover Observations

- 3.6.1 OS mapping (Figure 3.11) shows unnamed watercourses: 'Watercourse 1' conveys flows west around the north boundary of Parcel 2. 'Watercourse 2', conveys flows south along the southeastern boundary of Parcel 1 before flowing underneath Holyhead Road away from the Site.
- 3.6.2 Another unnamed watercourse, 'Watercourse 3', flows south approximately 300m east of the Site.

- 3.6.3 There is also large pond, 'Pond 1', outside the south boundary of Parcel 1, and two small ponds (Pond 3 and Pond 4) in the northern extent of Parcel 1. There is also a large pond, 'Pond 2', in the centre of Parcel 2.
- 3.6.4 The walkover observed multiple ditches: 'Ditch 1', 'Ditch 2', 'Ditch 3' and 'Ditch 4' along multiple field boundaries of the Site. 'Ditch 5' was observed south of the southeast corner of the Site.

Figure 3.11: Map of Watercourses



Watercourses 1, 2 and 3

- 3.6.5 Watercourse 1 was observed parallel to Patshull Road (Figure 3.12), along the eastern boundary of Parcel 1. The Site walkover observed the channel to have an approximate 0.50m bed width, 0.70m depth and 1:3 side slope. The channel was dry at the time of the walkover, which is normal for the time of year when the walkover was undertaken. There was evidence of flowing water within the channel. The channel flows south towards Holyhead Road (A464). There was a trash screen at the southern end of the ditch that was blocked.

Figure 3.12: Watercourse 1

Left: North of eastern boundary of Parcel 1. Right: Patshull Road to the right, and ditch 1 to the left.



Bottom: Blocked trash screen at the southern end of the ditch.

- 3.6.6 Watercourse 2 flows south along the southwestern boundary of Parcel 1 and proceeds to flow underneath Holyhead Road and out of a culvert south of Holyhead Road. During the walkover, this culvert could not be seen due to dense vegetation.
- 3.6.7 Watercourse 3 flows west along the northern boundary of Parcel 2, before entering a Ø600mm circular culvert approximately 40m east of Patshull Road. The channel was free flowing, clear from overgrown vegetation or blockages (Figure 3.13). Using a survey staff, the ditch is estimated to be 1.5m deep.
- 3.6.8 During the walkover, it could not be determined where the watercourse reappeared at the surface after flowing into the culvert. It is assumed to route south along Patshull Road, eventually connecting to watercourses south of the A464 Holyhead Road.

Figure 3.13: Watercourse 3



Left: View west of Watercourse 3. Right: view east of Watercourse 3.



Left: View north of Watercourse 3. Right: Culvert entry and channel depth of Watercourse 3.

Watercourse 4

- 3.6.9 Watercourse 4 was observed on the Site walkover (Figure 3.14). It flows south approximately 300 metres east of the Site, before flowing underneath Holyhead road, outflowing through a Ø1.5x2.5m rectangular opening.

Figure 3.14: Watercourse 4*Watercourse 4 flowing south after flowing underneath Holyhead Road.*

Pond 1

- 3.6.10 Pond 1 was observed outside the south boundary of Parcel 1 (Figure 3.15). The pond was well established, full of water, and the embankments were roughly 1.5m tall. All sides of the pond were heavily vegetated, mature trees surrounded the east, south, and western sides. Though limited by dense vegetation, the Site walkover observed the pond to have an approximate 30m diameter.

Figure 3.15: Pond 1

Pond 2

- 3.6.11 Pond 2 was observed along a boundary between two fields in the centre of Parcel 2 (Figure 3.16). It is a sunken pond, where sides were gentle, and the pond was not impounded and water was observed in the Pond. The bank consisted of trees and shrubs. There was a trash screen with a Ø100mm circular plastic culvert inside situated 2m southeast of the pond which would likely flow into the pond during wet periods – however at the time of the walkover no flow was observed. The pond was observed to have an approximate diameter of 15m.

Figure 3.16: Pond 2



Left: View of eastern side of the pond. Right: View of western side of the pond.



Trash Screen with black pipe that is situated southeast of Pond 2.

Ponds 3 and 4

- 3.6.12 Pond 3 was observed in the northern extent of Parcel 1. It is a sunken pond with gentle sides, where the bank consisted of trees and small amounts of vegetation. It did not contain water.
- 3.6.13 Pond 4 was observed in the northern extent of Parcel 1 (Figure 3.17). It is a sunken pond with had gentle sides that were roughly 1m tall and was not impounded. The bank consisted of trees small amounts of vegetation. The Site walkover observed the pond to have an approximate 10m diameter. The pond did not contain water.

Figure 3.17: Pond 4*Left: View of Pond 4 from afar. Right: View of Pond 4 close up.***Ditch 1**

- 3.6.14 Ditch 1 was observed in the northern extent of Parcel 2 (Figure 3.18), orientated south to north and connected to Watercourse 3 in the north. Ditch 1 extended from Watercourse 3 to the south. for approximately 100m. The northern extent of Ditch 1 contained stagnant water, where the walkover observed the channel to have an approximate 1m bedwidth. In the southern extent of Ditch 1, the channel was dry and was observed to have an approximate 0.50m bedwidth, 0.50m depth and 1:3 side slope. There was evidence of flowing water within the channel.

Figure 3.18: Ditch 1

Left: The intersection of Watercourse 3 and Ditch 1, where Watercourse 3 flows from the west (the watercourse in the centre of the image) before flowing north (to the left within the image). Ditch 1 flows to the south (to the right within the image). Right: Ditch 1 further south of Watercourse 3.

Ditch 2

- 3.6.15 Ditch 2 was observed in the eastern extent of Parcel 2 (Figure 3.19). It parallels the hedgerow that extends from Pond 3 eastwards to Newhouse Lane. The Site walkover observed the channel to have an approximate 0.40 bed width, 0.50m depth and 1:3 side slope. The southern side of the ditch was vegetated with hedgerow, and the northern bank of the ditch was grassed. The channel contained water.