



Banks Group Ltd

Shepley Hydrogeological Impact Assessment



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Report for

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Executive summary

Purpose of this report

This report has been produced for the purpose of providing an initial hydrogeological impact assessment (HIA) of the potential impacts from a proposed residential development consisting of up to 110 units within the east of Shepley, West Yorkshire. The area contains important groundwater receptors, namely the boreholes of Shepley Spring Ltd (Shepley Spring) which is a local water bottling business located immediately adjacent to the northern boundary of the Proposed Development site. It is understood that Banks Property Ltd will use this HIA as part of the development outline planning application to assess the hydrogeological impacts. It is also assumed that data provided to WSP by the client in connection with the preparation of this report are accurate, complete and not misleading.

At the time of writing, consultation between Banks Group Ltd and Shepley Spring has been limited with no site-specific information as to the Shepley Spring groundwater resource being made available to inform this HIA. As a result, this HIA is a high-level assessment based upon numerous assumptions regarding the Shepley Spring supply.

The geology of the Shepley Spring area is reasonably complex, and the collection of data has led to the development of a preliminary Conceptual Site Model (CSM) and the identification of potential linkages within a source-pathway-receptor model. The assessment considers potential effects for construction and operational phases of the development with the consideration of appropriate hazards and mitigation for each. Due to the risks associated with this scheme and the requirement for no technical objections on the future application the scope of the HIA comprises all associated groundwater dependent receptors including aquifers, groundwater dependent conservation sites and water resources. However, the focus of the study is the Shepley Spring and mitigation of risks to this resource.

A range of design and good industry practices are included as embedded environmental measures to remove or minimise any environmental effects on the receptors as far as possible. Specific design and management mitigation are recommended to protect the nearby Shepley Spring water resource and aquifer receptors. The assessment concludes that there a Major/ Moderate Adverse to Negligible residual risk effects after the implementation of standard and site-specific mitigation measures during construction and Minor Adverse to Negligible residual risk during operations to the Shepley Spring water resource. No impacts on recharge to the aquifer resource are anticipated.

The reason for the wide range of risk is due to the current unknowns regarding the Shepley Spring groundwater resource source aquifer, i.e. is it a shallow or deep aquifer. Although the exact depth of Shepley Spring extraction is not available within the public domain, there is a strong indication that the source abstraction zone is from a deeper extraction, leading to a reduced Negligible risk. The depth of the source abstraction zone is to be confirmed during the determination period by further consultation with the Environment Agency. This HIA and the range of risk can be refined as well as further site-specific mitigation measures developed in the receipt of further information about the Shepley Spring water resource source receptor.

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1. Introduction

1.1 Overview

WSP UK Limited were asked by Banks Property Ltd to undertake a Phase 1 desk study for the purpose of providing an initial hydrogeological impact assessment (HIA) of the potential impacts from, development of a strategic residential development (Proposed Development) consisting of up to 110 units within the east of Shepley, West Yorkshire.

The area contains important groundwater receptors, namely the boreholes of Shepley Spring Ltd (The Knowle, Shepley, HD8 8EA) “Shepley Spring”, which is a local water bottling business located immediately adjacent to the northern boundary of the Proposed Development site. The Shepley Spring is the UK’s largest independent bottled water company, manufacturing over 130 million bottles per annum. Shepley Spring bottle several brands, including White Rock¹ and Ice Valley², both of which highlight the purity and mineral content of the water sourced which is believed to be mineralised groundwater from the Greenmoor Rock located within the Pennine Lower Coal Measures Formation. The collection of geological data within the Shepley Spring area has led to the development of a preliminary CSM and identified potential linkages to the Proposed Development site within a source-pathway-receptor model.

The hazards and mitigation are considered during the risk assessment process. Due to the risks associated with this scheme and the requirement for no credible technical objections on the future application the scope of works comprises all associated groundwater dependent receptors including aquifers, conservation sites and water resources. However, the focus of the study is the Shepley Spring and mitigation of risks from the Proposed Development to this resource. Due to the sensitivity of the Shepley Spring water resource receptor to changes in groundwater quantity and quality, the HIA and mitigation is a fundamental supporting document of any future development application.

Shepley Spring has raised concerns regarding the development and have indicated that they will be strongly objecting to the Proposed Development, as they believe it could potentially impact their water supply. Approximately half of the site is within a groundwater Source Protection Zone 1 (SPZ1), believed to be associated with this business and their operation. It is noted that previous applications (**Section 3.1**) within the Shepley Spring SPZ have not been subject to objections. Even so, groundwater and groundwater resources within the area is a technical discipline within the application which will require a robust risk assessment with appropriate mitigation in place to protect groundwater receptors during and after construction (operation) of the development. This report has been produced for the purpose of providing a preliminary, desk-based hydrogeological assessment to establish potential receptors that may be adversely impacted by the development. Following the HIA conclusions and recommendations for further investigation/ work are made.

1.2 Scope

This report is a desk study consisting of the following:

- An initial desk top study of the hydrogeological conditions and water resources, including the Shepley Spring abstraction receptor, within the Study Area;

¹ <https://whiterockwater.co.uk/>

² <https://ice-valley.com/>

- Collation of relevant site characteristics aimed at producing a preliminary, and hydrogeologically based, CSM for the development area;
- The identification of potential receptors that may be adversely impacted by the development;
- Undertaking a HIA to assess potential impacts on and mitigations for groundwater and water resources, with particular attention given to the Shepley Spring and associated SPZ within the area, suitable for supporting a submission as part of the Proposed Development application; and
- Conclusions and recommendations to be undertaken during formulation/ development of the above.

The HIA covers the construction works and operation of the Proposed Development.

1.3 Geographical scope and Study Area

The site is located to the southeast of Abbey Road South (A629) on the eastern fringe of Shepley, West Yorkshire, and is situated around Ordnance Survey (OS) national grid reference (NGR) 419724, 409640. The site boundary is shown in **Figure 3-1**. The site is approximately 4.98 hectares in size and lies within agricultural ground to the southeast of existing residential buildings, whilst Shepley Spring is located directly to the northeast of the Proposed Development.

The study area has been focussed on the Proposed Development site and an area beyond the site. This study area has been defined by a 2 km radius around the site (**Figure 3-1**). The study area comprises a rural area with small villages and hamlets, namely Shelley and Birds Edge to the north and south, and Fulstone and Upper Cumberworth to the west and east respectively. The 2 km radius study area surrounding the site was considered to provide sufficient extent enabling collection of appropriate data for a baseline assessment.

1.4 Scoped out receptors and activities

The groundwater technical discipline will require a robust risk assessment with appropriate mitigation in place to protect groundwater receptors during and after construction of the development. Due to the risks associated with the scheme and the sensitive groundwater receptors within the vicinity of the Proposed Development area the scope of the assessment comprises all associated groundwater dependent receptors including aquifers, conservation sites and water resources. However, the focus of the study will be the Shepley Spring, given the proximity of the receptor to the Proposed Development and the concerns already raised by the owners, and to the specific mitigation of risks to protect this resource.

As such, direct impacts upon surface water features (i.e. not involving groundwater flow pathway) and surface water fed ecological habitats from surface runoff are not included within the assessment scope. Current discharges and/ or discharges to surface water bodies during construction and/ or operational phases of the Proposed development are also not considered within the scope of this assessment.

Although the construction phase will not exert significant nutrient discharges that may impact watercourses and downstream catchments/ habitats, the operational phase of new developments may increase the nutrient and nitrogen load discharged to surface water bodies because of the increased resident population within the catchment and the change in land use from agricultural to urban. However, any potential environmental impacts from additional remote water treatment processes and discharges are not considered within the HIA assessment for the Proposed Development.

In addition, commercial and/or industrial chemical sources have been discounted since the final Proposed Development site is for residential housing only.

The increase in flood risk due to surface water runoff from modified surfaces and/ or change in land use is not considered within the HIA assessment. However, the potential for the influence on groundwater recharge, subsurface groundwater levels and flow pathways are considered.

1.5 Key assumptions / limitations

This HIA is in support of an outline application to set out the principal constraints upon the Proposed Development in terms of groundwater. The current illustrative masterplan layout presented within **Section 4.1** is indicative at this time and could change in future. The Proposed Development is for residential properties only with associated roads and utilities including sewage effluent pipework. No commercial, heavy commercial/ industrial units, cemeteries, allotments, educational buildings (e.g. schools) and/ or ground source heating/ cooling infrastructure are planned.

Ground Investigation (GI) works are proposed in October 2025 across the full site area consisting of trial trenching up to 3m depth, (shallower if rock head is shallow) and window sampling to a similar depth. Rotary drilling is to be carried out to the east of the site where former mine workings are suspected. The rotary drilling incorporates water flush and bores will be up to 25m in depth to prove the mine workings. At the time of writing no data from the GI works was available for analysis or inclusions within the HIA. Works associated with GI and any future groundwater monitoring at the Proposed Development site should be designed and undertaken to minimise the risk to the groundwater abstraction. However, the undertaking of GI works, such as trial pitting and the drilling/ installation of boreholes and/ or borehole groundwater monitoring is not included within the scope of this HIA.

Although the Shepley Spring has conducted their own internal HIA study for this proposal, this was not made available to the Banks Group Ltd at the time of writing. Consultation between Banks Group Ltd and Shepley Spring at the time of writing has been limited and specific information as to the Shepley Spring groundwater resource (such as depth of abstraction and borehole construction) was not available to inform this HIA. Importantly, this HIA is therefore a high-level assessment based upon numerous assumptions regarding the Shepley Spring aquifer source zones. Primarily, these assumptions comprise the following:

- The Shepley Spring public website states that the Greenmoor Rock located within the Pennine Lower Coal Measures Formation is the source rock at the Shepley Spring and this aquifer is located at depth below the Proposed Development site. However, this does not align with the SPZ which falls within the Proposed Development site and thought to be associated with Shepley Spring. Therefore, a conservative approach to the assessment has been taken at this time with the possibility of abstraction occurring from a potentially shallower sandstone aquifer unit, namely the Grenoside Sandstone, considered (see Figure 4.6);
- If the Shepley Spring boreholes do abstract from the Greenmoor Rock then it is likely that the shallower formations, including the Grenoside Sandstone, are cased out given the importance of the supply. This is supported by the historical digital geological and construction borehole logs from the BGS Onshore GeoIndex data source from the Shepley Spring site which may be representative of the current production boreholes used by the company. In this case the integrity of the Shepley Spring production boreholes, due to their importance is assumed to be good, i.e. installation according to best practice and well maintained; and
- It should be noted that any change to recharge quantity (positive or negative) and/ or flow pathway of recharge and flow to the receptor source (SPZ and/ or aquifer) may change important hydrochemical characteristics even if the overall balance of

recharge remains the same. In the absence of specific detailed characteristics of the Shepley Spring abstractions we do not know how important the specific recharge characteristics are. The assumption is that there will be no change in overall recharge and therefore any change within the hydrochemical regime.

The proposed development lies within an area that has been defined by the Mining Remediation Authority³ as containing coal mining features at surface or shallow depth. However, the assessment does not consider hazards of stability issues and/ or coal gas associated with historical mining.

In addition, the assessment of water resources impacts, in terms of impacts upon groundwater levels and flow on the Shepley Spring boreholes and the aquifer during construction are not considered since activities are temporary and are unlikely to have a long-term influence on the hydrogeological groundwater flow regime. However, impacts upon groundwater levels and the hydrogeological flow regime is considered for the operational phase of the Proposed Development site, and a simple water balance is presented to support the HIA.

Other assumptions and limitations of the study include the following:

- To date a hydrogeologically based site visit has not undertaken (see Section 1.6) and all data collected to this point has been obtained via desk study;
- The conceptual model presented here will be updated as more information becomes available, such as any future intrusive site investigations including geophysical data or other intrusive data, which were not available at the time of writing; and
- The HIA can be updated and refined if addition data/ information is made available from Shepley Spring concerning their groundwater resource supply and/ or from the Environment Agency regarding the development of the SPZs within the Study Area which was not available at the time of writing;
- No digital geological modelling or software was used whilst undertaking the risk assessment.

1.6 Consultation

No direct consultation with the Environment Agency⁴ or Local Authority has been undertaken prior to the writing of this HIA. Banks Group Ltd approached Shepley Spring to initiate discussions on the Development Proposal and the sharing of information to inform the HIA scope and process, as well as likely suitable mitigating measures. However, the offer was declined and no information regarding the Shepley Spring abstractions or their previous hydrogeological risk assessment work were shared (see limitations **Section 1.5** above). Since no meeting at the Shepley Spring site has taken place no site visit walkover/ survey was undertaken.

1.7 Report Structure

In this report this Section contains an overview and scope of the study and important information key assumptions/ limitations and consultation. **Section 2** introduces the principles and regulations of groundwater protection applied to the project and important groundwater principles in the protection of groundwater. **Section 3** puts forward data to establish a Study Area baseline and **Section 4** uses this data to develop a conceptual hydrogeological site model in terms of source,

³ Formerly known as the Coal Authority.

⁴ A request for consultation was made to the Environment Agency's Yorkshire Area Sustainable Places Team and on the 9th October 2025 an automated response was returned saying: "Planning advice - Effective immediately, we are no longer able to accept new requests for our Charged Pre-Planning Advice service. Our planning advice service is discretionary, you and/or your client are not obliged to seek our advice at Pre-Application stage".

pathways and receptors. A hydrogeological risk assessment is given within **Section 5** and **Section 6** gives conclusions of the assessment and a summary of recommendations.

2. Principles and regulations of groundwater protection

2.1 Principles of Groundwater Protection

The approach to protecting groundwater in England is set out in The Environment Agency's Approach to Groundwater Protection (Environment Agency, 2018)⁵. The priority is to protect groundwater and water supplies intended for human consumption, as well as to ensure protection of the quality of groundwater that supports ecosystems. This is achieved by preventing hazardous substances and limiting non-hazardous pollutants from entering groundwater and by identifying the sensitivity of groundwater, i.e. within aquifers that can provide significant quantities of drinking water, and its vulnerability.

Sensitive groundwater locations have protection zones applied for areas where pollution on or below the land may present a risk to groundwater. These include drinking water protected areas (DrWPAs) and source protection zones (SPZs). The Environment Agency applies a general level of protection for all drinking water sources through the use of SPZs. In addition, private water supplies (PWSs) provide water to homes, businesses or services, commonly in rural areas, and are regulated by local authorities. All PWSs used for human consumption or food production purposes have an SPZ1 designation with a default radius of 50m and a default catchment radius area of 250m.

The Proposed Development may impact groundwater resources through the risk of contamination during construction and during operation affecting groundwater quality. Depending on the potential severity of the hazard, the Environment Agency may object (through planning or permitting controls) to such activities in certain areas. Where works and infrastructure are close to sensitive receptors, the Environment Agency is likely to adopt the precautionary principle as even where the likelihood is not high, the consequences may be serious or irreversible.

2.2 Legislative and Regulatory Framework

This section identifies the legislation, policy and other documentation that has informed the study. National and local legislation and policy relevant to the protection of groundwater is given in **Table 2-1**.

⁵ Environment Agency, February 2018. The Environment Agency's approach to groundwater protection Version 1.2 <https://assets.publishing.service.gov.uk/media/5ab38864e5274a3dc898e29b/Environment-Agency-approach-to-groundwater-protection.pdf>

Table 2-1 Relevant Legislation and Policy

Legislation	Relevance to protection of groundwater
<u>National</u>	
The Water Environment Regulations, 2017	This applies to surface waters (including some coastal waters) and groundwater (water below the surface of the ground). These regulations set out requirements to prevent the deterioration of aquatic ecosystems; protect, enhance and restore water bodies to 'good' status; and achieve compliance with standards and objectives for protected areas. Local planning authorities must, in exercising their functions, have regard to River Basin Management Plans. These plans contain the main issues for the water environment and the actions needed to protect them.
Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (the EU WFD)	The requirements of various EU Directives such as the Water Framework Directive (WFD) (2000/60/EC), the European Liability Directive (2004/35/EEC) and the Groundwater Daughter Directive (2006/118/EEC) have been transposed into domestic legislation by the Environment Regulations 2019. Previously the WFD and now the Environment Regulations 2019 and supporting domestic legislation establish a legal framework for the protection, improvement and sustainable use of surface waters, transitional waters, coastal waters and groundwater resources.
National Policy Statement for Water Resources Infrastructure	The section on Water Quality and Resources links directly with the Environment Agency guidance that explains the legal requirements associated with groundwater activities. In this respect the National Policy Statement for Water Resources Infrastructure requires activities to adhere to the principles of the Environment Agency approach to groundwater protection.
Department of Environment, Food and Rural Affairs (Defra) (2023)⁶	In addition, the section on land use including open space, green infrastructure and Green Belt under the Applicant's Assessment states that the " <i>Risks to the quality and quantity of groundwater resources should be assessed</i> ".
Environmental Permitting (England and Wales) Regulations (EPR) 2016	The EPR (2016) is the principal legislation governing the environmental permitting and compliance regime which applies to various activities and industries. The EPR (2016) has specific schedules: 21 and 22, Water discharge activities and Groundwater activities respectively.

⁶ DEFRA (2023). Draft National Policy Statement for Water Resources Infrastructure [online]. Available at: https://assets.publishing.service.gov.uk/media/6437e3a2f4d420000cd4a1a7/E02879931_National_Policy_Statement_for_Water_Resources.pdf.

Legislation	Relevance to protection of groundwater
Core guidance for the Environmental Permitting (England and Wales) regulations (EPR) 2016 (SI 2016 No 1154) Defra (2020)	<p>This aims to provide comprehensive help for those operating, regulating or interested in 'regulated facilities' covered by the EPR. Such facilities could potentially harm the environment or human health, and EPR requires their operators to obtain a permit or to register some activities, which would otherwise require permits, as 'exempt facilities'. Under EPR it is a criminal offence to "<i>cause or knowingly permit</i>" groundwater to become polluted. Penalties include fines, imprisonment or both.</p> <p>Relevant to the Proposed Development and associated works include the following:</p> <ul style="list-style-type: none"> • Schedule 8 – Part B installations and Part B mobile plant (regulation 8(1)(b)); • Schedule 21 – water discharge activities (regulation 8(1)(f)); and • Schedule 22 – groundwater activities (regulation 8(1)(g))
Water Resources Act 1991	<p>The Water Resources Act 1991 (UK Government (1991)), Water Act 2003 (UK Government, 2003) and Environmental Permitting (England and Wales) Regulations 2016 (UK Government, 2016) are key legislation relevant to the Water Environment. The Water Resources Act 1991 states that it is an offence to cause or knowingly permit polluting, noxious, poisonous or any solid waste matter to enter controlled waters. The Act was revised by the Water Act 2003, which sets out regulatory controls for water abstraction, water impoundment and protection of water resources. Provisions for the regulation of water discharges to controlled waters are set out in the Environmental Permitting (England and Wales) Regulations 2016 and have replaced provisions in the earlier Acts mentioned here.</p> <p>These Acts and Regulations set out the permitting and compliance framework which will regulate all site emissions, water abstractions and discharges with the potential to interact with the water environment. Important to the Proposed Development is the requirement to obtain a licence for dewatering of engineering works and to ensure that any significant impact on the environment can be mitigated.</p>
Water Framework Directive (2000/60/EC)	<p>The Environment Agency may use SPZs as the basis for safeguard zones (SgZs) (European Commission 2007). These are used at sources at risk of groundwater pollution resulting in a deterioration in the quality of water abstracted leading to a likely increase in treatment needed to supply good quality water used for human consumption (Environment Agency, 2019).</p> <p>SgZs are established around public water supplies where additional pollution control measures are needed. The Water Framework Directive (2000/60/EC) requires that Drinking Water Protected Areas (DrWPAs) are identified (WFD Article 7.1) and that they are given the necessary protection (WFD Article 7.3) with the aim of avoiding deterioration in their quality, in order to reduce the level of treatment required in the production of drinking water (Environment Agency, 2021). The geometry of groundwater SgZs is based on groundwater SPZs, usually SPZ1 and SPZ2, and use additional assessment to identify areas, which may or may not coincide with the SPZ, for example where additional measures are required to ensure that abstraction waters meet Article 7.3 of the WFD (Environment Agency, 2021).</p>

Legislation	Relevance to protection of groundwater
	<p>All groundwater bodies in England are designated as drinking water protected areas. This aims to protect groundwater from over-abstraction and to prevent deterioration in groundwater quality that could increase the treatment of drinking water. DrWPAs are required to be identified under the Water Framework Directive (2000/60/EC) in order to protect groundwater and prevent groundwater pollution (Environment Agency, 2017).</p>
<p>Planning Act 2008 (as amended) (PA2008)</p>	<p>Relevant policies with respect to managing and protecting groundwater are detailed further under the sections below.</p>
<p>National Planning Policy Framework (NPPF), 2024⁷</p>	<p>The policy states that “<i>Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, water supply ...</i>”. Also, any development should, help to improve local environmental conditions in terms of water quality, taking into account relevant information such as river basin management plans.</p>
<p>Planning Practice Guidance (PPG), 2024⁸</p>	<p>Advises on how planning can ensure water quality. Gives guidance on how to help protect and enhance local surface water and groundwater. For example, to prevent potentially polluting development in the most sensitive areas, particularly those in the vicinity of drinking water supplies (designated source protection zones or near surface water drinking water abstractions). To aid an awareness of cross-boundary issues and the application of the river basin management plan to protect catchments.</p>
<p><u>Local</u></p>	
<p>Kirklees Local Plan 2019 – 2030 February 2019⁹</p>	<p>The Local Plan contains a number of policies which are relevant to this document and the Proposed Development:</p> <ul style="list-style-type: none"> ● LP27: Flood Risk must take account of all sources of flooding set out in the Strategic Flood Risk Assessment and demonstrate that the proposal will be safe throughout the lifetime of development (taking account of climate change). The proposal must also not increase flood risk elsewhere and where possible should reduce flood risk. Mitigation measures, where necessary, should be proposed; ● LP28: It is assumed that SuDS will be used to ensure that typical greenfield run-off rates are not exceeded at developments and there should be no negative impact on local water quality and improvements in water quality where practicable. In addition, consideration of whether proposed open spaces and green infrastructure within sites can contribute to the sustainable drainage of the site; ● LP29: Management of water bodies - Where proposals include an existing area of water, there needs to be careful consideration of the

⁷ Ministry of Housing, Communities & Local Government, June 2021, National Planning Policy Framework

⁸ Ministry of Housing, Communities & Local Government (Live Document). Planning Practice Guidance [online]. Available at: <http://planningguidance.communities.gov.uk/>

⁹ Kirklees Local Plan Strategy and Policies Adopted 27 February 2019 [Kirklees Local Plan Strategy and Policies](#)

Legislation	Relevance to protection of groundwater
Kirklees Council SFRA July 2016¹⁰	<p>potential flood risk and biodiversity implications of the development proposals; and</p> <ul style="list-style-type: none"> LP34: Conserving and enhancing the water environment. This policy seeks to address the key objectives of the Water Framework Directive as well as respond to the guidance and recommendations in the Humber River Basin Management Plan. The policy is to ensure there is no deterioration of water courses or water bodies (including groundwater) and to ensure SPZs are protected from contamination as a result of any proposal in line with national guidance. <p>The primary objective of the SFRA is to enable the Council to apply the Sequential and Exception Test in the development allocation and development management process set out in the NPPF. The NPPF requires that all development is steered to areas of lowest flood risk, where possible. The SFRA indicates that the LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater and states that development within areas susceptible to groundwater flooding will generally not be suited to SuDS and proposals for infiltration drainage. The SFRA shows the Environment Agency's national dataset, Areas Susceptible to Groundwater Flooding (AStGWF), which provides a dataset to assess the future risk of groundwater flooding.</p>
Mining Remediation Authority, January 2012¹¹	<p>The Mining Remediation Authority is the regulator to comply with building over or within the influencing distance of a mine entry as this could raise significant safety and engineering risks.</p> <p>In relation to new development within the influencing distance of a mine entry building will only be permissible when:</p> <ul style="list-style-type: none"> expertise advice allows a suitable engineering design to be developed and agreed to take account of all the relevant safety and environmental risk factors including gas and mine-water.....; andapproval for the works is obtained from the Mining Remediation Authority permissions service which will also monitor the implementation of the works to ensure public safety.

2.3 Key Legislation

The Water Resources Act 1991 (UK Government (1991)), Water Act 2003 (UK Government, 2003) and Environmental Permitting (England and Wales) Regulations 2016 (UK Government, 2016) are key legislation relevant to the Water Environment. The Water Resources Act 1991 states that it is an offence to cause or knowingly permit polluting, noxious, poisonous or any solid waste matter to enter controlled waters. The Act was revised by the Water Act 2003, which sets out regulatory controls for water abstraction, water impoundment and protection of water resources. Provisions for the regulation of water discharges to controlled waters are set out in the Environmental Permitting (England and Wales) Regulations 2016 and have replaced provisions in the earlier Acts mentioned here.

¹⁰ <https://www.kirklees.gov.uk/beta/planning-policy/strategic-flood-risk-assessment.aspx>

¹¹ <https://www.gov.uk/government/publications/building-on-or-within-the-influencing-distance-of-mine-entries>

These Acts and Regulations set out the permitting and compliance framework which will regulate all site emissions, water abstractions and discharges with the potential to interact with the water environment. Important to the Proposed Development is the requirement to obtain a licence for dewatering of engineering works and to ensure that any impact on the environment can be mitigated.

2.4 Key Guidance

The Environment Agency is the regulator with respect to environmental permitting. It is also a statutory consultee for the purpose of the Planning Act 2008. The Environment Agency provides practical guidance on how to assess the hydrogeological impact of groundwater abstractions, for those who are preparing applications to the Environment Agency for full abstraction licences, within the *Hydrogeological impact appraisal for groundwater abstractions Science Report* (Environment Agency, 2007¹²).

The EA's approach to groundwater protection (Environment Agency, 2018) contains position statements which provide information about its approach to managing and protecting groundwater. They detail how the Environment Agency delivers government policy for groundwater and adopts a risk-based approach where legislation allows. Many of the approaches set out in the position statements are not statutory but may be referenced in statutory guidance and legislation. The most relevant of these policies with respect to the Proposed Development are summarised below:

B1: Initial screening tools: The Environment Agency will use SPZs as an initial screening tool to identify “*areas where it would object in principle to certain potentially polluting activities, or other activities that could damage groundwater*” and/ or areas “*where additional controls or restrictions on activities may be needed to protect water intended for human consumption*”;

N7: Hydrogeological risk assessment: “*Developers proposing schemes that present a hazard to groundwater resources, quality or abstractions must provide an acceptable hydrogeological risk assessment (HRA) to the Environment Agency and the planning authority. Any activities that can adversely affect groundwater must be considered, including physical disturbance of the aquifer. If the HRA identifies unacceptable risks then the developer must provide appropriate mitigation. If this is not done or is not possible the Environment Agency will recommend that the planning permission is conditioned, or it will object to the proposal*”;

N8: Physical disturbance of aquifers in SPZ1: “*Within SPZ1, the Environment Agency will normally object in principle to any planning application for a development that may physically disturb an aquifer*”; and

N11: Protection of resources and the environment from changes to aquifer conditions: “*For any proposal that would physically disturb aquifers, lower groundwater levels, or impede or intercept groundwater flow, the Environment Agency will seek to achieve equivalent protection for water resources and the related groundwater-dependent environment as if the effect were caused by a licensable abstraction*”. Hence, on the basis of these policies the Environment Agency require a hydrogeological risk assessment and suitable mitigation for the proposed works.

2.5 Aquifer Status

The designation of an aquifer reflects the importance of the aquifer in terms of groundwater as a drinking water supply resource and its role in supporting surface water flows and wetland ecosystems (British Geological Survey (BGS), 2022). Principal and Secondary aquifers may provide significant quantities of drinking water and water for business needs. They may also support rivers, lakes and wetlands and other groundwater dependent ecosystems.

¹² EA, 2007. Hydrogeological impact appraisal for groundwater abstractions Science Report – SC040020/SR2

Aquifers are divided into two different types: superficial (permeable, unconsolidated (loose) deposits, e.g. sands and gravel) and bedrock (solid, permeable formations, e.g. sandstone, chalk and limestone). The designations (in order of importance) are as follows: Principal, Secondary A, Secondary B, Secondary undifferentiated and unproductive strata.

The Defra (2024) Multi-Agency Geographic Information for the Countryside (MAGIC) web application Aquifer Designation Map was used to identify aquifer designations within the study area. Within the study area the mudstone, siltstone and sandstone within the Pennine Lower Coal Measures Formation are designated as 'Secondary A' aquifers. With regards to superficial deposits, the Defra (2024) MAGIC Aquifer Designation map indicates that superficial deposits if present, are not designated as aquifers.

2.6 Source Protection Zones

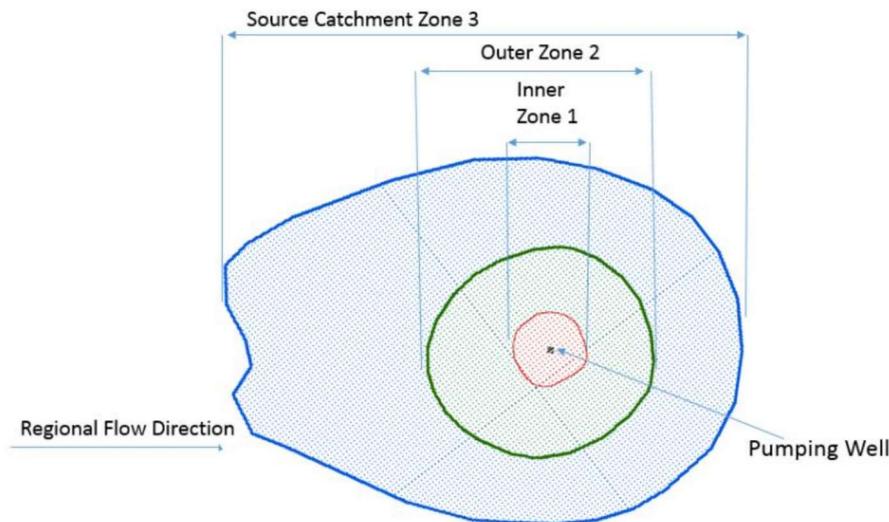
The Environment Agency has defined SPZs to protect groundwater abstraction sources (wells, boreholes and springs). SPZs indicate those areas where groundwater supplies are at risk from potentially polluting activities and accidental releases of pollutants. SPZs are primarily a policy tool used to control activities close to public water supplies. Water companies use SPZs to protect their groundwater abstraction sources and they also provide the basis for catchment management work, such as safeguard zones. SPZs are not statutory and are mainly for guidance but they do relate to distances and zones defined in legislation where certain activities may be restricted.

The Environment Agency first published SPZ methodology guidance in August 1996 (Environment Agency, 1996). An updated document "Groundwater Source Protection Zones – Review of Methods" was published in August 2009 and updated in August 2024 (Environment Agency, 2024). The most recent guidance published in March 2019 "Manual for the production of Groundwater Source Protection Zones" (Environment Agency, 2019) updates the methodology for defining groundwater SPZ's.

SPZs typically comprise three main zones (**Figure 2-1**). The first two zones are based on predicted travel time of potential pollutants through the saturated zone, whilst SPZ 3 represents the recharge area:

- Inner 'SPZ 1' – defined as the 50-day travel time of pollutant to source and has a 50m default minimum radius. This zone is usually located adjacent to the abstraction, although in karst terrain it can extend some distance away due to rapid transport pathways. The EA's Approach to Groundwater Protection (2018) sets the tightest control of activities in this zone;
- Outer 'SPZ 2' – is defined as the 400-day travel time of pollutant to source with a 250 or 500m minimum radius around the source depending on the amount of water abstracted;
- Total catchment 'SPZ 3' –the area around a supply source within which all the groundwater ends up at the abstraction point. This is the area from where the recharge water is being taken and can extend some distance from the abstraction.

Figure 2-1 Schematic Representation of SPZ (from EA, 2019)



Based upon Environment Agency guidance, the list below shows the principles to follow when designing the proposed development.

2.7 Safeguard Zone / Drinking Water Protection Areas

The Environment Agency may use SPZs as the basis for safeguard zones (SgZs) (European Commission, 2007). These are used at sources at risk of groundwater pollution resulting in a deterioration in the quality of water abstracted leading to a likely increase in treatment needed to supply good quality water used for human consumption (Environment Agency, 2019).

SgZs are established around public water supplies where additional pollution control measures are needed. The Water Framework Directive (2000/60/EC) requires that DrWPAs are identified (WFD Article 7.1) and that they are given the necessary protection (WFD Article 7.3) with the aim of avoiding deterioration in their quality, in order to reduce the level of treatment required in the production of drinking water (Environment Agency, 2021).

The geometry of groundwater SgZs is based on groundwater SPZs, usually SPZ1 and SPZ2, and use additional assessment to identify areas which may or may not coincide with the SPZ, for example where additional measures are required to ensure that abstraction waters meet Article 7.3 of the WFD (Environment Agency, 2021).

All groundwater bodies in England are designated as DrWPAs. This aims to protect groundwater from over-abstraction and to prevent deterioration in groundwater quality that could increase the treatment of drinking water. The Defra (2023) MAGIC Map shows that SPZ1 and the SPZ2 of the groundwater abstraction source are not designated as drinking water SgZs¹³.

¹³ It should be noted that the SPZ within the Proposed Development site boundary is not designated as a SgZ.

3. Hydrogeological Environment

3.1 Previous Work

The Kirklees Council planning portal was searched for relevant local and recent planning applications and data. Two site investigation reports of interest have been identified within the vicinity of the Proposed Development:

- The Phase 1 Geo-environmental Report¹⁴ for a residential development southeast of Abbey Road North, Shepley (NGR 419816, 410007) was reviewed during this study and is particularly relevant being of a similar development, within close proximity to the Proposed Development (200 metres to the north of the Proposed Development site) and partially located within the Shepley Spring SPZ. This report was commissioned to examine the risk of contamination for the development in line with the recommendations of Part II of the Environmental Protection Act 1990 to support an application¹⁵ (2024/70/90991/E) made by Yorkshire Country Properties and subsequently agreed on the 5th October 2021. It is believed that no consultation comments or objection was made by the Environment Agency or Shepley Spring at the time of the application; and
- A Stage 2: Site Investigation 2A report¹⁶ for a residential development north of the Holmfirth Road, Shepley (NGR 419361, 408817) was reviewed during this study and is relevant to the study being a recent residential development within the Study Area, being 760 m southwest of the Proposed Development. The purpose of this investigation was to provide a factual and interpretative report on five trial pit excavations with associated sample laboratory testing.

3.2 Data Sources

The data and other sources of information collected are listed in **Table 3-1**.

In addition, the Environment Agency was sent a freedom of information request on the 25th July 2025 and this was answered within the reply Reference: 250728/IL06¹⁷ on the 22nd August 2025 and included information from the Environment Agency Yorkshire area team. A freedom of information request was also sent to the Kirklees Council on the 25th July 2025 requesting data on surface and groundwater private water supplies (PWSs) within the Study Area. These data searches were conducted for the full Study Area, i.e. 2 km of the Proposed Development site boundary.

Given that the Proposed Development is within a historical coal mining district and a coal mine development high risk area, a Consultants Coal Mining Report was obtained from the Mining Remediation Authority data for the Proposed Development site boundary plus an additional surrounding 250 m buffer.

¹⁴ Huddleston., M (June 2019). Phase 1 Geo-environmental Report. Ref: E19/7465/R001

¹⁵ <https://www.kirklees.gov.uk/beta/planning-applications/search-for-planning-applications/detail.aspx?id=2024/90991>

¹⁶ Your Environment, (August 1919). Stage 2: Site Investigation 2A report for a residential development south Holmfirth Road, Shepley. Ref: YG0125-19

¹⁷ E-mail reply to a Freedom of Information request - communication from Jon Haste (YOR Area Customers and Engagement Team) to WSP UK Ltd on the 22nd August 2025; Ref: EIR2025_21325

Table 3-1 Desk study data sources

Type	Data	Source	Purpose for collecting dataset
Topography	Mapping	Ordnance Survey (OS) mapping at 1:50,000 and 1:25,000 scales	To interpret geological outcrop, potential runoff/ recharge influence and subsurface groundwater catchment
Climate	Rainfall	Meteorological Office (Met Office) Rainfall data, climate averages and locations of stations https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcx57w9fb	Rainfall amounts and influence on likely recharge
Hydrology	Main rivers	EA Statutory Main River Map	Water features that may be subject to groundwater baseflow
	River flows	Centre for Ecology and Hydrology, (2022). National River Flow Archive (NRFA) at https://nrfa.ceh.ac.uk/data/search	Baseflow from groundwater flow
	Ponds and lakes	OS mapping at 1:50,000 and 1:25,000 scales.	Water feature that may be subject to groundwater baseflow
	Flood risk	EA Flood Map for Planning map, at: https://flood-map-for-planning.service.gov.uk/ EA Flood Risk from Surface Water map, at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/	Areas subject to high groundwater levels, groundwater discharge areas and groundwater flooding
	Surface water abstractions	Licensed abstraction/ discharge data request to EA Private water supply data request to Kirklees Council.	Water feature that may be impacted if the surface water feature is subject to groundwater baseflow
	Discharges to surface water	Register of Environmental Permits (https://environment.data.gov.uk/public-register/view/search-water-discharge-consents)	Water feature that may be impacted by any future development
	Surface water resource availability	Environment Agency Don and Rother Abstraction Licensing Strategy (ALS) (Environment Agency, February 2013)	Water feature that may be impacted if the surface water feature is subject to groundwater baseflow

Type	Data	Source	Purpose for collecting dataset
	Surface water quality	EA River Basin Management Plan (2022 cycle 3) information, via the Environment Agency Catchment Data Explorer accessed 24/09/21 at: http://environment.data.gov.uk/catchment-planning/ DEFRA Data Services surface water quality at the River Team at Third Avenue Bridge (sampling point ID - NE-43500051) https://environment.data.gov.uk/water-quality/view/sampling-point/NE-43500051? all=true	Gives an indication of possible ground contaminant inputs into the subsurface
Conservation sites	Statutory and non-statutory	Defra MAGIC database, at: http://magic.defra.gov.uk/	Water feature that may be impacted by Proposed Development works
Land Use	Historical Mapping	National Library of Scotland - Side by side georeferenced maps viewer (https://maps.nls.uk/geo/explore/side-by-side/)	Historical use of land and possible contamination sources that may be remobilised within groundwater
Geology	Bedrock and superficial geology maps	Geological Survey of England and Wales, New Series 1:63 360/1:50 000 geological map series Sheet 86 Glossop. (1981) at: https://largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001575 Solid and Drift https://largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001492 Online BGS GeoIndex geology mapping https://www.bgs.ac.uk/map-viewers/geoindex-onshore/ Online BGS Lexicon of Named Rock Units http://www.bgs.ac.uk/lexicon	Identifying subsurface strata to inform development of the conceptual model for the site along with impacts upon pathways
	Borehole logs	Digital geological and construction logs from the BGS Onshore GeoIndex https://www.bgs.ac.uk/map-viewers/geoindex-onshore/	Identifying subsurface strata and likely depths to inform development of the conceptual model for the site along with impacts upon pathways
	Coal Mining	The Mining Remediation Authority web viewer https://mapapps2.bgs.ac.uk/coalauthority/home.html Coal Mining Report from the Coal Remediation Authority	Identifying areas of mining activity

Type	Data	Source	Purpose for collecting dataset
Hydrogeology	Aquifer status	Defra MAGIC website, at: http://magic.defra.gov.uk/	Likely yields of the strata below the Proposed Development and likely regulatory regime
	Source protection zones	Defra MAGIC website, at: http://magic.defra.gov.uk/ and https://environment.data.gov.uk/spatialdata/source-protection-zones-merged/wms	Water feature that may be impacted by Proposed Development works
	Groundwater abstractions and discharges	Licensed abstraction data request to EA Private water supply data request to Kirklees Council.	Water feature that may be impacted by Proposed Development works
	Springs	OS 1:25,000 scale mapping	Water feature that may be impacted by Proposed Development works
	Baseflow	National River Flow Archive, https://nrfa.ceh.ac.uk/	Indication of groundwater flow
	Groundwater levels and flows	Groundwater level data request to EA	Indication of groundwater level and flows likely at the Proposed Development location
	Groundwater resource availability	Environment Agency Don and Rother Abstraction Licensing Strategy (ALS) (Environment Agency, February 2013)	Likely allowable regulated abstractions
	Groundwater quality	EA River Basin Management Plan (2016 cycle 2) information, via the Environment Agency Catchment Data Explorer accessed 24/09/21 at: http://environment.data.gov.uk/catchment-planning/ EA and DEFRA online water quality archive	Likely quality of groundwater that may be impacted by Proposed Development works. Identifying any elements of concern and or contaminants which may be remobilised

3.3 Site Setting

The Proposed Development site is located to the southeast of Abbey Road South (A629) on the eastern fringe of Shepley, Kirklees, West Yorkshire. Land cover maps (UKCEH Aggregated Land Cover Maps 2023) record crop land within the site's footprint, with aerial photography (Google, 2025) showing three large agricultural buildings within the central area of the site. The wider Study Area dominantly comprises grassland or pasture interspersed with cropland, woodland, shrubland and small urban settlements. Historic mining within the wider Study Area has littered the landscape with quarries, mainly to the south of the site, and relics of small-scale coal mining (shafts and pits) throughout.

3.4 Topography and Drainage

The Proposed Development site is situated on the northeast of a shallow valley centred around the Shepley Dike watercourse located approximately 1 km to the north. The Proposed Development site has an elevation ranging from 195 mAOD in the northeast to 220 mAOD within the south (**Figure 3-1**). Regionally, the topography within the Study Area rises to the south forming a steep northeast-southwest orientated escarpment northwest of Haddingley, marking its highest point at Haddingley Hill (346 mAOD). To the north of the Shepley Dike within the Study Area the topography forms gently rolling hills and shallow valleys.

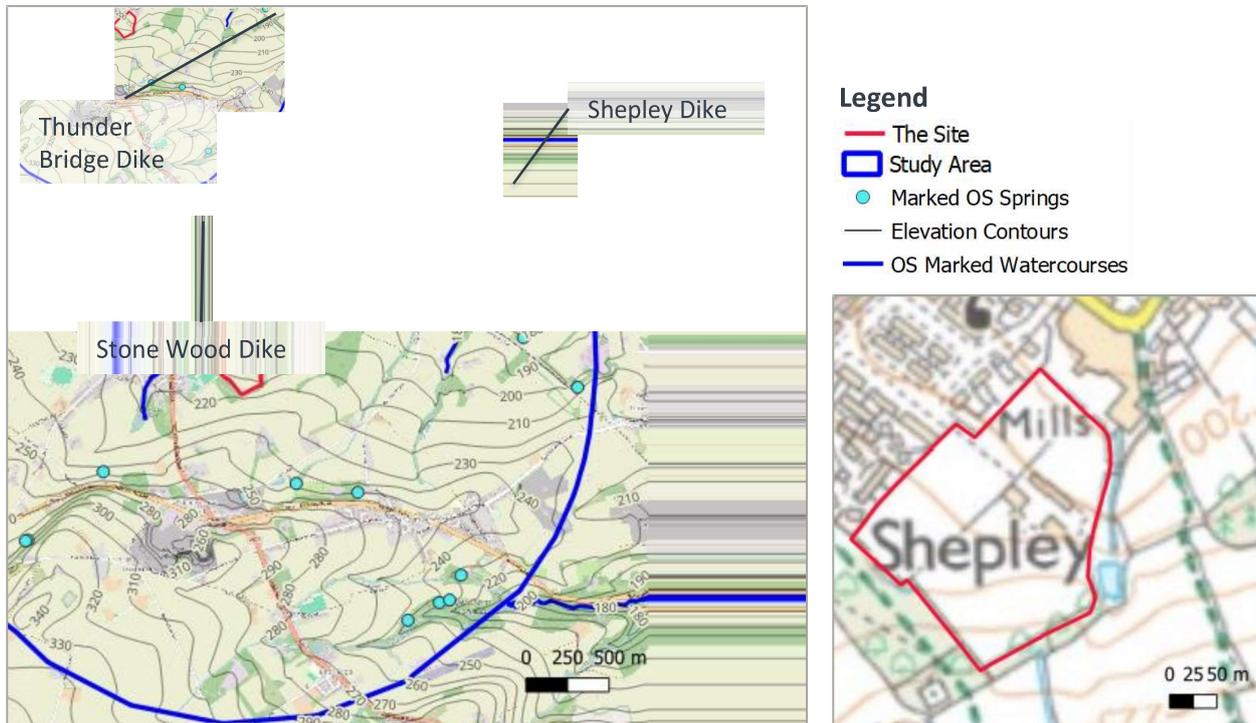
The Shepley Dike flows to the west between the towns of Shepley and Shelley and its tributaries, such as the Stone Wood Dike, flow predominantly from the south and have a distinct southwest to northeast orientation, which is likely to be geologically controlled. In the northern and northwestern parts of the Study Area, the Shepley Dike and Stone Wood Dike are within incised channels, reaching a topographic low of 137 mAOD.

The Environment Agency has evaluated surface water quality in the Study Area as part of the River Basin Management Planning cycle that is undertaken under the EU Water Framework Directive (WFD)¹⁸. There is one WFD surface water body within the Study Area named 'Fenay beck from Source to River Colne' under the Water Body ID: GB104027063340. The waterbody begins at the Shepley Dike near Upper Cumberworth (within the Study Area) and flows northwest through Thunderbridge Dike and then Fenay Beck until its confluence with the River Colne, 9.1 km northwest of the Proposed Development site. The waterbody is classified as heavily modified, and the cycle classification (2022) assessed it as having an overall Moderate status. The reasons for not achieving good status include urbanisation, contaminated land, flood protection and ecological barriers.

In the local area of the Proposed Development site surface drainage flows north from Shepley Carr within field drainage ditches. A drainage route is located to the east of the Proposed Development site which flows north from a reservoir (approximately 460 m²) through woodland towards Shepley Spring (**Figure 3-1**). On OS mapping this watercourse disappears within the Shepley Spring built environment, to reappear approximately 200 m to the north, again as a modified drainage system.

¹⁸ The requirements of various EU Directives such as the Water Framework Directive (WFD) (2000/60/EC) and the Groundwater Daughter Directive (2006/118/EEC) were transposed into domestic legislation by the Environment Regulations 2019. Previously the WFD and now the Environment Regulations 2019 and supporting domestic legislation establish a legal framework for the protection, improvement and sustainable use of surface waters, transitional waters, coastal waters and groundwater resources.

Figure 3-1 Topography and major hydrology of the Study Area (left) and the Site (right)



The Study Area includes 12 marked springs (Ordnance Survey 1:50,000), many of which emerge at the base of the ridge south of the Study Area (**Figure 3-1**). These springs are the source of many small streams which cover the landscape. The springs appear to be associated with topography and geology, since they tend to occur at the base of significant sandstone formations (see **Section 3.7**).

Although no springs are recorded on recent OS mapping within the Proposed Development site, two historic springs (NGR: 419816, 409777 and 419791, 409510) are recorded on Ordnance Survey maps - 25-inch England and Wales, 1841-1952¹⁹ along a field boundary within the north of the site. However, recent aerial photography (Google, 2025) does not imply a change in vegetation or presence of water indicative of an active spring currently within this area.

3.5 Climate

The Meteorological Office website provides the latest set of 30-year rainfall averages, covering the period from 1991 to 2020. The mean annual rainfall for the Midlands region is 809.77 mm. Data from the nearest climate station (Huddersfield Oakes²⁰) to the Proposed Development site is summarised in **Table 3-2**. Given the close proximity and similar elevation, the local annual rainfall at the site is likely similar to that recorded at the Huddersfield Oakes climate station.

¹⁹ <https://maps.nls.uk/geo/explore/side-by-side/#zoom=16.6&lat=53.58593&lon=-1.70393&layers=168&right=ESRIWorld>

²⁰ <https://www.metoffice.gov.uk/research/climate/maps-and-data/location-specific-long-term-averages/gcw9nrs5j>

Table 3-2 Annual climate information for regional climate stations

Climate Station	Location (NGR)	Distance from Study Area (km)	Altitude (mAOD)	Annual Mean Rainfall (mm)	Annual Days of Rainfall \geq 1mm
Hudderson Oaks	411335,4 17069	Approximately 9.1 km northwest	196	1041	154

Note: Annual mean rainfall taken between 1991 – 2020, Annual rainfall data from 1981 to 2010 \geq 1mm taken for the period 1981-2010.

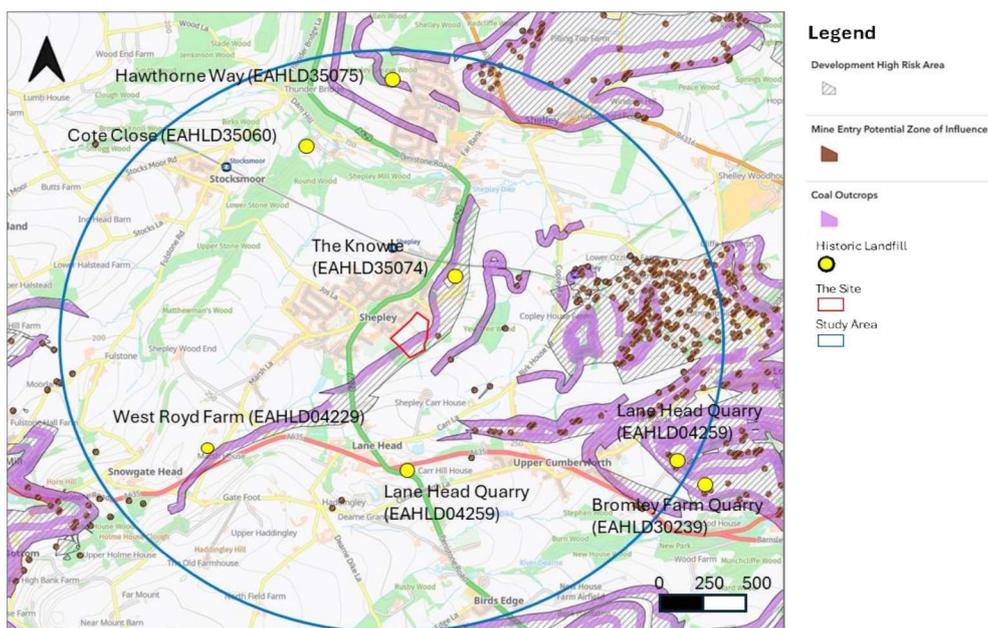
3.6 Historical Landuse and Mining

Mining in the Shepley area was generally of a small scale (Geological Survey of Great Britain, 1933). While coal measures extend across the Proposed Development site and Study Area, these are thin and often of poor quality and coal-related workings were limited to shallow day-holes or small pits supplying local domestic fuel (Waters, Chisholm, Hough, & Evans, 2012).

The Mining Remediation Authority web viewer shows the extent of the development high-risk area at the Proposed Development site which is coincident with probable coal mine workings (**Figure 3-2**). The high-risk area encompasses the southeastern portion of the site and extends from a coal seam outcrop (named the Crow Coal), which runs in a southwest to northeast orientation across the Proposed Development site. Potential entry mine zones of influence are also identified and shown in **Figure 3-2**. However, the web viewer and the Consultants Coal Mining Report, obtained from the Mining Remediation Authority (**Appendix A**), do not identify any mine features within the site itself.

The nearest mine feature is a shaft (NGR 419913, 409671) at Healey House Pit, located 0.1 km east of the Proposed Development site, and a second shaft (NGR 420002, 409502) 0.2 km southeast of the site, both being associated with coal mining. Details on the depth and lateral connectivity of these shafts are not well understood in the literature; the absence of depressions or mining architecture in recent aerial photography (Google, 2025) suggests these shafts are likely collapsed and/ or infilled.

Figure 3-2 Coal mine workings development high risk areas



In contrast to the minor coal workings described above, the Pennistone Flags, Greenmoor Rock and Grenoside Sandstone (see Section 3.7) were extensively worked locally for crushed rock aggregate, building stone, block stone, and dimension stone²¹ (Cameron, et al., 2008). These quarries are predominantly located in the south of the Study Area, with the most prominent (and actively worked) quarries featuring Sovereign (NGR 419730, 408870), Carr Hill (NGR 419815, 408740) and Appleton (NGR: 419465, 408510) quarries located 0.6, 0.8, and 1.3 km south of the Proposed Development site, respectively.

Historic maps from OS Six Inch (1888-1915) and OS 1:2,500 (1948-1974), viewed via the National Library of Scotland's Side by Side Map viewer, indicate that land use at the Proposed Development site has largely remained unchanged; with the site continually being used as farmed fields until the construction of recent agricultural buildings. The reservoir on the southeast border and much of the nearby woodland have been documented since 1888. Historical maps also record a woollen mill at the Proposed Development site's northern border, presumably the original use of the Shepley Spring site buildings.

The Environment Agency record six historic landfills within the Study Area (**Figure 3-2**), which range in use from construction/ excavation waste to domestic waste; none of these landfills are located within SPZs. The nearest historic landfill (EAHLD35074) is located 0.4 km northeast of the Proposed Development site. Additionally, there is potentially infilled land associated with the ponds and reservoirs in the vicinity of the site and also at the historical woollen mill to the north of the site.

3.7 Geology

The geological mapping of the area (Map Sheet 86 Glossop: BGS, 1981) is presented in **Figure 3-3**. The Proposed Development site does not have superficial deposits and is underlain by the Pennine Lower Coal Measures Formation²². The BGS describes the formation as interbedded grey mudstone, siltstone, and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part with more numerous and thicker coal seams occurring in the upper part. Within the Proposed Development site boundary, the formation is subdivided into the Grenoside Sandstone, which outcrops within the northwestern half of the site, whilst the south-western side of the site features interbedded mudstones, siltstones and sandstones. A coal seam (the Crow Coal) forms a thin outcrop trending in a southwest to northeast orientation through the centre of the Proposed Development site and forms the boundary between the two subdivided units described above. Another thinner unit of "hard flaggy" sandstone (Penistone Flags) is mapped on the southeastern margin of the site. A geological sequence illustrating the relationship between these subdivisions is presented in **Figure 3-3**.

BGS historic boreholes SE10NE21, SE10NE1 and SE10NE20 (**Appendix B**) (**Figure 3-3**), associated with Shepley Spring, located just beyond the northern boundary of the Proposed Development site were drilled up to 93 m depth. The borehole logs record sandstones and rhythmic sequences of grey/ brown sandstones and mudstones with rare seams of coal. A 13 to 28 thick layer of "Black Shale" is laterally continuous across these boreholes and observed within all at an elevation between 160 and 180 mAOD.

Grenoside Sandstone is described as thickly bedded, rough, gritty sandstone which contrast to the fine-grained thinly bedded sandstones of the Penistone Flags above (Geological Survey of Great Britain, 1933). The BGS²³ suggests that the subdivision occurs as two units of interbedded sandstone and laminated grey mudstone. Water boring at Victoria Mills (Shepley Spring), north of

²¹ Block Stone is a large, quarried piece of natural stone extracted in solid blocks before being cut, shaped, or dressed into usable forms, known as Dimension Stone.

²² <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=PLCM> – Accessed 19/09/2025

²³ <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=GR> – Accessed 19/09/2025

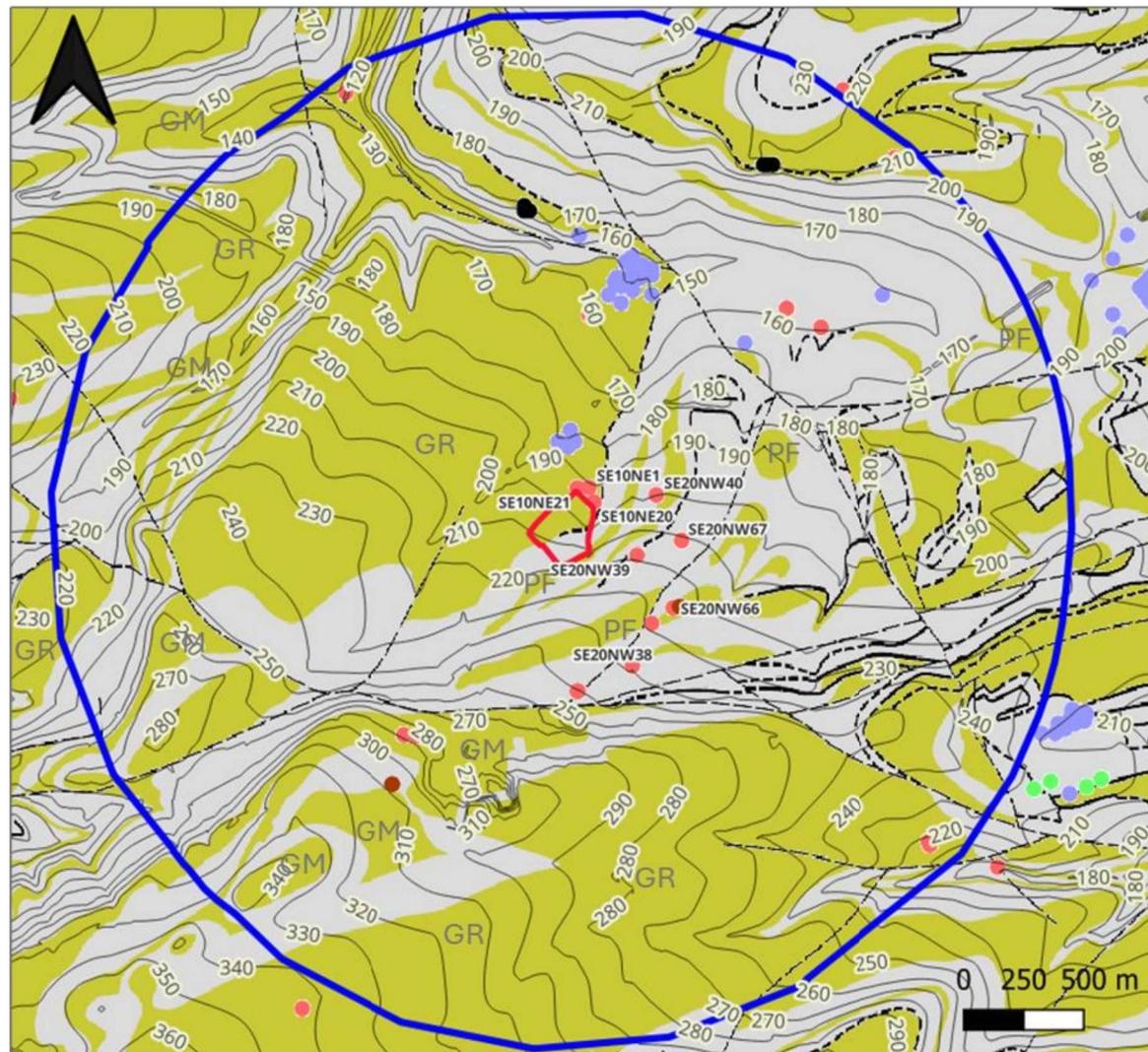
the Site, found Grenoside Sandstone to be 11.58 m thick (Geological Survey of Great Britain, 1933).

Greenmoor Rock²⁴ is described by the BGS as fine-grained thinly bedded, ripple cross-laminated sandstone. Within this area it usually occurs as groups of thin sandstone and siltstone beds interbedded with greenish grey mudstone. The unit outcrops approximately 1.3 km northwest of the Proposed Development site along the path of Stone Wood Dike and also approximately 0.6 km to the south of the site where it has been uplifted along the southern edge of an east to west trending fault. BGS historical borehole logs for boreholes which border the Proposed Development site (SE10NE21, SE10NE1 and SE10NE20) encounter Greenmoor Rock between 33.53 and 29.80 mbgl or 162.4 and 171.2 mAOD, respectively.

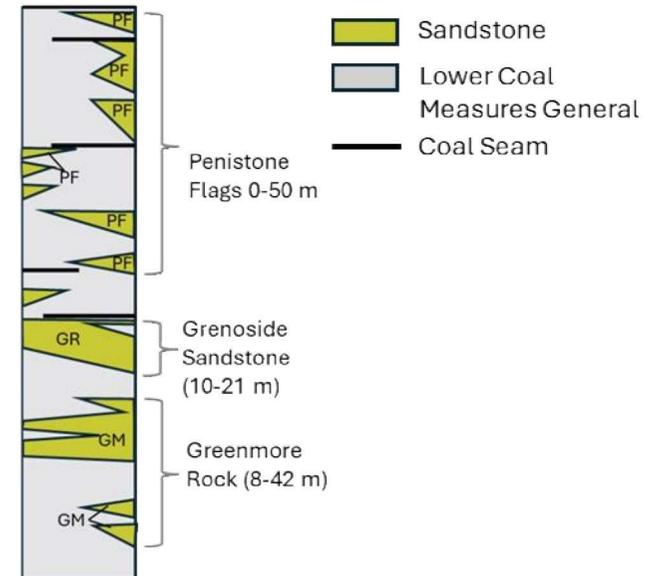
The bedrock at the Proposed Development site is believed to dip shallowly to the southeast by less than 10 degrees, and no faulting is recorded. Regionally, the faulting within the Study Area is complex with the Proposed Development area located within a downthrown block between two major unnamed normal faults (**Figure 3-3**). These major faults are oriented northwest to southeast and east northeast to west southwest and form a wedge shape which narrows to the east. Several minor normal faults, mostly trending northeast to southwest, branch off from these major faults, including one approximately 0.3 km from the site that influences the course of the upper reaches of the Shepley Dike.

²⁴ <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=GM> – Accessed 18/08/2025

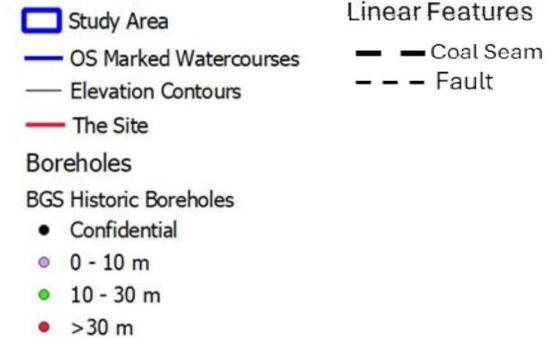
Figure 3-3 Solid Geology



Geological Sequence



Legend



3.8 Hydrogeology

The Pennine Lower Coal Measures are designated a Secondary A aquifer by the Environment Agency. The designation is attributed to permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases, form an important source of base flow to rivers. Larger sandstone units, such as the Grenoside Sandstone and Greenmoor Rock, can supply local water resources.

The Hydrogeological Map of Southern Yorkshire²⁵ and adjoining areas characterises the Pennine Lower Coal Measures as consisting of complex cyclic successions of mudstones, siltstones, seatearths²⁶ and coals. Many of the cycles are incomplete and there is great variation both laterally and vertically in the occurrence and thickness of beds. As a result of folding and faulting, individual beds are commonly discontinuous and restricted in outcrop.

In the area east of the Pennines (where the Proposed Development site is located) the Pennine Lower Coal Measure sandstones are generally fine-grained, very well cemented, extremely hard and dense and as a result possess very little primary porosity or intergranular permeability (Jones, et al., 2000). Groundwater storage and movement occurs predominantly within and through fractures in the sandstones. Under natural conditions, the sandstones act as individual aquifers separated by the intervening low permeability argillaceous horizons and constitute a complex multi-layered aquifer (Jones, et al., 2000). The BGS suggests that the shales and coal seams within the Pennine Lower Coal Measures have low to very low permeability and act as barriers to groundwater flow. Spring lines occur where perched water encounters lower permeability strata, and the topography allows flows and/ or water table to come to the surface. However, it should be noted that shales can have micro-fractures which can enhance permeability, particularly across thin units of strata.

Regionally mine water drainage plays an important role in groundwater pathways, and their voids (shafts and levels) can artificially increase aquifer transmissivity and connectivity. However, mining local to the Proposed Development site was limited to small-scale shallow operations (as outlined in **Section 3.6**) and therefore their effect on aquifer properties is likely to be limited.

Although jointing is frequently present in sandstone horizons, their interconnection is often poor, and sandstones at depth can be dry despite the presence of joints (Holliday, 1986). Rae (Rae, 1978) considered that they were generally unlikely to yield significant amounts of water at depths of more than 200 m due to this effect. The reduction in permeability is compounded by decreases in primary porosity and intergranular permeability with depth, due to increased cementation, an increased weight of overburden and compaction (Grey, Allender, & Lovelock, 1969).

3.9 Recharge

The recharge of the Pennine Lower Coal Measures is influenced by surface infiltration in areas where the formation is exposed or lies close to the surface and rainfall can percolate downward, although this is often slow and inefficient. Recharge rates are therefore generally low, reflecting the poor aquifer properties of the formation. Sandstone outcrop areas are generally small, limiting the amount of recharge which can infiltrate to individual sandstone units. Extensive faulting has frequently split previously continuous sandstone horizons into disconnected isolated fault-bounded blocks, to which no direct recharge can occur. Initially high yields frequently decline substantially due to the depletion of aquifer storage by abstraction.

²⁵ <https://largeimages.bgs.ac.uk/iip/hydromaps.html?id=southern-yorkshire.jp2>

²⁶ A term for a bed of rock underlying a coal seam. It represents the soil that supported the vegetation from which the coal was formed.

The Grenoside Sandstone is a fine-grained, thinly bedded, cross-laminated, micaceous and carbonaceous sandstone suggesting a moderate permeability, especially where the sandstone is well-jointed or fractured and therefore moderate recharge rates can exist. Recharge is more effective in unweathered, exposed outcrops and fractured zones, allowing direct rainfall to infiltrate the surface. Recharge is limited by overlying low-permeability layers, such as mudstones or coal seams. However, the sandstone's carbonaceous content may reduce porosity and water movement in some zones.

The Greenmoor Rock is a fine- to medium-grained sandstone and has moderate porosity but low permeability, especially when cemented with clay or iron oxides. This limits its ability to transmit water freely and recharge rates are likely to be low, depending on overlying soil and vegetation, fracture density (recharge may occur preferentially through fractures), rainfall and surface water availability. Recharge into the aquifer may also be via lateral flow from adjacent permeable formations and/ or leakage from overlying or underlying strata.

The Pennine Lower Coal Measures sandstones typically receive recharge ranging from 10–50 mm/year in areas with low permeability cover, up to 150 mm/year in exposed or fractured zones.

Aquifer Properties

Quantitative aquifer property data is rare for boreholes targeting the Pennine Lower Coal Measures and sandstone units identified in the vicinity of the Proposed Development site. A single site in the east Pennines completed 57 tests within the Lower Coal Measures; the tests found a porosity ranging from 8 to 13 % and a hydraulic conductivity of 3.8×10^{-6} to 3×10^{-1} m/s or 0.33 to 81.22 m/d (Jones, et al., 2000).

Historical borehole data shows the nearest available pumping test at borehole SE10NE1 (**Appendix B**), 50 m northeast of the Proposed Development site, which targeted the Greenmoor Rock aquifer. During the 3-day test, the borehole extracted 1.36 m³/hour, or 32.7 m³/day, resulting in a 9.1 m drawdown in water level at the borehole. However, since the pump was operated at full capacity during the test the potential yields may be higher.

The Study Area is located within the Aire & Calder Carb Limestone/ Millstone Grit/ Coal Measures Groundwater Body (GB40402G700400) which is part of the Humber Groundwater Management Catchment. This groundwater body covers an 1896 km² area and is assessed as having a Poor Overall Status (2019 Cyle 3), achieving Poor Overall Chemical and Good Quantity status. The reasons for not achieving Good status are attributed to mining and quarrying. The Environment Agency note that there are WFD mitigations for coal mine discharges into the Shepley Dike (although they do not indicate where the input is into the watercourse) and the requirement for more investigation and feasibility for a potential treatment scheme.

Groundwater levels

Groundwater levels in the Study Area are influenced by rhythmic sequences of permeable sandstones confined by low permeability mudstones or shales. This leads to multiple groundwater levels or perched horizons within the Pennine Lower Coal Measures. Faulting can also exert a strong control on groundwater movement, locally enhancing permeability along fracture zones while compartmentalising aquifers where faults act as barriers. As a result, groundwater levels can vary significantly over short distances. Although jointing is frequently present in sandstone horizons, their interconnection is often poor, and sandstones at depth can be dry despite the presence of joints (Holliday, 1986).

No long-term or continuous groundwater Environment Agency monitoring is available within the Study Area. There are six historic BGS boreholes located within the Proposed Development site's respective fault block (**Figure 3-3**) and the borehole design and water level measurements from these locations are summarised in **Table 3-3**. These boreholes range from 73 and 140 m depth,

with an open hole construction covering most of their length (typically from 18 m) within the Lower Pennine Coal Measures and Greenmoor Rock.

Table 3-3 Groundwater Level Measurements from local BGS Historic Boreholes

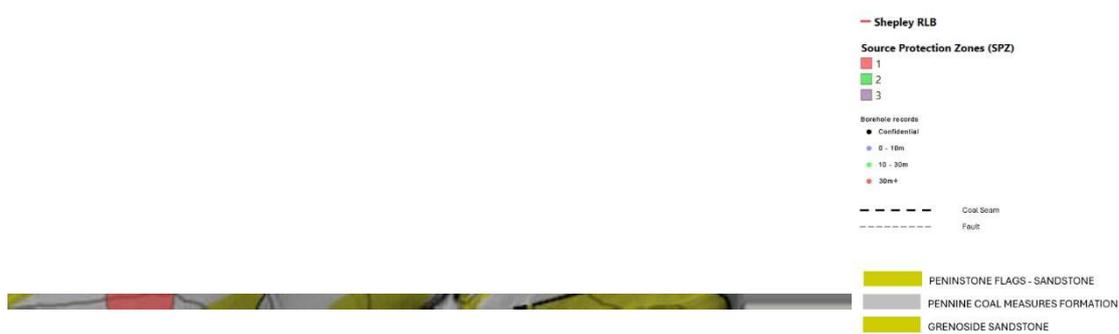
ID	NGR	Ground Elevation (mAOD)	Completion Date	Depth	Water Strike* mbgl (mAOD)	RWL mbgl (mAOD)	Response Zone Interval	Comment
SE10NE21	419769, 409830	193.00	Jan 2000	83.0	46 (147.0) 71 (122.0)	37 (156.0)	18.50 – 83.00	For Eastfield Mills
SE10NE1	419820, 409831	191.0	Dec 1937	92.7	85.34 (105.66)	28.0 (162.96)	4.55 – 92.65	Victoria Mills (historic textiles factory)
SE10NE20	419840, 409770	193.0	Jan 2000	72.5	50 (143) 62 (131) 36 (157)	36 (157.00)	18 – 72.5	For Eastfield Springs
SE20NW40	420100, 409800	201.0	Nov 2004	120.0	69 (132)	65 (136.0)	19 – 120.00	Shepley Spring observation well
SE20NW39	420020, 409550	219.0	Dec 2002	140.0	120 (99) - 130 (89)	95.83 (123.2)	18 - 130	Shepley Spring
SE20NW67	420204, 409611	211.0	Jun 2019	90.5	10 (201)	N/A	N/A	Penmore UK borehole (Shepley Springs). Backfilled

Note: RWL = Rest Water Level

*The groundwater strikes recorded during the drilling of the boreholes indicate that perched groundwater is also likely to be encountered within strata such as sandstone units at depth.

The above groundwater level measurements range from 36 to 95 mbgl. Groundwater elevations are shown within **Figure 3-4** and vary from 123.2 to 163.0 mAOD and generally decrease towards the east. However, it should be noted that the boreholes listed were drilled between 1937 and 2019 and therefore may not provide a reliable indicator of current groundwater levels and groundwater flow direction. Recorded groundwater strikes suggest that the Penistone Flags and Grenoside Sandstone are dry in areas with borehole records, except for SE20NW67, located 0.4 km east of the Proposed Development site, which intercepted a perched sandstone aquifer at 10 mbgl (201 mAOD). Groundwater strikes within Greenmoor Rock were recorded between 46 and 130 mbgl, or 89 to 157 mAOD across the boreholes listed in **Table 3-3**.

Figure 3-4 Recorded Rest Water Levels in mAOD



Groundwater levels within the Greenmoor Rock at the Proposed Development site are likely influenced by abstractions at the Shepley Springs plant on the northern edge of the site. However, no monitoring is currently available in this area to confirm drawdown and extent of the groundwater depression associated with pumping at the facility.

The SFRA shows the Environment Agency’s national dataset, Areas Susceptible to Groundwater Flooding (AS_TGWF), which provides a dataset to assess the future risk of groundwater flooding. The Proposed Development site lies within a 1km grid square where geological and hydrogeological conditions indicate a <25% risk of groundwater emergence as shown within Figure 3-5 of Calder Catchment Strategic Flood Risk Assessment²⁷ (JBL Consulting, 2016).

Groundwater Quality

A detailed description of the groundwater quality of the Pennine Coal Measures aquifer of South Yorkshire is given within BGS *Baseline groundwater chemistry: the Pennine Coal Measures of the East Midlands and South Yorkshire* report²⁸. The groundwater chemistry within the Pennine Coal Measures aquifer is predominantly controlled by aquifer water-rock interactions and the impact of

²⁷ <https://www.kirklees.gov.uk/beta/planning-policy/pdf/flood-risk/strategic-flood-risk-assessment-2.pdf>

²⁸ BGS (2021). *Baseline groundwater chemistry: the Pennine Coal Measures of the East Midlands and South Yorkshire*, Environmental Change and Resilience Programme Open, Report OR/21/023

historical coal-mining activities, although relationships are complex (BGS, 2021). The aquifer is recharged by rainfall, providing inputs of solutes including Na, Cl and NO₃ into the aquifer.

Reaction with carbonates (calcite, siderite), clays and sulphides form the dominant sources for Ca, Mg, Na, Fe, SO₄ and HCO₃ within the groundwater chemistry. Groundwater has a neutral pH and groundwaters are typically moderately to highly reducing, controlled by redox reactions including denitrification and nitrate reduction and reductive dissolution of Fe and Mn oxides. These reactions lead to typically low concentrations of NO₃, high concentrations of NH₄, Fe and Mn and slightly elevated concentrations of NO₂.

No groundwater quality data is currently available from beneath the Proposed Development site. The BGS borehole SE20NW38 (**Appendix B**) (NGR 420000, 409090) located just north of the Carr Lane, approximately 480 m southwest of the Proposed Development site is the only BGS borehole log with water quality data attached. From the geological log for this borehole the groundwater chemistry appears to be of a Ca-Mg-HCO₃ type, although this borehole is only 40 metres in depth and the sample was turbid with elevated iron and manganese and may have been taken shortly after drilling in 2002. However, the groundwater quality displayed seems to be broadly typical of the Pennine Coal Measures aquifer and it is noticeable that no detects for herbicides/ pesticides were detected.

Groundwater vulnerability mapping from the Defra MAGIC website shows that the groundwater within the Study Area is of a high to medium vulnerability. It is assumed that this is for shallow groundwater and due to the lack of superficial deposits within the area. Deeper groundwater is likely to be much better protected due to the existence of low permeability strata to reduce vertical migration. There is no direct evidence in the area of the Proposed Development site of anthropogenic pollution related with surface inputs and/ or mobilisation of the reaction products occurring in rising groundwaters associated with groundwater rebound following cessation of historical mining activities.

3.10 Groundwater Resources/ Abstractions

Water Abstraction licences

The Environment Agency license all groundwater and surface water abstractions that take more than 20 m³/d. Details of licensed abstractions within 5 km of the Proposed Development site were acquired through a freedom of information environmental data request (Ref: EIR2025_21325) to the Environment Agency.

The Environment Agency identified two active abstraction licences within the Study Area, which are summarised in **Table 3-4** and mapped in **Figure 3-5**. The first licence (2/27/11/030) relates to four groundwater abstractions²⁹ operated by Penmoor UK Ltd for the Shepley Springs bottling plant. Abstractions from Borehole A and C are located at the main Eastfield Mills site within Shepley, just to the north of the Proposed Development site. Two of these abstractions are located just beyond the northern border of the Proposed Development site, whilst the remaining two abstractions are 0.4 km (Borehole D) and 0.5 km (Borehole B) southeast of the site. A detailed review of the available data for the boreholes which supply Shepley Springs is provided in the preceding section.

²⁹ The licence holder can abstract water from multiple points, provided the combined volume does not exceed the set limits. Licence 2/27/11/030 is a groundwater licence and all points draw from the same aquifer. As a result, the licence does not specify separate volumes for each point, compliance is assessed against the cumulative abstraction volume from all four points against the maximum permitted rates.

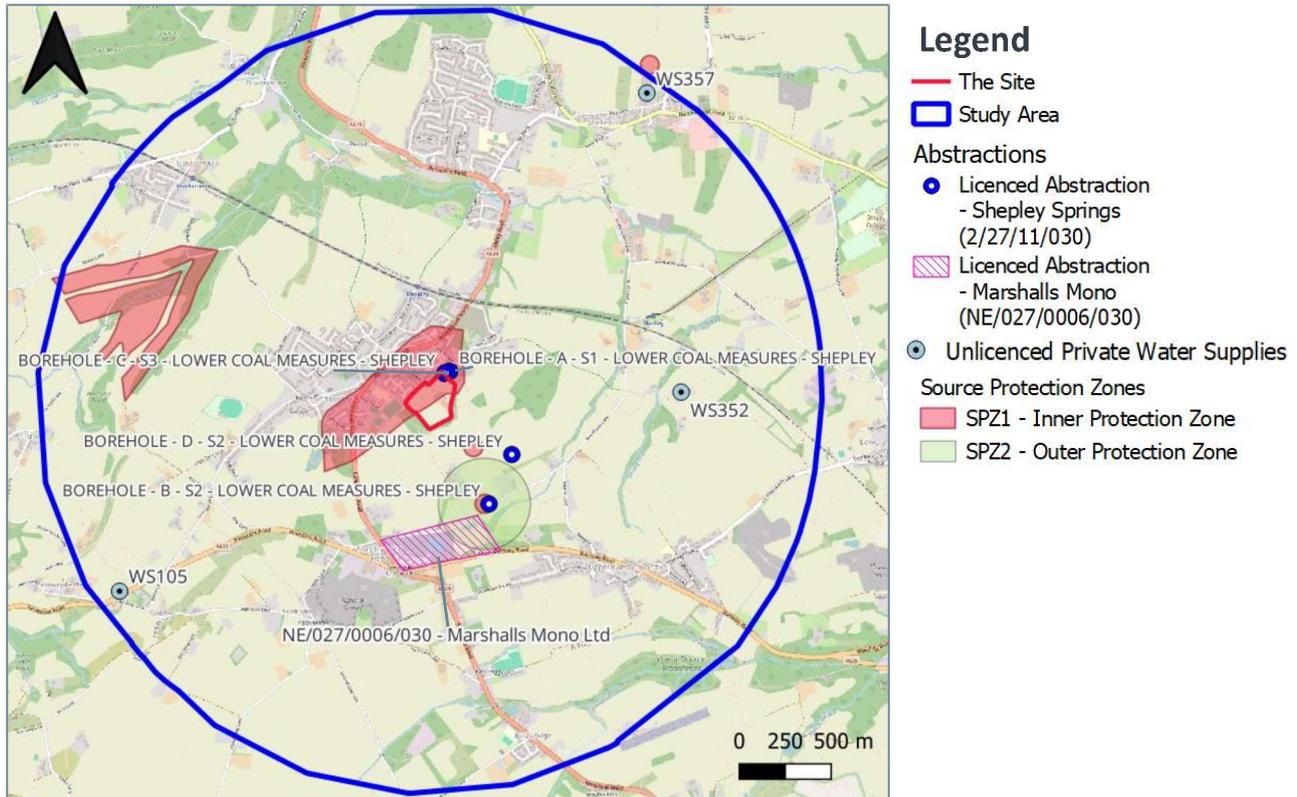
A second licence (NE/027/0006/030) is active for an 11-hectare area, which is located 0.5 km south of the Proposed Development site and is a groundwater abstraction, primarily used to dewater a quarry operated by Marshalls Mono Ltd.

Table 3-4 Licensed abstractions located within the Study Area

Abstraction licence number	Licence holder name	Address	Shepley Point Name	Use	Source of supply description	Easting	Northing	Max Daily Quantity (m ³)	Max Annual Quantity (m ³)	Max Pump Rate (l/s)
NE/027/0006/030	Marshalls Mono Ltd	Landscape House, Premier Way, Lowfields Business Park, Halifax HX5 9HT	Sovereign Quarry, Upper Cumberworth, Huddersfield	Dewatering	Groundwater	*Abstraction area: 1) 419436 2) 419961 3) 420090 4) 419560	*Abstraction area: 1) 408891 2) 409026 3) 408834 4) 408723	N/A	N/A	40
2/27/11/030	Penmoor UK Ltd	Eastfield Mills, The Knowle, Shepley HD8 8EA	Borehole - A - S1 - Lower Coal Measures - Shepley	Water Bottling	Groundwater	419810	409816	263	96000	N/A
			Borehole - B - S2 - Lower Coal Measures - Shepley			420026	409089			
			Borehole - C - S3 - Lower Coal Measures - Shepley			419782	409806			
			Borehole - D - S2 - Lower Coal Measures - Shepley			420150	409360			

Table notes: * Coordinates quoted represent four corners of the defined licence area rather than individual points.

Figure 3-5 Groundwater abstractions



Shepley Springs Water supply

Overview

Shepley Springs Ltd is a local water bottling business with its main premises located adjacent to the northern boundary of the Proposed Development site. In the absence of available detailed hydrogeological information having been supplied by Shepley Spring on these abstractions this section relies upon historical borehole logs from the BGS, and information supplied by the Environment Agency.

Abstraction Boreholes

As outlined in the above section, the bottling plant appears to be fed by four licenced wells (**Figure 3-5**) under the licence number 2/27/11/030. The BGS report boreholes (**Appendix B**) drilled for and presumably owned by Shepley Springs are located near these licenced point locations. A summary of these boreholes and their possible association with licenced locations is summarised in **Table 3-5**. It should be noted that the naming and exact location of BGS boreholes do not correspond to the licenced locations reported by the Environment Agency. Therefore, these boreholes should be considered as indicative of likely hydrogeological conditions and construction details, which may be similar to those of the licenced production wells.

Table 3-5 Shepley Springs BGS Borehole Summary

ID	Possible Association with Licence	NGR	Ground Elevation (mAOD)	Completion Date	Depth	Strike mbgl (mAOD)	RWL mbgl (mAOD)	Response Zone Interval	Target Aquifer	Comment
SE10NE21	Borehole A or C (located 26 m and 46 m away respectively)	419769, 409830	193	Jan 2000	83.0	46 (147.0) 71 (122.0)	37 (156.0)	18.50 – 83.00	Greenmoor Rock and Pennine Lower Coal Measures Formation	For Eastfield Mills.
SE10NE20	Borehole A or C (located 54 m and 68 m away respectively)	419840, 409770	193	Jan 2000	72.5	50 (143) 62 (131) 36 (157)	36 (157.00)	18 – 72.5	Greenmoor Rock and Pennine Lower Coal Measures Formation	For Eastfield Springs.
SE20NW66	Borehole D (located 35 m away)	420169, 409331	224	June 2019	129.5	89.5 (132.5)	78.4 (145.6)	19.50-129.50	Greenmoor Rock and Pennine Lower Coal Measures Formation	Shepley Springs No.12.
SE20NW38	Borehole B (located 26 m away)	420000, 409090	239	November 2002	40.0	3.5 (235.5) 5.9 (233.1) 8.8 (230.2) 20.8 (218.2) 22.00 (217)	12.00 (227)	18.00-40.00	Penistone Flags. Located at the boundary of a fault.	Shepley Springs No.4.

The above table suggests that abstractions at Shepley Springs primarily target the Greenmoor Rock aquifer or Penistone Flags. A summary of each BGS borehole possibly associated with the Shepley Springs is provided as follows:

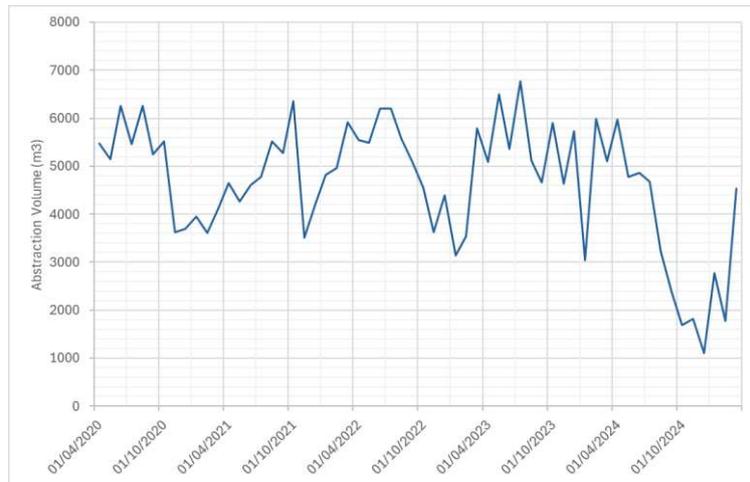
- Boreholes SE10NE20 and SE10NE21 likely target the Greenmoor Rock, which are confined by a 12.8 m thick layer called the Black Shale on BGS geological logs. Any abstractions within the area of these boreholes are protected by an SPZ1³⁰, which covers the northwestern half of the Proposed Development site and extends into the village of Shepley (**Figure 3-5**). Another SPZ1 is located 1.4 km northwest of these boreholes where it is aligned with the Greenmoor Rock outcrops. The outcrop serves as a potential recharge zone for these licenced wells, but it is uncertain whether the SPZs in this area pertain to the Shepley Spring abstractions;
- Borehole SE20NW66 with a response zone is between 19.50 and 129.50 m and drilled into the Penistone Flags Sandstone of the Pennine Lower Coal Measures and also likely to be deep enough to reach the Grenoside Sandstone³¹ and Greenmoor Rock strata at depth. The abstraction is not located within an SPZ although an unrelated circular SPZ1 (50 m buffer) appears to be located approximately 250 m to the northwest of the borehole. This SPZ is situated approximately 150 m southeast of the Proposed Development site. According to BGS or Environment Agency records, there are no boreholes and/ or abstractions within this area, although aerial photographs show a small building at the centre (NGR: 419948, 409405) of the SPZ, which could suggest the presence of an unmapped abstraction; and
- Borehole SE20NW38 is located near the boundary of a northeast to southwest trending fault. The abstraction likely targets shallower strata between 18 and 40 m likely within the Penistone Flags Sandstone of the Pennine Lower Coal Measures. This borehole is not deep enough in this area to reach the Grenoside Sandstone and Greenmoor Rock or strata. A perfectly circular SPZ within the vicinity of this borehole consists of a SPZ1 (50 m buffer) and a SPZ2 which extends to a maximum radius 250 m from the abstraction.

Under the Shepley Spring abstraction licence, their wells are permitted to abstract a combined 263 m³/d or 96000 m³/yr. The Environment Agency have provided nearly 5 years of monthly abstraction volumes between 01/04/2020 and 01/03/2025 (**Figure 3-6**). During this period, monthly abstraction volumes range from 1,108 to 6,764 m³, with an average of 4,664 m³. The data indicate that abstraction volumes fluctuate throughout the year, typically decreasing during the winter months (November to January) and increasing during spring and summer (February to September).

³⁰ This SPZ has no associated SPZ2 or SZP3 and the reason for the lack of outer SPZ and total SPZ catchment is unclear.

³¹ Although Grenoside Sandstone at the surface and in the shallow subsurface at the Proposed Development site it is significantly faulted downwards in the vicinity of this borehole (see Section 1 -Figure 4-3)

Figure 3-6 Groundwater abstraction volumes from Shepley Springs (2/27/11/030) between 2020 and 2024



Note: Source: Environment Agency freedom of information data request.

3.11 Private Water Supplies

Under the Private Water Supplies Regulations, local authorities are required to maintain a register of private water supplies used for potable supply where the volume is below the licensing threshold of 20 m³/d. Although the Environment Agency do not hold records for supplies less than 20 m³/d, the Local Authority have an obligation to record this data. A freedom of information environmental data request was made to Kirklees Council to request data on surface and groundwater PWSs within the Study Area.

Kirklees Council report two active (WS352 and WS357) and one historic (WS105) groundwater abstractions within the Study Area, located between 1.3 km and 1.9 km from the Site. No information is available from the BGS or local authorities to confirm borehole design, target aquifer and abstraction volumes. A summary of these abstractions is provided in **Figure 3-6**.

Table 3-6 Private groundwater abstractions within the Study Area

Abstraction Reference	Use	Status	Distance from Site
WS105	Not specified	Historic ³²	1.9 km southwest
WS352	Domestic and potable	Presumed active	1.3 km east
WS357	Domestic and potable	Presumed active	1.9 km northeast

Sixteen wells are also mapped (1:25,000) by the Ordnance Survey within the study area and are located between 0.5 and 1.9 km from the site. These wells are generally situated at the base of the southern ridge, ranging from 320 mAOD to 250 mAOD. Many of these wells are likely associated with faulting and prominent springs.

³² The freedom of information states that this source is now “capped now on Yorkshire Water”.

4. Conceptual Hydrogeological Site Model

4.1 Project Description / Proposed Works

The project is to develop the land for residential end use consisting of up to 110 residential dwellings up to 2.5 storey in height. As part of the outline application to set the principle of development the current illustrative masterplan (Figure 4-1) is indicative at this time.

Figure 4-1 Current Illustrative Masterplan



The surface water drainage features are shown indicatively on the masterplan. Flows will be captured and conveyed by a gravity drainage system, attenuated on site in a below ground sealed tank to the north, up to 2.5m total excavation depth, and discharged to the watercourse to the east of the site. No infiltration of surface water to the ground is proposed. An existing surface water culvert which follows the hedge line down the centre of the site from south to north will be opened up into an open swale running down the east of the existing hedge and discharging to the watercourse.

The dwellings will be of brick/ stone construction, with roof coverings of a locally sourced material, and will be founded on traditional strip footings up to 1.5 m in depth. The development will also include the infrastructure required to support the development. This will include roads lit by streetlighting, drainage with pipes laid up to 2.5m in depth, an attenuation tank up to 2.5m in depth,

utilities laid up to 1.5m in depth, and a foul water pumping station with a wet well of approximately 4m depth. No excavations will be greater than 5 meters in depth during construction works. Areas of public open space on the site will be landscaped, with footpaths connecting between the areas of open space and the infrastructure. Private gardens will be fenced to the rear and turfed, whilst private driveways will be of a block construction. The site will be accessed off Eastfield.

4.2 Potential Sources of Impact

There is the potential for spillage or leakage of fuels, lubricants or other chemicals during construction of the development and during the movement of construction vehicles and plant. Deeper excavation works pose the greatest risk to receptors given that they involve the removal and exposure of material to greater depths and into bedrock. In general, groundwater abstractions are known to be at risk from potentially polluting activities (including agriculture pathogenic microorganisms, such as coliform and cryptosporidium), transport infrastructure and industry within their catchments. Care should be taken therefore during works not to mobilise contaminants in areas such as these, i.e., within land drains, historical reservoir sediment infills, sewer system, soakaways etc. It is known that some abstractions can also be prone to elevated natural turbidity if the groundwater source is shallow and aquifers have fractures connecting to the surface.

During operation, i.e. after construction, the following factors can become a risk to groundwater quality in urban areas if not suitably managed:

- Hydrocarbons, e.g. from road run-off and leaks and spills;
- Use of salt for de-icing roads and associated road runoff;
- Sewerage, e.g. leaking sewers;
- Domestic use of pesticides/ herbicides in gardens;
- Construction activity increasing turbidity; and
- Disturbance of the historical landfill/ infill material during construction; and water level changes within the landfill/ infill area.

4.3 Potential Pathways

The Pennine Lower Coal Measures are generally of low permeability, especially the mudstones and coals, which restricts water movement. Recharge rates are therefore generally low, reflecting the poor aquifer properties of the formation. However, recharge into sandstone units, such as the Grenoside Sandstone, through thin, absent or permeable superficial deposits is possible. Recharge therefore tends to be limited and localised, occurring primarily through fractures and faults and sandstone layers and mining-induced pathways.

Mine works can act as permeable rapid transport pathways through adits and/ or shafts and have the potential to contain contaminated groundwater from deep mine sources. Coal seams that are not mined can be permeable, but their permeability is highly variable and depends on several geological and structural factors.

The Greenmoor Rock is a fine to medium-grained quartz-rich sandstone, which tends to have moderate porosity and permeability, especially where the sandstone is well-jointed or fractured, and this allows for some infiltration of rainfall, especially where the rock is exposed or overlain by permeable soils. Beneath the Proposed Development site, the Greenmoor Rock is located below a Black Shale which is likely to be of low to very low permeability with only slow leakage into the deeper sandstone aquifer. The confined Greenmoor Rock aquifer may source groundwater through groundwater flow from a distant recharge area. Groundwater flow patterns will be

controlled by piezometric vertical head differences, i.e. flows from areas with higher hydraulic heads.

4.4 Potential Receptors

The Proposed Development overlays a significant proportion of the SPZ1 for Shepley Spring's abstraction, a valuable drinking water abstraction which requires protection. Development of the site to an urban area must therefore be managed to ensure there is no additional risk of significant pollution.

The list of potential groundwater receptors associated with the Study Area are given in **Table 4-1**.

Table 4-1 Groundwater Receptor List

Receptor	Rationale
R1: Shepley Spring abstraction boreholes (Boreholes A and C)	Important private large groundwater abstraction supply (and associated catchment/ SPZ).
R2: Secondary Aquifer - Pennine Lower Coal Measures	Underlies entire Study Area including the Site.

The following theoretical groundwater and water resource receptors have been 'scoped out' from further assessment because the potential effects are not considered likely to be significant:

- Shepley Spring abstraction licences (Boreholes D and B) are approximately 400 m and 500 m respectively to the southeast of the Proposed Development site. Although the boreholes for these licences are down hydraulic gradient of the site, the Proposed Development site is outside of the published SPZs which appear to correspond to these abstraction sites. In addition, these Shepley Spring abstraction licences are separated from the Proposed Development site by geological faulting which will likely disrupt permeable sandstone strata reducing any potential pathway linkages. The Shepley Spring abstraction licences (Boreholes D and B) are therefore 'scoped out' from further assessment;
- Wells and possible spring discharges are located outside of the Proposed Development site over 0.5 km to the south, on higher ground and up hydraulic gradient of the site. In addition, the faulting that appears to be coincident with the wells and springs in the area, is not aligned with any significant proposed infrastructure and therefore any hydrologic connection with the Proposed Development site is not considered likely, and the features are 'scoped out' from further assessment;
- The SEPA Marshalls Mono Ltd licensed site (NE/027/0006/030) has been 'scoped out' from further assessment since it is over 0.5 km to the south of the Proposed Development site, located on higher ground and up hydraulic gradient of the site. Although the quarry is located on the Greenmoor Rock, it is likely hydraulically disconnected from the Proposed Development site due to faulting along the northern edge of the licence site area, which potentially separates the groundwater catchment area from the Proposed Development site;
- The PWSs WS357 and WS105 are approximately 1.9 km from the Proposed Development site can be 'scoped out' based on distance from and the lack of a hydrogeological connection with the site. For example, PWS WS357 is separated by the Shepley Dike watercourse from the Proposed Development site and within a

separate geological fault block; whilst WS105 is separated by a topographical high (283 mAOD) north of Snowgate Head and within a different catchment area of the Holme House Dike. In addition, PWS WS352 is approximately 1.3 km east from the Proposed Development site and although it is down hydraulic gradient of the site, it is separated by numerous small watercourses and geological faulting which will disrupt permeable sandstone strata reducing any potential pathway linkages. Further to this, default SPZs for PWSs are limited to a radius of 250m from the source which is remote from the Proposed Development site. All PWSs are therefore 'scoped out' from further assessment;

- The deterioration of groundwater waterbodies under the WFD is not considered within the assessment. The fundamental requirement of the WFD is to ensure that any deterioration in status is prevented. Given the scale of the Aire & Calder Carb Limestone/ Millstone Grit/ Coal Measures WFD groundwater body within which the Proposed Development site lies (the Humber Groundwater Management Catchment) covers an area of 1896 km² area and is assessed as having a Poor Overall Status (2019 Cyle 3) no discernible or significant impact or further deterioration in status is considered feasible given the size of the Proposed Development;
- Local landfills as sources have been discounted since the nearest is approximately 400 m northeast of the Proposed Development site, along geological strike of the bedding and not directly up hydraulic gradient of the site; and
- Excavating and/ or dewatering near polluted sources (such as sediment within existing river beds and/ or historical and current reservoirs/ ponds etc.) and the remobilisation of already polluted sediment/ groundwater is not considered because these potential areas are outside of the Proposed Development site.

4.5 Conceptual model

Introduction

The Proposed Development site is situated within a shallow valley of the Shepley Dike watercourse which lies approximately 1 km to the north. The site lies on the eastern edge of Shepley on agricultural arable land. The topography at the site is low lying, ranging from 195 mAOD in the northeast to 220 mAOD within the south (**Figure 3 1**). Surface flow in the area is via modified field drainage and reservoirs on the edge of the site and drainage is to the north of the site.

The geology and hydrogeology conceptual understanding is presented below and supported by conceptual cross sections which pass through the centre of the Proposed Development site (**Figure 4-3** and **Figure 4-4**) and are based on the current available geological data and other information presented within the baseline. **Figure 4-2** shows the Proposed Development site boundary, local geology, the location of the SPZs, locations of boreholes used in the geological interpretation, and geological conceptual cross section lines based. **Figure 4-5** shows a cross-sectional source/ pathways and receptors schematic and is useful to assess the vulnerability of groundwater and associated risks.

Geology

Within the Proposed Development site, the outcrop geology (**Figure 3-3**) comprises the Grenoside Sandstone and the Pennine Lower Coal Measures Formation. A thin coal seam called the Crow Coal lies within the boundary between the two formations and broadly runs through the centre of the site from northeast to southwest. The exact extent and location of this coal is yet to be determined, and it may disappear within the site towards the southwest. Local boreholes from just

north of the Proposed Development site indicate that the Grenoside Sandstone comprises of a brown sandstone and lies above an approximately 15 m thick Black Shale, below which interbedded grey mudstone/ sandstone bands are encountered. The Black Shale separates the Grenoside Sandstone from the deeper Greenmoor Rock.

There are no superficial deposits present at the site with the assumption that only a thin agricultural soil exists. GI works commenced on the 6th October 2025 at the site to confirm the shallow geological characteristics at the site. The local horizontal continuity of the strata is difficult to determined spatially due to the lack of available data, for example the extent of the Black Shale unit beyond the extent of the Proposed Development site as shown within Section 1 - **Figure 4-3**.

The Pennine Coal Measures Formation is encountered within boreholes to the east of the Proposed Development site and indicate strata comprising of interbedded grey mudstone and sandstones, with some thicker sandstone units known as the Penistone Flags, and these form a narrow outcrop along the south-eastern boundary of the Proposed Development site. Strata are believed to have a shallow dip of less than 10 degrees to the southeast. As shown within Section 1 - **Figure 4-3**, the geological units in the region are affected by faulting, where a significant displacement of the units could affect the dip of these strata and their continuity.

Local Coal Mining

The southeast corner of the Proposed Development site, corresponding to the Crow Coal subcrop, is located within an area of potential historical coal mining. However, mining local to the Proposed Development site was limited to small-scale shallow operations with two potential mine entrances approximately 50 m to the east of the site. The mining target was presumably the Crow Coal seam which dips to the southeast and is the only significant seam in the vicinity. The depth to the coal seam as well any cavities due to the historic mining activity within the Proposed Development site area could be confirmed during GI works.

Recharge

The recharge within the area is predominantly through the sandstone units, such as the Greenmoor Rock and Grenoside Sandstone present within the Pennine Lower Coal Measures Formation and is likely to be through surface infiltration in areas where the formation is exposed. This is often slow and inefficient process due to the interbedded nature of the rock lithologies, and recharge rates are therefore generally low. The Pennine Lower Coal Measures sandstones typically receive recharge ranging from 10–50 mm/year in areas with low permeability cover, up to 150 mm/year in exposed or fractured zones.

The Grenoside Sandstone outcrop within the Proposed Development site is therefore likely to experience the greatest recharge although the outcrop is not exposed and even thin soils may reduce the recharge within the area. Other Pennine Lower Coal Measures Formation strata and coal seams are likely to have much reduced recharge. Recharge into the lower aquifer, such as the Greenmoor Rock may be via lateral flow from adjacent permeable formations and/ or leakage from overlying or underlying strata. However, the recharge of the aquifers may also be influenced by faults and fractured zones as well as mining shafts/ adits which may allow direct infiltration from the surface.

Figure 4-2 Geology Mapping – Location of Cross Sections 1 and 2

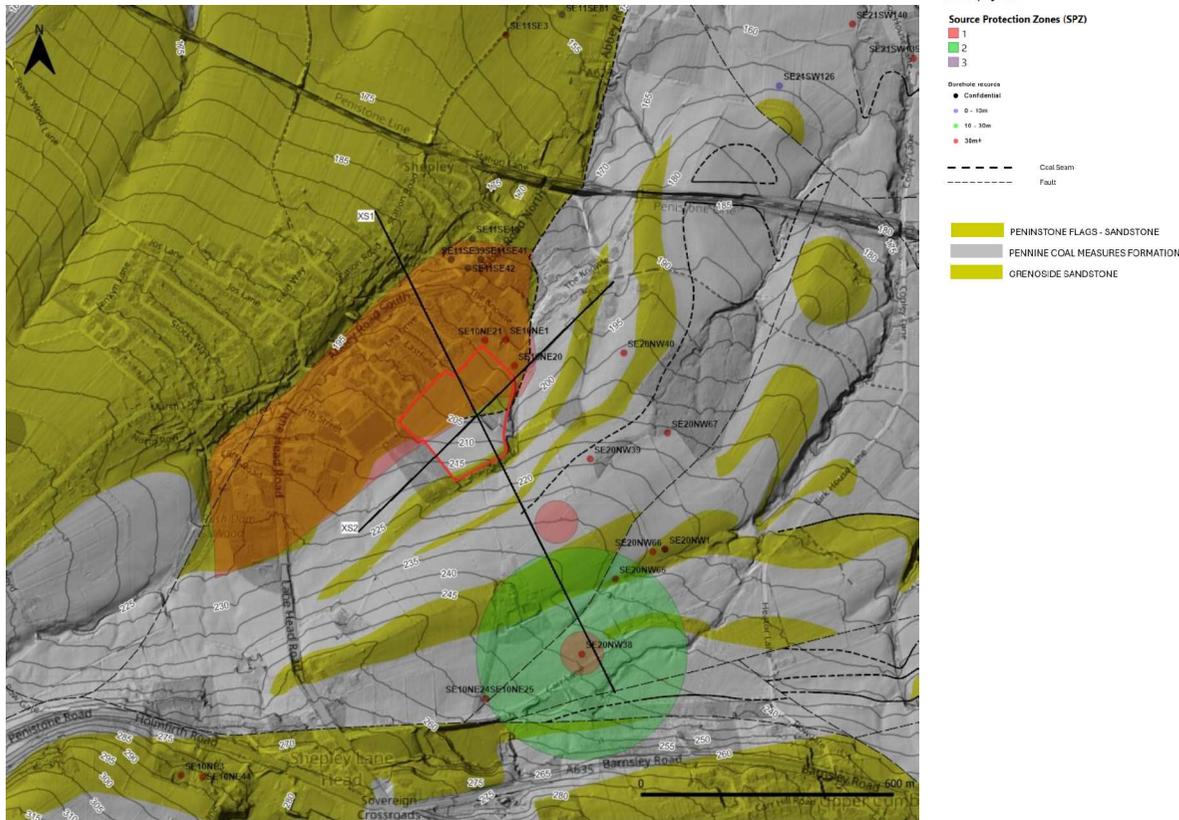


Figure 4-3 Cross Section 1

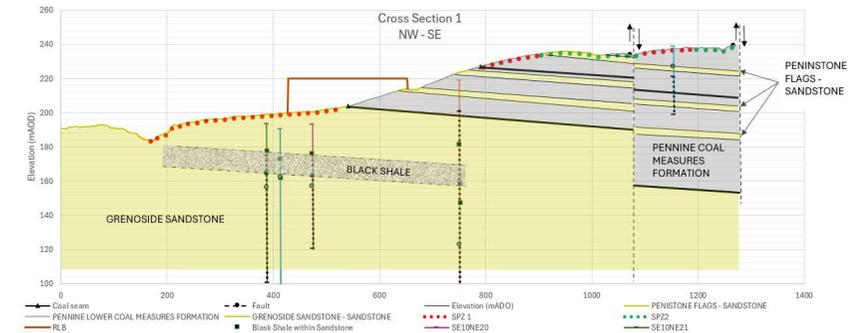
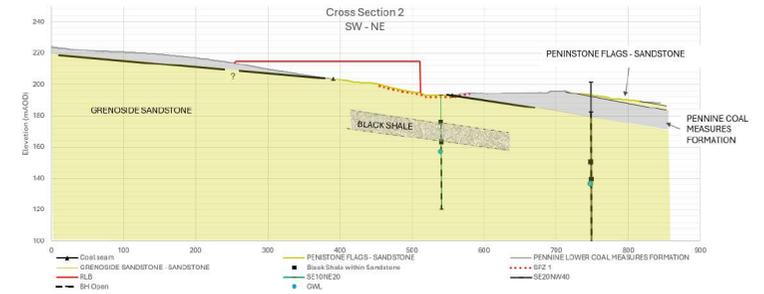


Figure 4-4 Cross Section 2



Groundwater Levels

Recent groundwater level monitoring records at or near the Proposed Development site does not currently exist. The only groundwater level records available at the time of writing are the water strikes, and rest water levels recorded on historical borehole geological logs (**Appendix B**) and summarised in **Table 3-5**. Available rest water levels are also shown on the cross sections above (**Figure 4-3** and **Figure 4-4**).

It is difficult to make any interpretations on groundwater levels due to the sparse and historical nature of the data. However, it appears that below the Proposed Development site the hydraulic heads within the deeper confined aquifer, i.e. the Greenmoor Rock sandstone may be between 30 and 40 mbgl. There is some evidence within the wider area that the shallower aquifer and sandstone units may have higher heads. However, there is much uncertainty and likely complexity regarding vertical variations in groundwater levels and associated hydraulic gradients with depth. Groundwater levels, particularly within the shallow aquifer, are likely to be subject to seasonal variation. In addition, the groundwater levels below the Proposed Development site are likely to be influenced by the drawdown of the abstractions at the neighbouring Shepley Spring boreholes.

Groundwater flow

The Pennine Lower Coal Measures Formation bedrock is a dual porosity system. It is generally of low permeability with most units, especially the mudstones and siltstones, exhibiting low matrix permeability. However, sandstone horizons, can have higher permeabilities associated with fractures potentially generating preferential or dominant flow pathways particularly along bedding planes.

Shallow groundwater flow is likely to be influenced by topography and by more permeable sandstone horizons where perched water tables can develop and interact with the ground surface. This is shown at springs within the Study Area and at the Proposed Development site where historical springs have discharged down slope from the Grenoside Sandstone. Groundwater within the deeper aquifer may be largely static within its natural regime, but this could be significantly influenced by present day abstractions with remote recharge zones, such as in the case of the Greenmoor Rock beneath the site. External influences, such as the abstraction from the Shepley Spring boreholes may therefore initiate a cone of depression within groundwater levels and change the local hydrogeological flow regime.

Groundwater quality

There is uncertainty regarding the water quality below the Proposed Development site as no site-specific data is currently available. The indication is of good water quality at the site, at least at depth, since the abstraction of the Shepley Spring groundwater is of a good quality. As a natural mineral water, the groundwater must be free of parasites, and bacteria that cause disease, protected from pollution and subject to minimal, if any, treatment. However, the Proposed Development site has little or no superficial deposit cover and the presence of potential historic shallow mining at/ near the site means that it is potentially vulnerable to the ingress of contaminants into the shallow aquifer. Groundwater vulnerability mapping from the for the Study Area shows that it is of a high to medium vulnerability.

Shepley SPZs

The locations of the SPZs within a 2km radius are shown on **Figure 4-2**. There is much uncertainty regarding the formulation of these SPZs and the receptors they protect as described within **Section 3-10** above. However, licence abstraction details appear to confirm that the identified SPZ coincident with the northwest of the Proposed Development site protects the Shepley Springs

abstractions. It is noticeable that the SPZ boundary within the site is broadly aligned to the Crow Coal seam within the Proposed Development area. This suggests abstraction at the Shepley Spring boreholes, to the north of the Proposed Development area, is from the Grenoside Sandstone immediately underlying the northwest of the site, with surface outcrop geology controlling recharge into the subsurface and aquifer. As mentioned above, it is believed that the strata dips slightly towards the southeast and a thickening sequence of the Pennine Lower Coal Measures is believed to exist beneath higher ground within the south and southeast of the Proposed Development site. As described within the conceptual narrative of **Figure 4-5** this stratum offers a degree of protection to the underlying sandstone aquifers.

Available online historical borehole data from BGS suggests that the Shepley Spring boreholes (**Appendix B**) maybe cased out through the Grenoside Sandstone into an underlying Black Shale (12.8 metres thick) to a depth of approximately 18 metres depth below ground level (mbgl). Indeed, the Shepley Spring website³³ states: “An exceptional Natural Spring Water, drawn from an ancient source beneath the Yorkshire Pennines. Slow filtration through the mineral-rich Greenmoor rock gives Ice Valley its unique character and taste”. This appears to indicate that the source rock for their abstracted groundwater is the Greenmoor Rock which is a thick sandstone beneath the Black Shale. If abstraction is from the Greenmoor Rock at depth (as indicated by “ancient source” and “slow filtration”), as opposed to a shallow aquifer source, then the less permeable strata above would offer a degree of protection by reducing pathway linkages to the surface and recharge. However, this interpretation does not align with the published extent of the Shepley Spring SPZ, suggestive of abstraction from the Grenoside Sandstone.

There is an uncertainty here which can only be resolved by more information about the Shepley Spring abstractions and the process undertaken to develop the current SPZ for their abstraction borehole/s that intersecting the Proposed Development site. However, a conservative approach has been taken, and it is assumed that the Shepley Spring SPZ is representative of abstraction from the shallower Grenoside Sandstone and the impact assessment has been undertaken to include this premise, i.e. by assessing for a shallow aquifer (Grenoside Sandstone) and deeper aquifer (Greenmoor Rock) source (**Figure 4-5**).

That said, although the exact depth of Shepley Spring abstraction source zone is not currently known there is strong evidence to suggest that abstraction is from the Greenmoor Rock sandstone (deeper aquifer), for example:

- The Shepley Spring website states that filtration is through Greenmoor rock;
- Based on suggestive correspondence with Shepley Spring regarding the capabilities of the Black Shale acting as a hydraulic barrier;
- The Shepley Spring SPZ is also coincident with existing and recently consented development with no objection indicating that these developments presented no concern to abstractions at Shepley Spring; and
- Lack of superficial deposits over the site would mean that extraction from the Grenoside Sandstone (shallow aquifer) would be vulnerable to pollution from existing urban development and any contaminants sprayed onto existing fields.

The depth of the source abstraction zone is to be confirmed during the determination period by further consultation with the Environment Agency.

If the source aquifer is the Greenmoor Rock sandstone then groundwater is likely to be protected by less permeable overlying geology, i.e. the Penning Lower Coal Measures or Black Shale (Section 1 - **Figure 4-3**). The Greenmoor Rock outcrops 1.3 km to the west and is coincident with a SPZ1 area although it is not clear how this zone was defined and whether it represents the

³³ <https://ice-valley.com/>

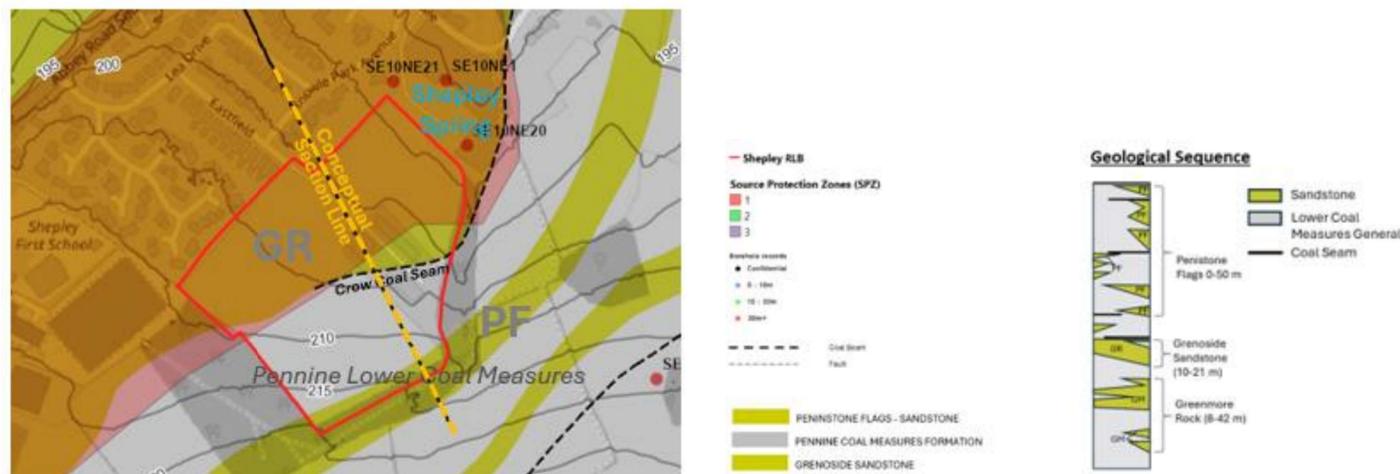
recharge zone for the Shepley Spring abstractions³⁴. A calculation of approximate recharge from the SPZ area gives a total volume of 3755 m³ of water. Given that Shepley Spring licenced abstractions have a total average of 4,664 m³, this may equate to 2,332 m³ for the two abstractions associated with the SPZ coincident with the Proposed Development site. Although there are many uncertainties here, this may indicate that the recharge zone of the SPZ shown indicated for the Shepley Spring abstraction is capable of providing the supply of groundwater.

The licence abstraction data also indicates that a SPZ located 250m to the southeast of the Proposed Development site also serves Shepley Springs and is licenced as Shepley Borehole B. It is represented as concentric SPZ1 and SZP2, with no marked SPZ3. However, this does not align with the local geological setting, and appears to be automatically generated, since the zone of influence of the abstraction is likely to be affected by the presence of geological faults to the northwest, south and southeast in this area. Although some historical BGS borehole locations do align with the SPZs it is felt that no linkage can be made at this time, as to the depth and source of abstraction, and confirmation with be sought with the owner.

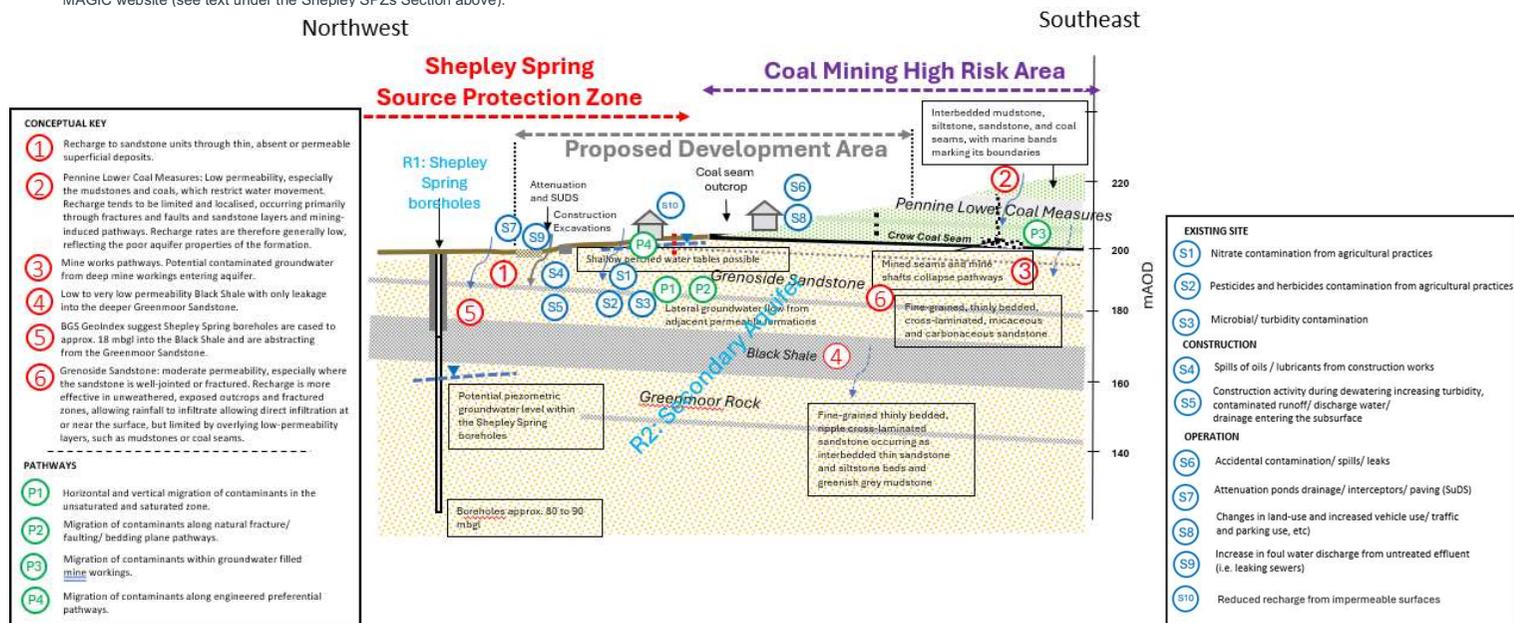
There is the potential for Shepley Spring boreholes to the southwest of and down hydraulic gradient the Proposed Development site to be in hydraulic connection with the Grenoside Sandstone and Greenmoor Rock beneath the site although they are approximately 500 m apart. Given the distance and the nature of the strata it is assumed that there would be limited pathways between the Proposed Development site and the abstractions, and if there was then presumably the Shepley Spring boreholes would be influenced by activities taking place upon the Grenoside outcrop within Shepley town.

³⁴ Not all abstraction sites have full zoning established. Some groundwater sources may only have an SPZ1 (Inner Zone) defined, especially if the hydrogeological data is limited and SPZ2 and SPZ3 may require more complex modelling, to establish for a site (Environment Agency, 2019).

Figure 4-5 Source/ pathways and receptors schematic of the Proposed Development Site



Note: Only SPZ1 is shown with the location map above since other zones are not available on the Defra MAGIC website (see text under the Shepley SPZs Section above).



5. Hydrogeological Risk Assessment

5.1 Approach

The approach adopted follows the Government guidelines for a HIA report (Environment Agency and Defra, 2018) with conceptual source/pathway/receptor linkages identified. The assessment will include a quantitative and qualitative assessment of potential effects during the construction and operational stages of development on groundwater receptors, including water resources, together with the consideration of attributes that inform the potential for deterioration of protected groundwater waterbodies.

At this stage the information used is largely desk-based data with the emphasis of this groundwater risk assessment being placed on the protection of groundwater abstractions, namely the Shepley Spring. The HIA identifies all the potential risk linkages along with the best practice techniques to mitigate the groundwater risks. Shepley Spring Ltd was approached but declined discussions regarding the Proposed Development intended to inform mitigation of risks to Shepley Spring sources.

As identified in **Section 2.6** above the presence of SPZs in the vicinity of the Proposed Development influences the assessment. The Environment Agency will only agree to proposals for infrastructure developments within SPZs where they do not have the potential to cause pollution or harmful disturbance to groundwater flow or where these risks can be reduced to an acceptable level. In order to reduce any risks, the Environment Agency expects best available techniques (BAT) to be applied. In addition, the SPZs represent the total catchment area of an abstraction source and any influences on groundwater regimes within this area has the potential to impact the quality and quantity of supply to the receptor respectively. The following assessment therefore considers potential activities within the SPZs, and it is assumed that all construction activities will have embedded mitigation and best practice applied during works.

In addition, a simple water balance with high level calculations is performed (**Section 5.6**) to predict the potential impact of the Proposed Development on the recharge to groundwater. This was undertaken as an indication as to potential impacts upon groundwater levels within the Shepley Spring SPZ coincident with the Proposed Development area.

5.2 Methodology

Hazard Identification

Hazard (source of risk) identification has been undertaken for the Proposed Development to evaluate whether the development (with appropriate mitigation measures) is acceptable in terms of the risk to the receptors. The main mechanisms that could result in a release of contaminants to the groundwater for instance are from the leak of fuel, lubricants and other chemicals during proposed works. Sediments can also be disturbed and released into the subsurface during excavation, laydown and construction works. Dewatering of excavations is another source of risk, albeit normally related to groundwater quantity rather than quality.

In addition, the proposed development lies within an area that has been defined by the Mining Remediation Authority as containing coal mining features at surface or shallow depth (**Section 3.6**). These features may include: mine entries (shafts and adits); shallow coal workings; geological features (coal seams, fissures and break lines); and former surface mining sites. Former mining activities may affect the proposed development by introducing subsurface pathways and mine waters within subsurface workings.

Potential Risk Pathways

The main contaminant and sediment risk pathway is from the surface into the natural subsurface aquifer system by vertical flow in the unsaturated zone and lateral flow in the saturated zone. The occurrence of thin/ absent soils, and exposed bedrock do not retain pollutants and sediments such that downward flow can occur into the unsaturated zone and ultimately to the water table.

An additional pathway therefore exists where contaminants from runoff can enter surface water features and then drain (soakaways) or leak from surface drainage and/ or attenuation ponds/ features into the unsaturated zone and then into the saturated zone within the aquifer.

The Pennine Lower Coal Measures Formation bedrock is generally of low permeability with most units, especially the mudstones and siltstones, exhibit low matrix permeability. However, sandstone horizons, and indeed coal seams, can have higher permeabilities associated with fractures generating higher flow pathways. A dual porosity system means that although it exhibits many rapid pathways (fissures) for contaminants and sediments to travel along, the bulk of the water present is within the matrix. Matrix porewater has the potential to attenuate dissolved contaminants. In addition, subsurface mining activities below the site may have enhanced secondary permeability.

5.3 Risk Register

The current land-use (pre-development) is primarily agricultural, with some associated farm buildings and it is believed that there has been no historical catchment management to reduce the risk from contaminants entering the ground. However, the construction phase of the project has the potential to introduce additional sources and pathways to sensitive receptors. During the construction phase the potential impacts to groundwater are from the following:

- Increased pollution risks from spillage of fuels or other harmful substances that may migrate to local groundwater receptors (such as aquifers, abstractions (both licensed and unlicensed), springs and surface watercourses);
- Ground disturbance during excavations works, increasing turbidity in groundwater during works, including discharge of dewatered groundwater pumped from excavations; and
- Direct quantitative impact or changes to groundwater flows and levels associated with the dewatering of trenches and deep excavations into the aquifer.

Mitigation measures need to be carefully planned and implemented to ensure that groundwater quality and quantity are not affected by the Proposed Development over the short and long-term. These risks will need to be managed by appropriate design and construction methods to ensure there are no adverse and long-term impacts upon receptors. This is particularly the case for the underlying aquifer which has a high vulnerability and is a groundwater resource, such as for the Shepley Spring groundwater abstraction. Proposed mitigation measures should be incorporated into a Construction Environmental Management Plan (CEMP).

During the operational phase (post-construction) the new development will potentially introduce new sources and pathways when compared to the areas current use. Potential impacts to groundwater on a permanent basis after construction are from the following:

- Increased pollution risks from accidental contamination events from spills/ leaks of fuels or other harmful substances that may migrate to local groundwater receptors;
- Increased risk of pollution to the ground from changes in land-use (e.g. roadway use of salt for de-icing and associated runoff) and pathways by which surface water reaches the underlying geology;

- Increase in foul water discharge from untreated effluent (i.e. leaking sewers) to the ground increasing the nutrient nitrate and phosphorus input into the ground and potential aquifer;
- Domestic (pesticides/ herbicides) and commercial and/ or use of chemicals; and
- Reduced recharge from impermeable surfaces impacting groundwater quantity, levels and flowpaths of groundwater within the aquifer.

After construction deep below ground structures are not believed to exist within the Proposed Development site and therefore impacts to changes to groundwater flows and levels associated with barrier effects are not expected and unlikely to have a significant effect on aquifers and groundwater supported abstractions. Preferential pathways along shallow buried pipework impacting subsurface groundwater flow are also not expected given the anticipated depth to the water table in most areas of the Proposed Development site. If infrastructure is below the water table then mitigation and barriers can be installed to prevent the development of subsurface preferential pathways. However, these aspects of barriers to flow and preferential pathways have not currently been scoped out of the assessment at this time as final design details of the Proposed Development works have not been developed.

The risk register considers potential on-site sources and pathways that have potential to cause effects during construction/ operations. These are listed in are presented in **Table 5-1**.

Table 5-1 Sources, pathways and receptors

Activity/ sources	Pathway	Receptors	Potential contaminants/ effects
Existing site (pre-development)			
S1: Nitrate contamination from agricultural practices	Extensive farming leading to leaching of nitrates leading to: P1: Horizontal and vertical migration of contaminants in the unsaturated and saturated zone.	R1: Shepley Spring R2: Secondary Aquifer (including SPZs)	Nitrate/ Ammonium
S2: Pesticides and herbicides contamination from agricultural practices	Extensive farming leading to leaching of agricultural pest control substances.		Pesticides and herbicides
S3: Microbial/ turbidity contamination	Heavy rainfall events, leading to rapid recharge: P1: Horizontal and vertical migration of contaminants in the unsaturated and saturated zone. P2: Migration of contaminants along natural fracture/ faulting/ bedding plane pathways. P3: Migration of contaminants within groundwater filled mine workings.		E-Coli, Enterococci, Coli, Clostridia, pathogens and silt load
Construction Phase (temporary effects)			
S4: Spills of oils / lubricants from construction works	Uncontrolled mitigation measures leading to: P1: Horizontal and vertical migration of contaminants in the unsaturated and saturated zone. P2: Migration of contaminants along natural fracture/ faulting/ bedding plane pathways.	R1: Shepley Spring R2: Secondary Aquifer (including SPZs)	Heavy metals, Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAH), organic and inorganic
S5: Construction activity during dewatering increasing	P3: Migration of contaminants within groundwater filled mine workings.		Silt laden groundwater

Activity/ sources	Pathway	Receptors	Potential contaminants/ effects
turbidity, contaminated runoff/ discharge water/ drainage entering the subsurface	<p>P4: Migration of contaminants along engineered preferential pathways.</p> <p>P5: From attenuation ponds/ temporary settlement ponds/ drainage routes</p>		<p>Changes to groundwater flows and levels</p> <p>Contaminant impacts</p>
Operational Phase (built development)			
S6: Accidental contamination/ spills/ leaks	<p>Ineffective mitigation measures leading to:</p> <p>P1: Horizontal and vertical migration of contaminants in the unsaturated and saturated zone.</p> <p>P2: Migration of contaminants along natural fracture/ faulting/ bedding plane pathways.</p>	<p>R1: Shepley Spring R2: Secondary Aquifer (including SPZs)</p>	<p>Heavy metals, Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAH), organic and inorganic</p>
S7: Attenuation ponds drainage/ interceptors/ paving (SuDS)	<p>P3: Migration of contaminants within groundwater filled mine workings.</p>		<p>Silt laden groundwater</p>
S8: Changes in land-use and increased vehicle use/ traffic and parking use, etc	<p>P4: Migration of contaminants along engineered preferential pathways.</p>		<p>Heavy metals, Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAH), organic and inorganic</p> <p>Road salts</p> <p>Pesticides and herbicides</p>
S9: Increase in foul water discharge from untreated effluent (i.e. leaking sewers)			<p>Nutrient nitrate and phosphorus</p>

Activity/ sources	Pathway	Receptors	Potential contaminants/ effects
S10: Reduced recharge from impermeable surfaces	Ineffective mitigation measures leading to: R1: Reduced recharge to the unsaturated and saturated zone from the Proposed Development site		Changes to groundwater flows and levels

5.4 Mitigation Measures

In order to ensure the development is viable and does not have an adverse impact on the underlying aquifer in the SPZ areas, as well as the nearby Shepley Spring groundwater supply, significant mitigation measures will be considered and supported by the detailed hydrogeological conceptual model provided within **Section 4** of this HIA. Appropriate mitigation measures to avoid, prevent, reduce, or offset impacts during construction and operation of the Proposed Development will be in place. Opportunities for enhancement are also considered, where feasible, to maximise any positive effects.

Measures during construction

During construction the embedded environmental measures will be fed iteratively into the assessment process. These measures include those that would be considered as standard good practice in construction and include actions that would be undertaken to meet existing regulatory requirements. During the construction phase, measures should focus on preventing contaminants from entering the ground and protecting both surface water and groundwater quality and quantity as far as possible.

During construction of the Proposed Development the following embedded mitigations are envisaged:

- **Surface water management:** Set up temporary drainage systems to prevent runoff that might contain sediment, oils or chemicals from construction activities from infiltrating the soil. Use silt traps, swales and sedimentation ponds to capture and treat surface water runoff before discharge. Surface water collected from vehicular and delivery areas is proposed to be treated with a petrol interceptor as appropriate and in accordance with best practice to provide treatment for contaminants to a quality suitable for discharging. Wherever possible, plant and machinery will be kept away from the drainage systems, such as near the central swale drainage and attenuation ponds. Appropriate attenuation pond lining, capacity and through flow into connecting drainage and discharge/ dewatering requirements;
- **Excavation Controls:** Minimise the footprint and depth of excavations. Avoid deep or open excavations during wet weather to reduce risk of rapid infiltration, particularly within the SPZ area of the Proposed Development site. Minimise soil disturbance to reduce erosion, which can carry contaminants into the groundwater. Where possible, implement soil stabilisation techniques, such as silt fencing, mulching or geotextiles, and use liners or sheeting to isolate excavations from groundwater inflow;
- **Spill prevention, control and accident response:** Establish spill prevention and response plans. In the event of a spillage: stop work and notify supervisor, contain the spill with kits/ absorbent granules, excavate affected area, bag and label any impacted soil, arrange appropriate waste disposal. Designate specific zones for refuelling (e.g. refuelling should be outside of SPZ areas) and maintenance activities, with impermeable liners and containment systems to prevent leaks or spills from seeping into the ground. Mobile plant should be refuelled at the site compound via bunded fuel bowser and limited quantities of fuel (e.g. less than 25 l) used for static plant refuelling. If ground contamination is encountered during construction works, work will stop immediately and measures will be taken to prevent disturbance and mobilisation of contaminants, until the contamination has been treated in-situ or removed for off-site treatment. This also includes ensuring on-site availability of oil spill clean-up equipment including absorbent material and inflatable booms for use in the event of an oil spill or leak. Drip trays shall be used beneath mobile plant. The soil/ superficial deposits do also, despite their shallow thickness, offer some protection to the

underlying bedrock aquifer. As such the stripping of it should be minimised as much as is possible, especially within the SPZ;

- Storage of hazardous materials: Store fuels, oils and chemicals in bunded areas or secure storage tanks to avoid accidental contamination and store outside SPZs. Strict handling and disposal procedures for hazardous materials are to be implemented and all fuel/ chemicals are required to be stored above ground;
- Construction waste management: Define controlled and covered waste storage areas. Ensure proper disposal and management of construction waste to prevent leaching of contaminants. All waste should be stored and disposed of in accordance with regulatory requirements;
- Concrete and Grout Management: Prevent washout water, fresh concrete or grout from coming into contact with groundwater and use designated washout areas with containment and off-site disposal. Avoid wet concrete works in open excavations where possible;
- Mine working awareness: As a consequence of enhanced flow pathways cause by mine workings that could potentially significantly shorten travel times of contaminants entering the subsurface. Therefore, if any mine working features, such as shafts, voids, collapse features etc. are encountered during the construction phase, these need to be reported and potentially investigated further. A watching brief and toolbox talks on mine working awareness should be undertaken;
- Construction Environmental Management Plan (CEMP): A CEMP will be implemented and will include measures to prevent pollution of the water environment during construction. Best practice recommendations for the prevention of contamination will be agreed with relevant statutory consultees prior to the commencement of construction works. This will include an erosion prevention and sediment control plan to reduce the quantity of sediment entrained in runoff;
- Other measures may include:
 - ▶ Working areas shall be clearly defined to ensure the disturbance of soils is minimised, where possible;
 - ▶ Vehicle and plant management by strictly controlling vehicle access, wheel washing, and cleaning to prevent accidental spills and minimise soil disturbance;
 - ▶ Haul/ temporary routes and accesses shall be clearly defined to minimise risk of accidents;
 - ▶ Vehicle wheels are to be cleaned in designated areas prior to leaving the Proposed Development site;
 - ▶ Environmental awareness training is to be provided for site workers;
 - ▶ Inert, uncontaminated material is to be used during construction. Construction materials brought to the Proposed Development site should be free of any contaminated material, so as to avoid any possible contamination of groundwater or watercourses. The CEMP will ensure that any material imported into the site will not contain polluting material, such as PFAS (per- and polyfluoroalkyl substances) chemicals;
 - ▶ Preparation of emergency pollution incident response plans, prior to construction, which should be present on-site throughout construction to inform contractors of required actions in the event of a pollution incident. Development incident response plans would bring together inputs from the developer and other relevant stakeholders.; and

- ▶ Care should be taken to ensure that wet cement does not come into contact with surface water, surface water drainage or infiltrating drainage features.

Measures during operations

During operation of the Proposed Development the following restrictions and mitigation are envisaged:

- The use of the highest specification pipework and designs for the new sewerage systems to minimise leakage (Environment Agency, 2018³⁵);
- The discharge of clean roof water to ground is acceptable both within and outside SPZ1, provided that all roof water down pipes is sealed against pollutants entering the system from surface run-off, effluent disposal or other forms of discharge. The balance of artificial groundwater input to natural recharge lost to the aquifer can be balanced (**Section 5.6**) to establish no net change and/ or appropriate for the local shallow water table and groundwater flow regime. The method of discharge must not create new pathways for pollutants to groundwater or mobilise contaminants already in the ground (Environment Agency, 2018). No permit for discharge is required if the above criteria can be met;
- Permanent drainage pipes will be laid up to 2.5m in depth with either an attenuation tank or basin up to 2.5m in depth and utilities will be laid up to 1.5m in depth. This infrastructure should be above shallow groundwater, but where they may interact with groundwater then barriers can be installed to prevent the development of subsurface preferential pathways;
- Roof water runoff could be discharged to the aquifer in several ways, such as direct recharge to the aquifer through carefully designed soakaways. Soakaways and/ or attenuation ponds should be designed such that they cannot receive water from additional sources of water and minimise infiltration. Flows on the Proposed Development site will be captured and conveyed by a gravity drainage system (open swale from southwest to northeast) and attenuated on site in a below ground sealed tank (up to 2.5 m deep) to the north of the site and discharged to the watercourse to the east of the site. No infiltration of surface water to the ground is proposed from the drainage system;
- Surface water should be collected, treated and discharged outside SPZ zones (or preferably to surface water) with designs to ensure long-term protection of the aquifer;
- Sewage effluent, trade effluent or contaminated surface water must not be infiltrated to ground in the SPZ areas, due to the potential impact it could have on the nearby abstraction/s. Instead, water should be collected in fully lined ponds and treated to be discharged to local surface water courses. A foul water pumping station with a wet well of approximately 4m depth will be installed;
- The use of pesticides/ herbicides and fertilisers should be kept to a minimum or not allowed in order to avoid contamination of the aquifer. Communal landscaped areas should be designed such that they do not require maintenance with pesticides/ herbicides or fertilisers, and any proposed features, such as open grass areas, should be sited outside of the SPZ zones;

³⁵ Environment Agency. 2018. The Environment Agency's approach to groundwater protection. February 2018 Version 1.2. (Bristol, UK: Environment Agency)

- The development should be designed such that there are no additional sources of contamination, i.e. future heavy commercial or industrial landuse within the development area, and particularly within the area of the SPZ;
- Foul flows must be treated to an appropriate standard prior to discharge into local drainage to minimise nutrient impacts to the Shepley Dike (Fenay Beck and River Colne); and
- Surface water drainage: Surface water must be treated through a sustainable drainage system (SuDS) to minimise nutrient impacts to local waterbodies and conveyed either through groundwater or surface water features. Major road highway drainage will be removed via SuDS designed and maintained to current good practice standards, including the provision of suitable treatment or pollution prevention measures prior to entry to groundwater. The point of discharge of such systems will be outside of the SPZ.

Design Measures and Site Restrictions

Proposed restrictions within the SPZ1 zones are summarised in **Table 5-2** to aid the planning process and reduce the hydrogeological risks associated with the project. Although some of the proposed restrictions may sometimes be permitted outside of the SPZ1, given the sensitive nature of the site it is recommended that, where possible, precautions are taken within all areas of the Proposed Development site.

Table 5-2 Proposed Development Restrictions

Development Area	SPZ1
Houses and private gardens	Discharge of clean roof water to ground permitted provided pipes are sealed against pollutants and new pathways are not created.
Landscaped areas	Limit the use of pesticides/herbicides and fertilisers.
Roads	Surface water should be collected, treated and discharged to the surface water watercourse. Designs need to ensure long-term protection of the aquifer.
Sewage and trade effluent	Highest specification pipework and designs to minimise leakage, must not be infiltrated to ground within SPZ.

Specific Enhanced Water Quality Protection Mitigation Measures

Specific enhanced water quality protection mitigation measures are given below:

- Double-Lined Settlement Ponds: Where settlement lagoons are used, line with double layers and include leak detection to prevent bypass to ground;
- Risk assess all activities with respect to groundwater vulnerability within the SPZ and 50 m of the Shepley Spring abstraction boreholes;
- Trigger Levels and Response Plan: Establish site-specific water quality trigger levels (e.g. turbidity, pH, hydrocarbons, nitrate, etc.) and develop an action plan should levels be approached or exceeded. Immediate cessation of works, investigation, and remediation must be specified;

- **Physical Barriers:** Use impermeable liners or secant piles to isolate deep excavations from the groundwater table and reduce connectivity with the aquifer (particularly important if previously undetected mine features are encountered);
- **Restricted Use of Infiltration Drainage:** No use of soakaways, infiltration basins, or permeable paving for temporary or permanent drainage within SPZ1 unless proven safe via detailed risk assessment;
- **Enhanced Concrete and Grout Controls:** All wet concrete works to be contained and cured above ground where possible. Use pre-cast elements or in-situ works with full containment;
- **Wastewater Management:** All site effluent and wash water to be contained and removed from site for off-site treatment and disposal and no discharge to ground or surface water permitted;
- **Staff Training and Supervision:** All site personnel must be trained in groundwater protection and spill response procedures. Regular site inspections by environmental specialists are essential.

Mine Working Pathway Mitigations

Early warning indicators to protect against the activation of mine working pathways during excavation are as follows:

- **Rising Turbidity:** Sudden or sustained increases in turbidity at monitoring boreholes or the abstraction borehole may indicate sediment breakthrough and work should halt pending investigation;
- **Detection of Contaminants:** Presence of hydrocarbons, elevated nitrate, ammonia, or pH changes in samples from monitoring points or supply borehole;
- **Rapid Water Level Drops:** Unexpected rapid drops in water levels in monitoring boreholes may indicate interception of a mine workings, cavities or large fissures;
- **Formation of Voids or Ground Collapse:** Sudden ground loss, voids or unexpected ground instability are potential indicators of underlying mine working features requiring immediate investigation and revised mitigation; and
- **Odour or Colour Changes:** Any unusual odours or colour changes in groundwater are cause for immediate action and suspension of works.

5.5 Risk Matrix

There are no standard significance criteria for assessing effects on the water environment. The significance of effects has been derived from measures of groundwater and water resource (receptor) sensitivity and magnitude of change, as shown in **Table 5-3** and **Table 5-4** respectively which will be used within the assessment to determine whether the effect is significant. The assessment of potential effects resulting from the Proposed Development will consider the construction phase or operational phase for both water quantity and quality impacts/effects.

Table 5-3 Receptor Sensitivity

Receptor Sensitivity / Importance	Receptor Type	Description
High	Aquifer	Principal Aquifer
	Groundwater body	WFD groundwater body (or part thereof) with overall High status. Water body exhibiting deterioration from current abstraction pressures under WFD Regs. Groundwater fed area of international designations i.e. Special Protection Areas (SPAs), Special Areas of Conservation (SAC) or Ramsar site
	Water resources	Water use supporting human health and economic activity at a regional scale. Licensed public groundwater supply (and associated catchment) or significant abstraction of strategic importance
Moderate	Aquifer	Secondary Aquifer
	Groundwater body	WFD groundwater body (or part thereof) with overall Good status/ potential. Water body predicted to exhibit deterioration if abstraction increased from current rates. Groundwater fed area of national and regional importance i.e. Site of Special Scientific Interest (SSSI), National Nature Reserves (NNR)
	Water resources	Water use supporting human health and economic activity at a local, household/ individual business scale. Licensed/ registered non-public groundwater supply abstraction (and associated groundwater catchment) where raw water quality is important e.g. industrial process water, cooling water, spray irrigation, mineral washing etc.
Low	Aquifer	Unproductive strata that have no resource
	Groundwater body	No current abstraction-related deterioration observed or predicted under the WFD Regs. Groundwater fed area of local importance which is not designated and little ecological value.
	Water resources	Water use does not support human health, and of only limited economic benefit. Unregistered non-potable surface water and groundwater abstraction (and associated catchment) e.g. livestock supply.

Table 5-4 Impact Magnitude

Magnitude	Characteristics of Change	Example Criteria
Major Beneficial	The proposed development would remove features that adversely affect the existing environment, prevent further degradation, and enhance and protect the environment in the long-term.	Removal of existing pollution from soluble pollutants and sedimentation and improvement in groundwater WFD classification.
Moderate Beneficial	The proposed development would notably reduce rate of current degradation and/or enhance existing character.	Reduction in baseline pollution from both soluble pollutants and sedimentation, contribution to improvement in groundwater WFD classification.
Minor Beneficial	The proposed development would reduce rate of current degradation.	Reduction in baseline pollution from either soluble pollutants or sedimentation. Minor benefit to WFD classification.
Neutral	The proposed development would not result in any meaningful change to the receptor/resource.	No change - no measurable effect on groundwater levels, flows or water quality, and no consequences in terms of WFD groundwater body status. No measurable change in water availability or quality and no change in ability of the water user to exercise licensed rights.
Minor Adverse	The proposed development would increase the rate of current degradation or introduce some minor detractors into the environment.	Measurable effect on groundwater levels, flows or water quality, but with no short-term or permanent downgrading of WFD groundwater body status. Deterioration of water quality of water resource abstraction, pond/lake, or spring, moderate likelihood of pollution from either soluble pollutants or sedimentation, increase in peak flood level (>10 mm). Minor reduction in water availability and/or quality, but unlikely to affect the ability of a water user to abstract. Deterioration of integrity of a groundwater dependent conservation site.
Moderate Adverse	The proposed development would result in the partial loss of a resource or notably degrade a receptor environment.	Deterioration/ change in groundwater levels, flows or water quality, leading to potential temporary downgrading of WFD groundwater body status, although not affecting the ability of the groundwater body to achieve future WFD objectives and measurable impacts upon conservation sites. Moderate reduction in water availability and/or quality, which may compromise the ability of the water user to abstract on a temporary basis or for limited periods, with no longer-term impact on the purpose for which the water is used.
Major Adverse	The proposed development would result in the complete loss of a resource or compromise the integrity of a receptor such that its long-term survival is highly unlikely.	High likelihood of deterioration/ change in groundwater levels, flows or water quality, leading to non-temporary downgrading of WFD groundwater body status, or the inability of the groundwater body to attain "Good" status and measurable long-term impacts upon conservation sites. Completely or severely reduced water availability and/or quality, compromising the ability of water users to abstract.

The assessment of significance of potential impacts resulting from the Proposed Development will consider the potential magnitude of the impact (including the duration/ persistence and likelihood of the impact) and the sensitivity of the receiving environment/ receptor. Once the sensitivity of the groundwater receptor and the magnitude of the impact/ change are both established, the potential effect can then be derived by combining the two assessments in a simple matrix as set out in **Table 5-5**. The assessment uses standard criteria to define the magnitude of potential impacts, defined in terms of volume, lateral extent, area, and pathways. This can be considered ‘Major’, ‘Moderate’, ‘Minor’ or ‘Neutral’ for each of the potential impacts.

Table 5-5 Determination of impact significance from magnitude of impact and receptor sensitivity

		BASELINE SENSITIVITY		
		HIGH	MODERATE	LOW
MAGNITUDE OF CHANGE	MAJOR BENEFICIAL	Major Beneficial	Moderate Beneficial	Minor Beneficial
	MODERATE BENEFICIAL	Major-Moderate Beneficial	Moderate/Minor Beneficial	Minor/Negligible Beneficial
	MINOR BENEFICIAL	Moderate Beneficial	Minor Beneficial	Negligible
	NEUTRAL	Negligible	Negligible	Negligible
	MINOR ADVERSE	Moderate Adverse	Minor Adverse	Negligible
	MODERATE ADVERSE	Major-Moderate Adverse	Moderate/Minor Adverse	Minor/Negligible Adverse
	MAJOR ADVERSE	Major Adverse	Moderate Adverse	Minor Adverse

5.6 Groundwater Balance

High level calculations were performed to predict the potential impact of the development on the water balance for the area of the Proposed Development site coincident with the Shepley Spring SPZ, should the proposed development go ahead. Approximate areas were provided by Banks Group Ltd for hardstanding and green space within the developable area coincident with the SPZs. Estimates were also provided for the percentage of clean and potentially polluted runoff for the hardstanding areas. These estimates were used to calculate the potential surplus or deficit in recharge to groundwater within the SPZ areas that could be caused by the artificial changes in recharge.

Owing to the sensitive nature of the aquifer and its proximity to the Shepley Spring drinking water source, only water known to be uncontaminated should be discharged to the aquifer from the Proposed Development. Surface water potentially contaminated by pollutants on roads, driveways and other such hardstanding areas will be diverted to lined ponds for treatment before being discharged to the local surface water courses. This would result in a deficit in recharge reaching groundwater in these areas compared to natural conditions.

Runoff collected on rooftops can be considered clean, since it is unlikely to have come into contact with any contaminants. In the SPZ1 area roof water down-pipes should be sealed against pollutants entering the system from surface water run-off, effluent disposal and other forms of discharge. The runoff can then be directly discharged to the aquifer (i.e. increasing groundwater

recharge rates compared to current conditions), mitigating against the deficit caused by removing contaminated runoff in hardstanding areas.

High-level calculations were performed (**Table 5-6**) to look at the potential chances of a deficit in recharge to the aquifer occurring in the SPZ area, as this could potentially impact on the available yield at the water supply borehole (if the borehole is utilising the shallow aquifer and not a deeper source). Only approximations were used at this stage of the study to examine the viability of the development. This will need to be refined in the future, when additional data is available and design is developed.

An approximate estimate of rainfall for the Shepley area was used, based on average data from the nearest Meteorological Office climate station (Huddersfield Oakes) to the Proposed Development site. It should be noted that only 9.4 % of total SPZ area is intersected by the Proposed Developable site. The water balance predicts that if the natural recharge rate over the SPZ zones could be up to 15% of total rainfall³⁶ (see **Section 3.9**) there could be a potential overall increase in the recharge volume to the aquifer following development. 15% is a likely upper limit for the natural recharge rate (150 mm/year) as infiltration will be reduced by the underlying geology and the presence of the clay in some parts of the catchment, the general sloping topography of the site generating runoff and shallow groundwater flow towards surface water features. Infiltration tests during GI works on the Proposed Development site should be able to help confirm likely recharge rates into the subsurface. At 15% natural recharge the calculations suggest that the natural recharge over the SPZ areas after the development could be reduced by 85%. However, the artificial input of half of the clean roof runoff into the subsurface within the Proposed Development site could maintain natural recharge rates (**Table 5-6**).

The proposed land use distribution and proportions provide confidence that the groundwater availability will not be affected by the development. Direct clean runoff volume from roofs could supply twice that of the total natural recharge. Approximately 17% hardstanding roofs clean runoff area would be able to balance the natural recharge across the Proposed Development site. In addition, further enhancement could be built into the drainage design making the water quality better within particularly sensitive areas of direct discharge into the aquifer via suitable pre-treatment (i.e. discharging to ground rather than surface water), for example, within down hydraulic areas within the north of the Proposed Development site and closest to the Shepley Spring facility.

Table 5-6 Water balance calculations

	Total
Total area of SPZ (ha)	29.34
Developable area within SPZ (ha)	2.76
Developable area (% of total SPZ area)	9.41
75% of developable area (within SPZ) is hardstanding (ha)	2.08
75% of developable area (within SPZ) is hardstanding (% of total SPZ area)	7.06
25% of developable area (within SPZ) is green space/landscape/vegetated gardens (ha)	0.69

³⁶ It should be noted that runoff drainage will ultimately discharge to the watercourse east of the Proposed Development site, outside of the SPZ and in an area underlain by Pennine Lower Coal Measures. The water balance assumes that there is no infiltration from this watercourse as it flows north back onto the area of the SPZ as this water would be returned into the water balance deficit. It also is assumed that no water infiltrates during transport along the swale/ drainage on the site.

	Total
25% of developable area (within SPZ) is green space/landscape/vegetated gardens (% of total SPZ area)	2.35
Clean runoff area (40% hardstanding area = roofs) (ha)	0.83
Dirty runoff area (60% hardstanding area = roads etc) (ha)	1.24
Estimated annual rainfall rate (mm/year)	1041
Estimated natural recharge rate (%) (this number is currently unknown and has been varied during calculations to determine a hypothetical optimal value)	15
Estimated developed green space recharge rate (%) (this number is currently unknown and has been varied during calculations to determine a hypothetical optimal value)	15
Total rainfall falling on developable area (within SPZ) (m³/year)	28732
Natural recharge over developable area (within SPZ) (m³/year)	4310
Recharge over green space after development (within SPZ) (m³/year)	1077
Missing recharge due to hardstanding areas (m³/year)	3232
Direct clean runoff volume from roofs minus 10% loss to evaporation etc (m³/year)	7776
Recharge surplus (m³/year)	4544

It is important to note that the current calculations are high level, and approximations have been made as to the format of the development and the rainfall/ recharge rates to the site. Further calculations are likely to be required, and potentially a simple numerical flow model could be used, to refine these estimates once additional data and design information are available. It will also be important to ensure that measures are put in place to prevent a significant increase in groundwater levels particularly at lower topographic elevations in the north of the Proposed Development area.

5.7 Results

The risk assessment results are given in **Table 5-7** and **Table 5-8** based on risks to R1: Shepley Spring boreholes and R2: Secondary Aquifer - Pennine Lower Coal Measures respectively. The conceptual narrative in terms of source/ pathway/ receptor interactions can be seen within **Figure 4-5**. The risk assessment for each receptor is discussed below.

R1: Shepley Spring Boreholes - Construction/ Operational Phase

Assessment of water quality impacts

The Shepley Spring boreholes have been assigned a High sensitivity due to their strategic and commercial importance. Considering a Grenoside Sandstone source aquifer (shallow aquifer) during construction phase very short pathways potentially exist leading to a Moderate magnitude impact and Major/ Moderate Adverse residual risk even after mitigation. Whereas, considering a Greenmoor Rock source aquifer (deep aquifer) during construction pathways are longer or non-existent due to the isolation of the aquifer leading to a Neutral magnitude impact and Negligible residual risk after mitigation.

During the operational phase the pathways to the Grenoside Sandstone source aquifer (shallow aquifer) since there are no open/ deep excavations leading to a Minor magnitude impact and Minor Adverse residual risk after mitigation. The residual risk after mitigation to the Greenmoor Rock source aquifer (deep aquifer) during operations will remain Negligible.

Assessment of reduced recharge

The impacts on recharge during operation from impermeable surfaces within the Proposed Development site are considered a Neutral magnitude after mitigation, namely the discharge of clean roof water to ground and other appropriate measures leading to an overall Negligible residual risk.

R2: Secondary Aquifer - Construction/ Operational Phase

Assessment of water quality impacts

The Secondary Aquifer - Pennine Lower Coal Measures have been assigned a Moderate sensitivity due to its Secondary aquifer status. The aquifer consists of interbedded more permeable sandstone units, and it has been assessed based on potential shallow and deep sandstone receptors. Considering a Grenoside Sandstone aquifer (shallow aquifer) during construction phase very short pathways potentially exist leading to a Minor magnitude impact and Minor Adverse residual risk after mitigation. The consideration to impact is given to the deterioration of water quality is reduced due to the overall size of the waterbody when compared to the integrity of the whole. Whereas, considering a Greenmoor Rock source aquifer (deep aquifer) during construction pathways are longer or non-existent due to the isolation of the aquifer leading to a Neutral magnitude impact and Negligible residual risk after mitigation.

During the operational phase the pathways to the Grenoside Sandstone source aquifer (shallow aquifer) are much reduced, since there are no open/ deep excavations leading to a Neutral magnitude impact and Negligible residual risk after mitigation. The residual risk after mitigation to the Greenmoor Rock source aquifer (deep aquifer) during operations will remain Negligible.

Assessment of reduced recharge

The impacts on recharge during operation from impermeable surfaces within the Proposed Development site are considered a Neutral magnitude after mitigation, namely the discharge of clean roof water to ground and other appropriate measures leading to an overall Negligible residual risk.

Table 5-7 Determination of Hydrogeological Risks - R1: Shepley Spring boreholes

Activity	Potential Source	Potential effect	Mitigation	Sensitivity	Magnitude	Residual Risk
Construction						
S4: Spills of oil / lubricants from construction works		<p>Pathways are dependent upon the aquifer source strata for the Shepley Spring boreholes. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be much higher in magnitude.</p> <p>If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale and the borehole casing infrastructure.</p>	<ul style="list-style-type: none"> • Construction Environmental Management Plan (CEMP) • Surface water management • Excavation Controls • Spill prevention, control and accident response • Storage of hazardous materials • Construction waste management • Concrete and Grout Management • Mine working awareness • Specific Enhanced Water Quality Protection Mitigation Measures • Mine Working Pathway Mitigations 	High	Moderate to Neutral	Major/ Moderate Adverse to Negligible
S5: Construction activity during dewatering increasing turbidity, contaminated runoff/ discharge water/ drainage entering the subsurface		<p>Pathways are dependent upon the aquifer source strata for the Shepley Spring boreholes. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be much higher in magnitude.</p> <p>If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale and the borehole casing infrastructure.</p>	<ul style="list-style-type: none"> • Construction Environmental Management Plan (CEMP) • Surface water management • Excavation Controls • Spill prevention, control and accident response • Storage of hazardous materials • Construction waste management • Concrete and Grout Management • Mine working awareness • Specific Enhanced Water Quality Protection Mitigation Measures • Mine Working Pathway Mitigations 	High	Moderate to Neutral	Major/ Moderate Adverse to Negligible
Operations						
S6: Accidental contamination/ spills/ leaks		<p>Pathways are dependent upon the aquifer source strata for the Shepley Spring boreholes. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be much higher in magnitude. However, pathways will be reduced when compared to the construction phase since there will be no open/ deep excavations.</p> <p>If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale and the borehole casing infrastructure. Pathways are further reduced when compared to the construction phase since there will be no open/ deep excavations.</p>	<ul style="list-style-type: none"> • Design Measures and Site Restrictions • Measures during operations • Specific Enhanced Water Quality Protection Mitigation Measures 	High	Minor to Neutral	Minor Adverse to Negligible
S7: Attenuation ponds drainage/ interceptors/ paving (SuDS)		<p>Pathways are dependent upon the aquifer source strata for the Shepley Spring boreholes. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be much higher in magnitude. However, pathways will be reduced when compared to the construction phase since there will be no open/ deep excavations.</p>	<ul style="list-style-type: none"> • Design Measures and Site Restrictions • Measures during operations • Specific Enhanced Water Quality Protection Mitigation Measures 	High	Minor to Neutral	Minor Adverse to Negligible

Activity	Potential Source	Potential effect	Mitigation	Sensitivity	Magnitude	Residual Risk
		<p>If the aquifer is the Greenmoor Rock then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale and the borehole casing infrastructure. Pathways are further reduced when compared to the construction phase since there will be no open/ deep excavations.</p>				
S8: Changes in land-use and increased vehicle use/ traffic and parking use, etc		<p>Pathways are dependent upon the aquifer source strata for the Shepley Spring boreholes. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be much higher in magnitude. However, pathways will be reduced when compared to the construction phase since there will be no open/ deep excavations.</p> <p>If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale and the borehole casing infrastructure. Pathways are further reduced when compared to the construction phase since there will be no open/ deep excavations.</p>	<ul style="list-style-type: none"> ● Design Measures and Site Restrictions ● Measures during operations ● Specific Enhanced Water Quality Protection Mitigation Measures 	High	Minor to Neutral	Minor Adverse to Negligible
S9: Increase in foul water discharge from untreated effluent (i.e. leaking sewers)		<p>Pathways are dependent upon the aquifer source strata for the Shepley Spring boreholes. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be much higher in magnitude. However, pathways will be reduced when compared to the construction phase since there will be no open/ deep excavations.</p> <p>If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale and the borehole casing infrastructure. Pathways are further reduced when compared to the construction phase since there will be no open/ deep excavations.</p>	<ul style="list-style-type: none"> ● Design Measures and Site Restrictions ● Measures during operations ● Specific Enhanced Water Quality Protection Mitigation Measures 	High	Minor to Neutral	Minor Adverse to Negligible
S10: Reduced recharge from impermeable surfaces		<p>The discharge of clean roof water to ground is acceptable both within and outside SPZ1 and as shown within the water balance can account for reduce recharge due to impermeable hard standing.</p>	<ul style="list-style-type: none"> ● Design Measures and Site Restrictions ● Measures during operations ● Specific Enhanced Water Quality Protection Mitigation Measures 	High	Neutral	Negligible

Table 5-8 Determination of Hydrogeological Risks - R2: Secondary Aquifer - Pennine Lower Coal Measures

Activity	Potential Source	Potential effect	Mitigation	Sensitivity	Magnitude	Residual Risk
Construction						
S4: Spills of oils / lubricants from construction works	Pathways are dependent upon the shallow or deep location of the Secondary aquifer. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be minor in magnitude. Deterioration of water quality is reduced due to the overall size of the waterbody when compared to the integrity of the whole. If the aquifer is the deep aquifer of the Secondary aquifer, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale.	<ul style="list-style-type: none"> • Construction Environmental Management Plan (CEMP) • Surface water management • Excavation Controls • Spill prevention, control and accident response • Storage of hazardous materials • Construction waste management • Concrete and Grout Management • Mine working awareness • Specific Enhanced Water Quality Protection Mitigation Measures • Mine Working Pathway Mitigations 	Moderate	Minor to Neutral	Minor Adverse to Negligible	
S5: Construction activity during dewatering increasing turbidity, contaminated runoff/ discharge water/ drainage entering the subsurface	Pathways are dependent upon the shallow or deep location of the Secondary aquifer. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be minor in magnitude. Deterioration of water quality is reduced due to the overall size of the waterbody when compared to the integrity of the whole. If the aquifer is the deep aquifer of the Secondary aquifer, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale.	<ul style="list-style-type: none"> • Construction Environmental Management Plan (CEMP) • Surface water management • Excavation Controls • Spill prevention, control and accident response • Storage of hazardous materials • Construction waste management • Concrete and Grout Management • Mine working awareness • Specific Enhanced Water Quality Protection Mitigation Measures • Mine Working Pathway Mitigations 	Moderate	Minor to Neutral	Minor Adverse to Negligible	
Operations						
S6: Accidental contamination/ spills/ leaks	Pathways are dependent upon the shallow or deep location of the Secondary aquifer. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be minor in magnitude. Deterioration of water quality is reduced due to the overall size of the waterbody when compared to the integrity of the whole. In addition, pathways will be reduced when compared to the construction phase since there will be no open/ deep excavations. If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less	<ul style="list-style-type: none"> • Design Measures and Site Restrictions • Measures during operations • Specific Enhanced Water Quality Protection Mitigation Measures 	Moderate	Neutral	Negligible	

Activity	Potential Source	Potential effect	Mitigation	Sensitivity	Magnitude	Residual Risk
		permeable Black Shale. Pathways are further reduced when compared to the construction phase since there will be no open/ deep excavations.				
S7: Attenuation ponds drainage/ interceptors/ paving (SuDS)		<p>Pathways are dependent upon the shallow or deep location of the Secondary aquifer. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be minor in magnitude. Deterioration of water quality is reduced due to the overall size of the waterbody when compared to the integrity of the whole. In addition, pathways will be reduced when compared to the construction phase since there will be no open/ deep excavations.</p> <p>If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale. Pathways are further reduced when compared to the construction phase since there will be no open/ deep excavations.</p>	<ul style="list-style-type: none"> • Design Measures and Site Restrictions • Measures during operations • Specific Enhanced Water Quality Protection Mitigation Measures 	Moderate	Neutral	Negligible
S8: Changes in land-use and increased vehicle use/ traffic and parking use, etc		<p>Pathways are dependent upon the shallow or deep location of the Secondary aquifer. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be minor in magnitude. Deterioration of water quality is reduced due to the overall size of the waterbody when compared to the integrity of the whole. In addition, pathways will be reduced when compared to the construction phase since there will be no open/ deep excavations.</p> <p>If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale. Pathways are further reduced when compared to the construction phase since there will be no open/ deep excavations.</p>	<ul style="list-style-type: none"> • Design Measures and Site Restrictions • Measures during operations • Specific Enhanced Water Quality Protection Mitigation Measures 	Moderate	Neutral	Negligible
S9: Increase in foul water discharge from untreated effluent (i.e. leaking sewers)		<p>Pathways are dependent upon the shallow or deep location of the Secondary aquifer. If the aquifer is the Grenoside Sandstone then pathways P1 and P2 are very short, and any impacts will be minor in magnitude. Deterioration of water quality is reduced due to the overall size of the waterbody when compared to the integrity of the whole. In addition, pathways will be reduced when compared to the construction phase since there will be no open/ deep excavations.</p> <p>If the aquifer is the Greenmoor Rock, then pathways P1 and P2 are longer or do not exist due to the isolation of the aquifer by the less permeable Black Shale. Pathways are further reduced when compared to the construction phase since there will be no open/ deep excavations.</p>	<ul style="list-style-type: none"> • Design Measures and Site Restrictions • Measures during operations • Specific Enhanced Water Quality Protection Mitigation Measures 	Moderate	Neutral	Negligible
S10: Reduced recharge from impermeable surfaces		<p>The discharge of clean roof water to ground is acceptable both within and outside SPZ1 and as shown within the water balance can account for reduce recharge due to impermeable hard standing.</p>	<ul style="list-style-type: none"> • Design Measures and Site Restrictions • Measures during operations • Specific Enhanced Water Quality Protection Mitigation Measures 	Moderate	Neutral	Negligible

6. Conclusions and Recommendations

Fundamental to the assessment of water quality impacts upon the Shepley Spring abstraction water resource is the consideration of the source aquifer. A range of risk to the receptor is therefore given due to the current unknowns regarding the Shepley Spring groundwater resource source aquifer, i.e. is it a shallow or deep aquifer. Although the exact depth of Shepley Spring extraction is not available within the public domain, there is a strong indication that the source abstraction zone is from a deeper extraction, leading to a reduced Negligible risk. That is, if the Greenmoor Rock is the source aquifer (deep aquifer), then during construction/ operation, a Negligible residual risk after mitigation is expected since any pathways are much longer or non-existent due to the isolation of the aquifer. In this case, the groundwater source to Shepley Spring is unlikely to be affected.

However, if the Grenoside Sandstone is the source aquifer (shallow aquifer) then during construction, due to the very close proximity to the site, there is a Major/ Moderate Adverse residual risk even after mitigation. During the operational phase, since there are no open/ deep excavations, any impacts are reduced to a Minor Adverse residual risk.

The depth of the source abstraction zone is to be confirmed during the determination period by further consultation with the Environment Agency. This HIA and the range of risk can be refined as well as further site-specific mitigation measures developed in the receipt of further information about the Shepley Spring water resource source receptor.

The impacts on recharge to groundwater receptors during operation from impermeable surfaces within the Proposed Development site are considered a Negligible residual risk after mitigation, namely the discharge of clean roof water to ground and other appropriate measures leading to an overall neutral impact. The flexibility in mitigation has been demonstrated through a simple water balance.

To develop clarity to the assessment the following recommendations are made:

- Current data about the Shepley Spring Ltd abstraction will be sought during the determination period, particularly regarding their production boreholes construction, depth and source zones. This will help to establish the receptor aquifer units for full detailed assessment;
- Specific groundwater hydrochemical data from the Shepley Spring abstractions will be sought during the determination period, to establish how sensitive the source is from any changes to recharge quantity (positive or negative), the flow pathway of recharge and associated groundwater quality effects;
- Initiate and develop a consultation with the Environment Agency, and local authorities throughout works. Fundamental to the Environment Agency consultation would be the agreed understanding of the SPZs within the Proposed Development site area;
- GI works are necessary to confirm the shallow geological characteristics at the site, the risk from historical mining activities and to update the conceptual model understanding. The first phase of these investigations was ongoing at the time of compiling this report;
- Site-specific GI data should be obtained, including data on infiltration rates, aquifer testing (falling and rising head tests), geology and groundwater levels. This information will feed into updating the conceptual model understanding, further detailed assessments, potential numerical modelling and water balance calculations; and

- Following the above-mentioned consultations, investigations and re-assessments the mitigation proposals associated with both Construction and Operation phases for the Proposed Development should be revisited and refined.

After clarity in the assessment has been established the range of risk can be refined and further site-specific mitigation measures developed.

7. Glossary of terms and abbreviations

Term (acronym)	Definition
Above Ordnance Datum (AOD)	Ordnance Datum is the vertical datum used by the Ordnance Survey as the basis for deriving the height of ground level on maps. Topography may be described using the level in comparison to 'above' ordnance datum.
ALS	Abstraction Licencing Strategy
BAT	Best Available Technology
BGS	British Geological Survey
CEMP	Construction Environmental Management Plan
CSM	Conceptual Site Model
Defra	Department for Environment, Food and Rural Affairs
DrWPAs	Drinking water protected areas
Environment Agency	A non-departmental public body, with responsibilities relating to the protection and enhancement of the environment in England.
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed project or development over and above the existing circumstances (or 'baseline').
Environmental Statement (ES)	The written output presenting the full findings of the Environmental Impact Assessment
EPR	Environmental Permitting Regulations
HIA	Hydrogeological Impact Assessment
HRA	Hydrogeological Risk Assessment
MAGIC	An online, map-based library of data sources maintained by Defra.
NGR	National Grid Reference
Planning Act 2008	The legislative framework for the process of approving major new infrastructure projects.
PGG	Planning Practice Guidance
PWS	Private water supply
SgZs	Safeguard Zones
SPZ	Source protection zone

Term (acronym)	Definition
SFRA	Strategic Flood Risk Assessment
UKCEH	UK Centre for Hydrology and Ecology
Water Framework Directive (WFD)	A substantial piece of EU water legislation that came into force in 2000, with the overarching objective to get all water bodies in Europe to attain Good or High Ecological Status. River Basin Management Plans have been created which set out measures and potential mitigation to ensure that water bodies in England and Wales achieve 'Good Ecological Status'.

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Appendix A Consultants Coal Mining Report

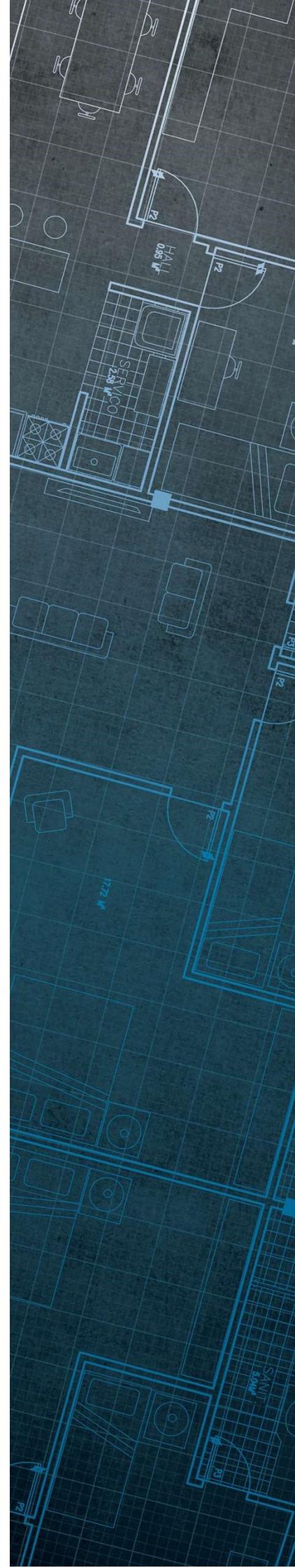


The Coal
Authority

Consultants Coal Mining Report

Shepley
Huddersfield
Kirklees
HD8 8EZ

Date of enquiry:	13 August 2025
Date enquiry received:	13 August 2025
Issue date:	13 August 2025
Our reference:	51003518305001
Your reference:	



Consultants Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

Banks Group Ltd

Enquiry address

Shepley
Huddersfield
Kirklees
HD8 8EZ

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

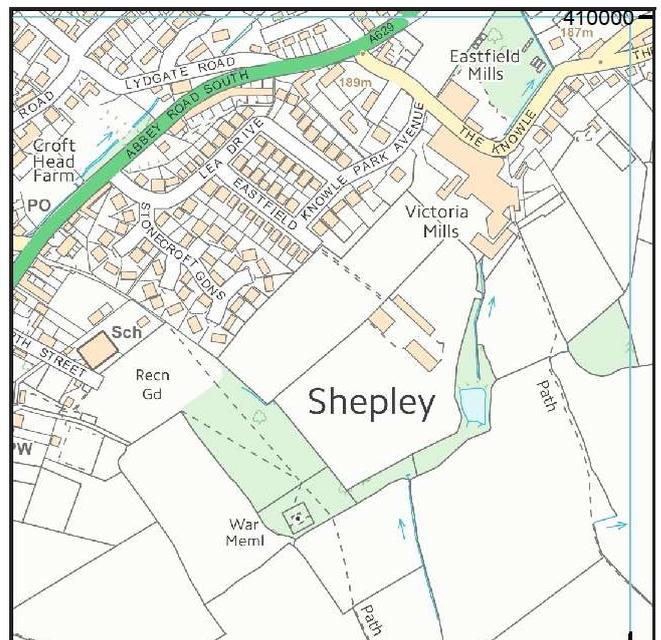
www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

No past mining recorded.

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	419409-001	419913 409671	Treatment details unknown.*	Coal	
Shaft	420409-008	420002 409502	Treatment details unknown.*	Coal	

*For your information, before the coal industry was nationalised in 1947, there was no requirement for a mine operator to record mine entry treatment details when a mine was abandoned. Therefore, it is not unusual for us to have no treatment details for many of the 176,000 recorded mine entries on our database. Despite this lack of information, please be assured that the fact we have no treatment recorded does not necessarily mean that the mine entries were left untreated when abandoned.

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

14461	PO0	M696
-------	-----	------

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
CROW	Coal	Yes	Within	N/A	4
CROW	Coal	Yes	Within	N/A	56
CROW	Coal	Yes	Within	N/A	353

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

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

Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

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

Payments to owners of former copyhold land

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

Section 4 – Further information

Based on the responses in this report, no further information has been highlighted.

Future development

If development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply specialist engineering practice required for former mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or coal mines without first obtaining the permission of the Coal Authority.

MINE GAS: Please note, if there are no recorded instances of mine gas within 500m of the enquiry boundary, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded. Developers should be aware that the investigation of coal seams, mine workings or mine entries may have the potential to generate and/or displace underground gases. Associated risks both to the development site and any neighbouring land or properties should be fully considered when undertaking any ground works. The need for effective measures to prevent gases migrating onto any land or into any properties, either during investigation or remediation work, or after development must also be assessed and properly addressed. In these instances, the Coal Authority recommends that a more detailed Gas Risk Assessment is undertaken by a competent assessor.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission. Please note, if there are no recorded instances of mine gas reported, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

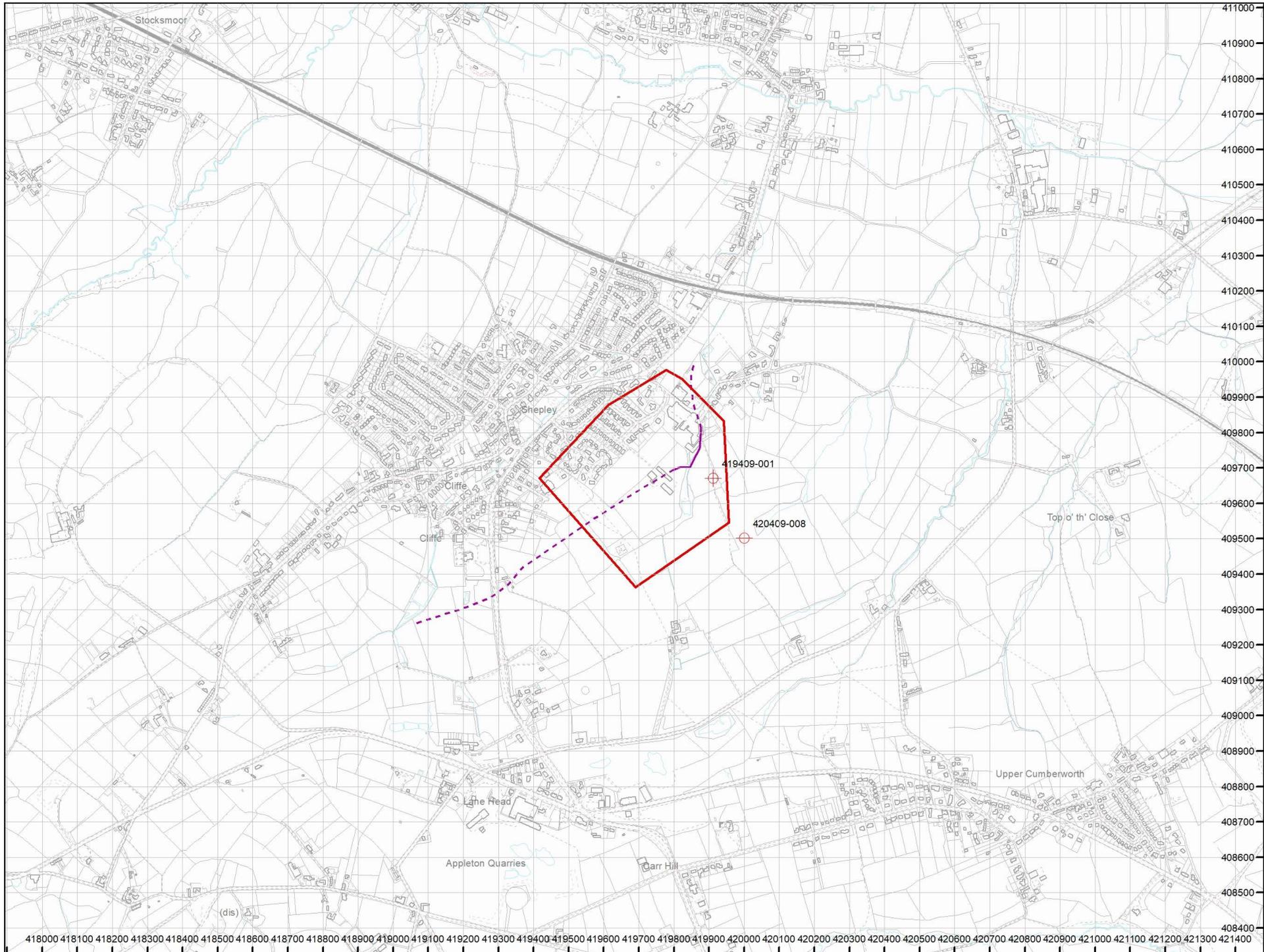
Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

- Approximate position of the enquiry boundary shown 
- Disused mine shaft 
- Outcrop (Proven) 
- Outcrop (Conjectured) 



Appendix B

Borehole Logs



RECORD OF WELL (SHAFT OR BORE)

SE 10 NE 1
86/46 2

At Benjamin Armitage & Sons
Town or Village Shepley Yorks
County Six-inch quarter sheet 261 S.W.
For Mr.

Exact site of well Victoria Mills - as on published map.
1/2 mile S by E of Shepley Station (Attach a tracing from a map, or a sketch-map, if possible.)

Level of ground surface above sea-level (O.D.) feet.
Is well-top at ground level? If not, state how far above ; feet.
below ; feet.
Shaft ft., diameter ft. Details of headings

Bore 304 ft.; diameter of bore: at top 12 ins.; at bottom 10 ins.
Lengths, diameters, perforations, etc., of lining tubes 10" tubes to 14' 9"
Water struck at depths, below well-top, of (feet) 280 ft.

TEST DETAILS (Rest-level of water 92 ft. above well-top. Suction at 175 ft. Yield on 3 hours days' Month pumping 300 gallons per hour (max. capacity of pump 300 g.p.h.), Year with depression of 60 feet. Recovery to 92 ft in 1/2 mins. hours.

WORKING CONDITIONS (Rest-level of water in (month), (year), ft. above well-top. Highest " in (month), (year), ft. above " Lowest " in (month), (year), ft. above " Suction at ft. Rate of pumping galls. per for hours per day. with average depression of ft. Recovery to in mins. hours

Quality of water (attach copy of analysis if available)
Well made by Thos. Matthews, Pendleton Date of well Dec 1937
Information from

ADDITIONAL NOTES.

Visited & sited on Yorks 261 S.W. O.D. + 625. Only used when there is insufficient surface water. - Then used to supply Benjamin Armitage's & W. E. Armitage's mills. No further details of yield. Red 27-9-49.

LOG OF STRATA OVERLEAF.

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.	Date received.	G.S.M. Office File No.	1" N.S. Map No.	1" O.S. Map No.	Site marked (use symbol) on 1" Map.	on 6" Map.

2
(For Survey use only)
GEOLOGICAL CLASSIFICATION

NATURE OF STRATA

If measurements start below 3
ground surface, state how far... ..

THICKNESS

Feet Inches

DEPTH

Feet Inches

Meters

NATURE OF STRATA	THICKNESS		DEPTH		Meters
	Feet	Inches	Feet	Inches	
Stony ground (Sump)			2	-	0.61
Grey sandst. with vertical splits and clay partings. Soft yellow sandstone down one side of core	32	6	34	6	10.52
Yellow grey rock	4		38	6	11.73
Grey rock	2	6	41	-	12.5 m.
Thin COAL			44	-	"
Grey rock	8	6	49	6	15.09
Blue band with 1/4" coal seam	8	6	58	-	17.68
Black shale	36	-	94	-	28.65
Hussels			94	-	"
Dark grey band	4		98	-	29.87
Fossils, "vegetable"	5	6	103	6	31.55
Dark grey band & rock	7	-	110	6	33.68
Thin coal			110	6	"
Fine clay	4	-			
Light grey band	2		116		35.36
	8		124	-	37.80
Grey band with ("vegetable") fossils	5		129		39.32
"	11		140		42.67
Rock	2		142		43.28
Dark grey rock with V. splits.	12		154		46.94
Dark grey rock	5		159		48.46
Grey rock with black partings	11		170		51.82
Grey band	34		204		62.18
Grey rock	52		256		78.03
Grey gritstone	4		260		79.25
Grey band w. vertical split.	28		278		84.73
Brown stone	2		280		85.34
Grey band	3	6	283	6	86.41
Grey sandy shale	12	6	296	-	90.22
Grey band	8		304		92.66
Water lost at 286'0" came back					
" " " 300					



RECORD OF WELL (SHAFT OR BORE)

SE 10 NE 1
86 / 46

At Messrs. Benjamin Armitage & Son Ltd., Shepley.
Town or Village _____ County Yorks.
Exact site _____

_____ in parish of _____
Level of ground surface above sea-level (O.D.) _____ ft. If well starts below ground surface, state how far _____ ft.
Shaft _____ ft., diameter _____ ft. Bore _____ ft. Diameter of bore: at top 11 1/2 ins.; at bottom 9 3/4 ins.

Details of permanent lining tubes (internal diameters preferred) _____

Water struck at depths of (feet) _____

Rest-level of water _____ below top of well _____ feet. Suction at _____ feet. Yield on _____ hours' test _____ gallons per _____ (with pump of capacity _____ g.p.h.); depressing water level to _____ feet below top. Time of recovery _____ hrs. Amount normally pumped daily _____ g.p.h. for _____ hours.

Quality (attach copy of analysis if available) _____

Sunk by Messrs. T. Matthews for Messrs. Benjamin Armitage Date of well 1937

Information from Messrs. Thomas Matthews, Pendleton, Manchester.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS		DEPTH	
		Feet.	Inches.	Feet.	Inches.
	Stony ground		<u>0.61</u>	2	-
	Grey sandstone	<u>10.52</u>		34	6
	Yellow grey rock	<u>11.73</u>		38	6
	Grey rock with thin coal at 41 ft.	<u>14.33</u>		47	-
	Blue bind	<u>17.68</u>		58	-
	Black shale	<u>28.35</u>		93	-
	Dark grey bind with muscels at 94 ft.	<u>33.68</u>		110	6
	Blue grey rock	<u>37.80</u>		124	-
	Grey bind	<u>46.94</u>		154	-
	Grey rock	<u>51.82</u>		170	-
	Grey bind	<u>64.47</u>		211	6
	Grey rock	<u>77.11</u>		253	-
	Grey bind	<u>78.03</u>		256	-
	Grey gritstone	<u>79.40</u>		260	6
	Grey bind	<u>84.73</u>		278	-
	Brown stone	<u>85.34</u>		280	-
	Grey bind	<u>86.41</u>		283	6
	Grey sandy shale	<u>90.22</u>		296	-
	Grey bind	<u>92.66</u>		304	-

Duplicate of 86/46.

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON, S.W.7.

For Survey use only

Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)
---------------	------------------------	------------------------------------

(7993) W1.28064/0849 5,000 12/38
A.&E.W.Ltd. Gp.686

YORKSHIRE WATER AUTHORITY - Survey of Existing Boreholes			
I.G.S. Ref. No .SE.10.NE.11		N.G.R. .SE.1982.0981.....	Licence No.
OWNERS NAME .Messrs. Benjamin. Armitage & Son Ltd .aka Johnson Smith Ltd		App No 771	Authorised Abstraction
ADDRESS		g.p.h. g.p.d. m.g.a.	
..... Shepley			
STRAATA DETAILS	Thick ^{ns}	Depth	
Stony gravel	2'	
Grey s/sst	34.6"	
Yellow grey rock	88' 6"	
Rock + clastic sil	47'	
"	41'	
Blue sand	58'	
Black s.s. sil	93'	
Dark grey band	110'	
+ remains of sil	124'	
Blue grey rock	154'	
Grey band	178'	
Grey rock	211' 6"	
" band	253'	
" rock	256'	
" band	266' 8"	
" gritstone	278'	
" band	289'	
Brown stone	283' 6"	
Grey band	296'	
" sandy shale	304'	
Grey band		
			Dia.
			Depth .. 92m
			Lining
			Well sinker <i>Matthew</i>
			Date .1937.....
			R.W.L. .92' = 28.04m
			R.W.

- 8m -
160' PUMP



INSPECTION REPORT	WATER QUALITY	DATE OF INSPECTION:-
Present Owner:- Access (Yes or No) ½" Probe 3" Instruments Landrover Access Agreed	Date pH Total hard Temp.hard Alk. <hr/> Ca Mg Na K	Other Comments:- <hr/> Sketch Plan of Location
Water Level at time of insp. metres below Date Datum above O.D. R.W.L. above O.D. Date	HCO ₃ SO ₄ Cl NO ₃ <hr/> Fe	



RECORD OF WELL (SHAFT OR BORE)

8. **86** SE10/5
46
SE10NE1

SE1981 0984

By Benjamin Armitage & Sons

Town or Village Shepley Yates

County Six-inch quarter sheet 261 S.W.

For Mr. _____

Exact site of well Victoria Mills - 60 on published map.

1/2 mile S by E of Shepley Station

Attach a tracing from a map, or a sketch-map, if possible.

Level of ground surface above sea-level (O.D.) _____ feet.

Is well-top at ground level? _____ If not, state how far above; _____ below; _____ feet.

Shaft _____ ft., diameter _____ ft. Details of headings _____

Bore 304 ft.; diameter of bore: at top 12 ins.; at bottom 10 ins.

Lengths, diameters, perforations, etc., of lining tubes 10" tubes to 14'9"

Water struck at depths, below well-top, of (feet) 280 ft.

TEST DETAILS { Rest-level of water 92 ft. ^{above} below well-top. Suction at 175 ft. Yield on 3 ^{hours} days' pumping 300 gallons per hour (max. capacity of pump 300 g.p.h.), with depression of 60 feet. Recovery to 92 ft. in 1/2 ^{mins.} hours.

WORKING CONDITIONS { Rest-level of water in _____ (month), _____ (year), _____ ft. ^{above} below well-top. Highest " in _____ (month), _____ (year), _____ ft. ^{above} below " Lowest " in _____ (month), _____ (year), _____ ft. ^{above} below " Suction at _____ ft. Rate of pumping _____ galls. per _____ for _____ hours per day, with average depression of _____ ft. Recovery to _____ in _____ ^{mins.} hours

Quality of water (attach copy of analysis if available) _____

Well made by Thos. Matthews, Pendleton Date of well Dec 1937

Information from " " " " " "

ADDITIONAL NOTES.

Visited & sited on fonts 261 S.W. O.D. + 625. Only used when there is insufficient surface water. - Then used to supply Benjamin Armitage & W. B. Armitage mills. See further details of yield **Red** 27.9.49.

LOG OF STRATA OVERLEAF.

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON, S.W.7.

Date received.	G.S.M. Office File No.	1" N.S. Map No.	1" O.S. Map No.	Sites marked (use symbol) on 1" Map.	on 6" Map.

(For Survey use only)
GEOLOGICAL CLASSIFICATION

NATURE OF STRATA

If measurements start below ground surface, state how far... ..

THICKNESS

Feet Inches

SE10/5
DEPTH

Feet Inches

Strong ground (Summit)			2	-
Grey sandst. with vertical splits and clay partings. Soft yellow sandstone down one side of core	32	6	34	6
Yellow grey rock	4		38	6
Grey rock	2	6	41	-
Thin COAL			41	-
Grey rock	8	6	49	6
Blue limd with 1/4" coal seams	8	6	58	-
Black shale	36	-	94	-
Mussels			94	
Dark grey limd	4		98	-
Fossils, "vegetable"	5	6	103	6
Dark grey limd & rock	7	-	110	6
Thin coal			110	6
Fine clay	4	-		
Light grey limd	2		116	
	8		124	
Grey limd with ("vegetable") fossils	5		129	
"	11		140	
Rock	2		142	
Dark grey rock with v. splits.	12		154	
Dark grey rock	5		159	
Grey rock with black partings	11		170	
Grey limd	34		204	
Grey rock	52		256	
Grey gritstone	4		260	
Grey limd w. vertical splits.	28		278	
Brown stone	2		280	
Grey limd	3	6	283	6
Grey sandy shale	13	6	296	-
Grey limd	8		304	
Water lost at 286'0" sand bottle				
" " " 300				

86
4



77

SE10/22

FORM WR-38
CENTRAL LS
NORTH-EAST EA
(Please type) (No 2)

National Rivers Authority

..... Region

BOREHOLE RECORD

NRA No. B1107

A. SITE DETAILS		SE10NE/20
Borehole drilled for	EASTFIELD MILLS -	
Location	SHEPLEY - HUDDERSFIELD	
NGR (8 fig.)	SE1984 0977	Please attach site plan
Ground Level (if known) ..		
Drilling Company	M & D DRILLING Co. LTD.	
Date of drilling	Commenced: DEC-99 Completed: 14-1-00	
B. CONSTRUCTION DETAILS		
Borehole datum (if not ground level).....	G.L.	above m below GL
(point from which all measurements of depth are taken eg flange, edge of chamber, etc)		
Borehole drilled diameter	368 mm from 0	to 18.00 m/depth
	200 mm from 18	to 72.50 m/depth
	mm from	to m/depth
Casing material <u>STEEL</u> diameter and type (eg plain steel, plastic slotted)	200 mm from 0	to 18.00 m/depth
	diameter mm from	to m/depth
	diameter mm from	to m/depth
	diameter mm from	to m/depth
Grouting details	ANNULUS GROUTED	
Water struck at	50.00	m (depth below datum - mbd)
	62.00	m (depth below datum - mbd)
Rest water Level on completion	36.00	mbd
C. TEST PUMPING SUMMARY (Please supply full details on Forms WR-39)		
Test Pumping Datum (if different from borehole datum)		above m below borehole datum (mbd)
Pump Suction Depth		mbd NOT CARRIED
Water Level (Start of Test)		mbd OUT TO DATE
Water Level (End of Test)		mbd
Pumping rate		m ³ /d : l/s
for		days/hours
Recovery to (from end of pumping)	mbd in	mins : hrs : days
Date(s) of measurements		
Please Supply Chemical Analysis If Available		



SE10/22

FORM WR-38 (cont.)

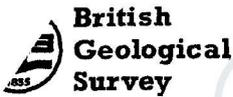
(Please type)

NRA No.	
---------	--

D. STRATA LOG			
Geological Classification (BGS only)	Description of strata	Thickness m	Depth m
	FILL	2.00	2.00
	SANDSTONE BROWN	15.00	17.00
	BLACK SHALE	12.80	29.80
	SANDSTONE GREY	6.70	36.50
	GREY MUDSTONE SANDSTONE BANDS.	13.30	49.80
	SANDSTONE GREY	22.70	72.50
[continue on separate page if necessary]			
Other Comments (eg gas encountered, saline water intercepted, etc)			

FOR OFFICIAL USE ONLY			
FILE	CONSENT NO	BGS REF NO	
LICENCE NO	USE OF BH	NGR	

Form 85



HYDROGEOLOGY RESEARCH GROUP

77

SE10/21

Form WR-38 (BGS)

BOREHOLE RECORD

(No. 1) B1107

CENTRAL LS NORTHEAST EA

SE10NE (2)

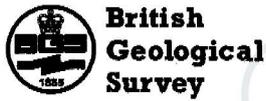
A SITE DETAILS	
Borehole drilled for	EAST FIELD MILLS
Location	SHEPLEY - HUDDERSFIELD
NGR (8 fig.)	SE 1977. 0983 Please attach site plan
Ground Level (if known)	
Drilling Company	MJD DRILLING Co. LTD.
Date of Drilling	Commenced DEC. 99 Completed 14-1-00
B CONSTRUCTION DETAILS	
Borehole Datum (if not ground level)	<u>GL.</u> above m below GL
(point from which all measurements of depth are taken e.g. flange, edge of chamber, etc.)	
Borehole drilled diameter	<u>368</u> mm from <u>0</u> to <u>18.50</u> m/depth
	<u>200</u> mm from <u>18.5</u> to <u>83.00</u> m/depth
	_____ mm from _____ to _____ m/depth
Casing material <u>STEEL</u> diameter and type (e.g. if plain steel, plastic slotted)	<u>200</u> mm from <u>0</u> to <u>18.50</u> m/depth
_____ diameter	_____ mm from _____ to _____ m/depth
_____ diameter	_____ mm from _____ to _____ m/depth
_____ diameter	_____ mm from _____ to _____ m/depth
Grouting details	<u>ANNULUS GROUTED</u>
Water struck at	<u>46.00</u> m (depth below datum — mbd)
	<u>71.00</u> m (depth below datum — mbd)
Rest water level on completion	<u>37.00</u> mbd
C TEST PUMPING SUMMARY (Please supply full details on Forms WR-39)	
Test Pumping Datum (if different from borehole datum)	_____ m above below borehole datum (mbd)
Pump Suction depth	_____ mbd
Water Level (Start of Test)	_____ mbd NOT Carried out
Water Level (End of Test)	_____ mbd TO DATE
Pumping rate	_____ m ³ /d:l/s
for _____	_____ days/hours
Recovery to (from end of pumping)	_____ mbd in _____ mins: hrs: days
Date(s) of measurements	_____
Please supply chemical Analysis if available.	

NGDC
 ACCESSION
 NUMBER
36964



D STRATA LOG		SE10/21	
Geological Classification	Description of strata	Thickness	Depth
(BGS only)		m	m
	FILL	0.30	0.30
	SANDSTONE BROWN	15.50	15.80
	BLACK SHALE	12.80	28.60
	SANDSTONE GREY	7.40	36.00
	GREY MUDSTONE/SANDSTONE BANDS.	12.30	48.30
	SANDSTONE GREY	28.70	77.00
	MUDSTONE GREY	6.00	83.00
(continue on separate page if necessary)			
Other comments (e.g. gas encountered, saline water intercepted, etc.)			

FOR OFFICIAL USE ONLY		
FILE	CONSENT NO.	NGS REF NO.
LIC NO.	PURPOSE	NRA REF NO.
DATE REC:	COPY TO:	ENTERED BY:



HYDROGEOLOGY RESEARCH GROUP

7.7

SE 10 / 21

Form WR-38 (BGS)

BOREHOLE RECORD

(No.1) B1107

CENTRAL LS NORTHEAST EA

SE10NE/21

A SITE DETAILS	
Borehole drilled for	EAST FIELD MILLS
Location	SHEPLEY - HUDDERSFIELD
NGR (8 fig.)	SE 1977. 0983 Please attach site plan
Ground Level (if known)	
Drilling Company	MJD DRILLING Co. LTD.
Date of Drilling	Commenced DEC. 99 Completed 14-1-00
B CONSTRUCTION DETAILS	
Borehole Datum (if not ground level)	<u>g.l.</u> above m below GL
(point from which all measurements of depth are taken e.g. flange, edge of chamber, etc.)	
Borehole drilled diameter	<u>368</u> mm from <u>0</u> to <u>18.50</u> m/depth
	<u>200</u> mm from <u>18.5</u> to <u>83.00</u> m/depth
	_____ mm from _____ to _____ m/depth
Casing material <u>STEEL</u> diameter and type (e.g. if plain steel, plastic slotted)	<u>200</u> mm from <u>0</u> to <u>18.50</u> m/depth
_____ diameter	_____ mm from _____ to _____ m/depth
_____ diameter	_____ mm from _____ to _____ m/depth
_____ diameter	_____ mm from _____ to _____ m/depth
Grouting details	<u>ANNULUS GROUTED</u>
Water struck at	<u>46.00</u> m (depth below datum — mbd)
	<u>71.00</u> m (depth below datum — mbd)
Rest water level on completion	<u>37.00</u> mbd
C TEST PUMPING SUMMARY (Please supply full details on Forms WR-39)	
Test Pumping Datum (if different from borehole datum)	_____ m above below borehole datum (mbd)
Pump Suction depth	_____ mbd
Water Level (Start of Test)	_____ mbd
Water Level (End of Test)	_____ mbd
Pumping rate	_____ m ³ /d:l/s
for	_____ days/hours
Recovery to (from end of pumping)	_____ mbd in _____ mins: hrs: days
Date(s) of measurements	_____
Please supply chemical Analysis if available.	

NOT Carried out
To DATE



D STRATA LOG		SE10/21	
Geological Classification	Description of strata	Thickness	Depth
(BGS only)		m	m
	FILL	0.30	0.30
	SANDSTONE BROWN	15.50	15.80
	BLACK SHALE	12.80	28.60
	SANDSTONE GREY	7.40	36.00
	GREY MUDSTONE/SANDSTONE BANDS.	12.30	48.30
	SANDSTONE GREY	28.70	77.00
	MUDSTONE GREY	6.00	83.00
(continue on separate page if necessary)			
Other comments (e.g. gas encountered, saline water intercepted, etc.)			

FOR OFFICIAL USE ONLY		
FILE	CONSENT NO.	NGS REF NO.
LIC NO.	PURPOSE	NRA REF NO.
DATE REC:	COPY TO:	ENTERED BY:

SURVEY OF EXISTING BOREHOLES		ENVIRONMENT AGENCY
B.G.S. Ref. No. N.G.R. SE 2000 0909		Licence No.
Owners Name SHEPLEY SPRING WATER - BORE HOLE 4 Address THE KNOWLE SHEPLEY HUDDERSFIELD		App No. Authorised Abstraction tcma cu m/d cu m/h
STRATA DETAILS	Thick	Depth
Top soil	0.40	0.40
Clay brown	2.70	3.10
Sandstone brown	0.50	3.60
Grey mudstone	2.30	5.90
Sandstone	1.50	7.40
Grey mudstone	1.40	8.80
Sandstone	1.40	10.20
Grey mudstone	4.30	14.50
Black shale, coal traces	0.70	15.20
Grey mudstone	2.40	17.60
Sandstone	3.20	20.80
Sandstone, bands	0.70	21.50
Sandstone	1.50	23.00
Grey mudstone	1.10	24.10
Black shale	0.50	24.60
Grey mudstone, Sandstone bands	4.20	28.80
Sandstone, green	1.60	30.40
Grey mudstone, Sandstone bands	9.60	40.00
381mm from O to 18.00 m/depth Dia. 250mm from 0 to 40.00 m/depth Depth 40.00 m/depth Lining STEEL 51800m Well Sinker M & D Drilling Date 22.10.2002 - 14.11.2002 R.W.L. 12.00m P.W.L. Rate		

Conductivity 20°C 386 µS/cm
pH 7.0

Boron	22 µg/l	B	Sulphate	37.1 mg/l	SO ₄
Arsenic	1.32 µg/l	As	Calcium	55.9 mg/l	Ca
Cadmium	<0.09 µg/l	Cd	Magnesium	11.5 mg/l	Mg
Chromium	1.13 µg/l	Cr	Sodium	14.0 mg/l	Na
Mercury	<0.100 µg/l	Hg	Potassium	1.93 mg/l	K
Nickel	<1.0 µg/l	Ni	Nitrate	<1.000 mg/l	NO ₃
Selenium	<0.3 µg/l	Se	Iron	34.06 µg/l	Fe
Copper	<3 µg/l	Cu	Manganese	4.16 µg/l	Mn
Lead	<0.3 µg/l	Pb			
Zinc	<6 µg/l	Zn			
Chloride	28.5 mg/l	Cl			

FORM WR - 38

Agency No:



ENVIRONMENT AGENCY

SOUTHERN L.S.

BOREHOLE RECORD
NORTH EAST E.A.

SE20/44

A. SITE DETAILS Bore Hole 4

86

SE20/NW38

Borehole drilled for	SHEPLEY SPRING WATER	
Location	THE KNOWLE SHEPLEY HUDDERSFIELD	
NGR (8 fig) Ground Level (if known)	SE 2000 0909	Please attach site plan
Drilling Company	M&D DRAWING	
Date of drilling	Commenced: 22-10-2002 Completed: 14-11-2002	

B. CONSTRUCTION DETAILS

Borehole datum (if not ground level).....	GROUND LEVEL		above
(point from which all measurements of depth are taken eg flange, edge of chamber, etc)			m below GL
Borehole drilled diameter	381 mm from 0	to 18.00	m/depth
	250 mm from 18.00	to 40.00	m/depth
	mm from	to	m/depth
Casing material <u>STEEL</u> diameter	250 mm from 0	to 18.00	m/depth
and type (eg plain steel, plastic slotted)			
diameter	2 mm from	to	m/depth
diameter	mm from	to	m/depth
diameter	mm from	to	m/depth
Grouting details	ANNULUS GROUTED		
Water struck at	3.50 - 5.90 - 8.80 m (depth below datum - mbd)		
	20.80 - 22.00 m (depth below datum - mbd)		
Rest water level on completion	12.00 m (depth below datum - mbd)		

SE20/44

C. TEST PUMPING SUMMARY (Please supply fully details on Form WR - 39)

Test Pumping Datum (if different from borehole datum)	_____	above m below borehole datum (mbd)
Pump Suction Depth	_____	mbd
Water Level (Start of Test)	_____	mbd
Water Level (End of Test)	_____	mbd
Pumping rate	_____	m ³ /d : l/s
for	_____	days/hours
Recovery to (from end of pumping)	_____ mbd in _____	mins : hrs : days
Date(s) of measurements	_____	
Please Supply Chemical Analysis If Available	ATTACHED	

D. STRATA LOG

Geological Classification	Description of Strata	Thickness	Depth
(BGS only)		m	m
	TOP SOIL	0-40	0-40
	CLAY, BROWN	2-70	3-10
	SANDSTONE, BROWN	0-50	3-60
	GREY MUDSTONE	2-30	5-90
	SANDSTONE	1-50	7-40
	GREY MUDSTONE	1-40	8-80
	SANDSTONE	1-40	10-20
	GREY MUDSTONE	4-30	14-50
	BLACK SHALE, COAL TRACES	0-70	15-20
	GREY MUDSTONE	2-40	17-60
	SANDSTONE	3-20	20-80
	SANDSTONE, BROWN	0-70	21-50
	SANDSTONE	1-50	23-00
	GREY MUDSTONE	1-10	24-10
	BLACK SHALE	0-50	24-60
	GREY MUDSTONE, SANDSTONE BANDS	4-20	28-80
	SANDSTONE, GREY	1-60	30-40
	GREY MUDSTONE, SANDSTONE BANDS.	9-60	40-00
	[continue on separate page if necessary]		
	Other Comments (eg gas encountered, saline water intercepted, etc)		

FOR OFFICIAL USE ONLY		
FILE	CONSENT NO	BGS REF NO
LICENCE NO	USE OF BH	NGR.....



ALcontrol Laboratories

Bradford Laboratory, George Street, Bradford BD1 5PZ (Lab No 0996)
Rotherham Laboratory, Templeborough House, Rotherham, S60 1BZ (Lab No 2300)
Telephone (0845) 1200 400 Facsimile: (01709) 841079

Certificate ID : 99432524/S/0/1

SE20/44

Certificate of Analysis

Kirklees Metropolitan Council
Environmental Health Department
West Riding House
9 Manchester Road
Huddersfield
HD1 3HH

Sample Date: 05/12/02
Sample Received: 05/12/02
Analysis Completed: 31/12/02

Batch Number: 2005740

KPW 619
Shepley Springs, BH4 **BONE HOLE 4.**

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
RP901.0	Conductivity 20C	386	uS/cm	1500	
RP901.0	pH	7.0	-	5.5 - 9.5	
*B	Odour qualitative	1	PRES/ABS		
*B	Taste qualitative	0	PRES/ABS		
*B	Odour dilution no	0	ODN	3	
*B	Taste dilution no	0	TDN	3	
RP901.0	Turbidity	22.3	FTU	4.00	Fail
RP902.0.6	Nitrate	< 1.000	mg/l NO3	50.000	
RP902.0.5	Nitrite	< 0.010	mg/l NO2	0.100	
*RP902.0.	Nitrogen tot oxid	< 1.000	mg/l NO3		
RP902.0.4	Ammoniacal Nitrogen	0.11	mg/l NH4	0.50	
RP908.B	Iron	3406	ug/l Fe	200	Fail
RP908.B	Aluminium	< 13	ug/l Al	200	
RP908.B	Manganese	416	ug/l Mn	50.0	Fail
RP901.0	Colour True	< 1.7	Hazen	20.0	
*R	Trihalomethanes - total	< 4.0	ug/l	100	
RP907.9A	Trichloromethane	< 0.9	ug/l		
RP907.9A	1,2-Dichloroethane	< 0.3	ug/l		
RP907.9A	Benzene	< 0.15	ug/l		

Page 1 of 9

Tests marked \$ in this report are subcontracted. Methods prefixed B were performed at the Bradford Lab, methods prefixed R were performed at the Rotherham Lab, addresses above. Tests marked * in this report are not included in the UKAS Accreditation Schedule for our laboratory. Sampling, opinions and interpretations expressed herein are outside the scope of UKAS Accreditation. Method details and performance characteristics are available on request. < = Less than, > = greater than. For taste and odour 1 = present, 0 = absent. # = Data supplied by client For softened water supply minimum concentrations apply for hardness (50mg/l as Ca) and alkalinity (30mg/l) as HCO3



0995
0996
2300

ALcontrol Laboratories is a trading division of ALcontrol UK Limited. Registered Office: Templeborough House, Mill Close, Rotherham S60 1BZ. Registered in England and Wales No. 4057291



ALcontrol Laboratories

Bradford Laboratory, George Street, Bradford BD1 5PZ (Lab No 0996)
Rotherham Laboratory, Templeborough House, Rotherham, S60 1BZ (Lab No 2300)
Telephone (0545) 1200 400 Facsimile: (01709) 841079

Certificate ID : 99432524/S/0/1

SE20/44

Certificate of Analysis

Kirklees Metropolitan Council
Environmental Health Department
West Riding House
9 Manchester Road
Huddersfield
HD1 3HH

Sample Date: 05/12/02
Sample Received: 05/12/02
Analysis Completed: 31/12/02

Batch Number: 2005740

KPW 619
Shepley Springs, BH4

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
RP907.9A	Tetrachloromethane	< 0.1	ug/l		
RP907.9A	Trichloroethene	< 0.6	ug/l		
RP907.9A	Dichlorobromomethane	< 0.3	ug/l		
RP907.9A	Dibromochloromethane	< 0.4	ug/l		
RP907.9A	Tetrachloroethene	< 0.3	ug/l		
RP907.9A	Tribromomethane	< 0.7	ug/l		
*R	PAH	< 0.020	ug/l	0.200	
RP907.8	Fluoranthene	< 0.3	ng/l		
RP907.8	Benzo 1, 12, perylene	< 0.1	ng/l		
RP907.8	Benzo 11 12, fluoranthene	< 0.1	ng/l		
RP907.8	Indeno (1,2,3-cd) pyrene	< 0.1	ng/l		
RP907.8	Benzo-3,4-fluoranthene	< 0.1	ng/l		
RP907.8	Benzo-3,4-pyrene	< 0.1	ng/l	10.0	
RP907.10	Dichlorobenil	< 0.008	ug/l	0.100	
RP907.10	EPTC	< 0.007	ug/l	0.100	
RP907.10	Simazine	< 0.005	ug/l	0.100	
RP907.10	Atrazine	< 0.005	ug/l	0.100	
RP907.10	Trietazine	< 0.007	ug/l	0.100	
RP907.10	Triallate	< 0.010	ug/l	0.100	
RP907.10	Bromacil	< 0.027	ug/l	0.100	
RP907.10	Chlorpyriphos	< 0.094	ug/l	0.100	

Page 2 of 9

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0995
0996
2300

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Telephone (0345) 1200 400 Facsimile: (01709) 841079

Certificate ID : 99432524/S/0/1

SE20/44

Certificate of Analysis

Kirklees Metropolitan Council
Environmental Health Department
West Riding House
9 Manchester Road
Huddersfield
HD1 3HH

Sample Date: 05/12/02
Sample Received: 05/12/02
Analysis Completed: 31/12/02

Batch Number: 2005740

KPW 619
Shepley Springs, BH4

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
RP907.10	Triadimefon	< 0.021	ug/l	0.100	
RP907.10	Pendimethalin	< 0.019	ug/l	0.100	
RP907.10	Flutriafol	< 0.021	ug/l	0.100	
RP907.10	Fluazifop-p-butyl	< 0.020	ug/l	0.100	
RP907.10	Triazophos	< 0.038	ug/l	0.100	
RP907.10	Propiconazole	< 0.020	ug/l	0.100	
RP907.10	Phosalone	< 0.020	ug/l	0.100	
RP907.4	Propham	< 0.008	ug/l	0.100	
RP907.3	PCB 28	< 0.0025	ug/l		
RP907.3	PCB 52	< 0.0026	ug/l		
RP907.3	PCB 101	< 0.0011	ug/l		
RP907.3	PCB 118	< 0.0028	ug/l		
RP907.3	PCB 153	< 0.0025	ug/l		
RP907.3	PCB 138	< 0.0030	ug/l		
RP907.3	PCB 180	< 0.0049	ug/l		
RP907.4	Azinphos-methyl	< 0.028	ug/l	0.100	
RP907.4	Bifenox	< 0.016	ug/l	0.100	
RP907.4	Carbophenothion	< 0.025	ug/l	0.100	
RP907.4	Chlorfenvinphos	< 0.015	ug/l	0.100	
RP907.4	Cyanazine	< 0.024	ug/l	0.100	
RP907.4	Desmetryne	< 0.012	ug/l	0.100	

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Environmental Health Department
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9 Manchester Road
Huddersfield
HD1 3HH

Sample Date: 05/12/02
Sample Received: 05/12/02
Analysis Completed: 31/12/02

Batch Number: 2005740

KPW 619
Shepley Springs, BH4

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
RP907.4	Diazinon	< 0.007	ug/l	0.100	
RP907.4	Dichlorvos	< 0.015	ug/l	0.100	
RP907.4	Fenitrothion	< 0.015	ug/l	0.100	
RP907.4	Fenpropidin	< 0.030	ug/l	0.100	
RP907.4	Fenpropimorph	< 0.020	ug/l	0.100	
RP907.4	Iprodione	< 0.025	ug/l	0.100	
RP907.4	Malathion	< 0.021	ug/l	0.100	
RP907.4	Oxadixyl	< 0.014	ug/l	0.100	
RP907.4	Parathion-ethyl	< 0.013	ug/l	0.100	
RP907.4	Prometryne	< 0.010	ug/l	0.100	
RP907.4	Propazine	< 0.004	ug/l	0.100	
RP907.4	Propetamphos	< 0.017	ug/l	0.100	
RP907.4	Propyzamide	< 0.004	ug/l	0.100	
RP907.4	Terbuthylazine	< 0.006	ug/l	0.100	
RP907.4	Dimethoate	< 0.021	ug/l	0.100	
RP907.4	Terbutryn	< 0.010	ug/l	0.100	
RP907.6	2,4 DB	< 0.050	ug/l	0.100	
RP907.6	2,4-D	< 0.007	ug/l	0.100	
RP907.6	2,4,5-T(acid)	< 0.010	ug/l	0.100	
RP907.6	Bentazone	< 0.004	ug/l	0.100	
RP907.6	Bromoxynil	< 0.005	ug/l	0.100	

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Environmental Health Department
West Riding House
9 Manchester Road
Huddersfield
HD1 3HH

Sample Date: 05/12/02
Sample Received: 05/12/02
Analysis Completed: 31/12/02

Batch Number: 2005740

KPW 619
Shepley Springs, BH4

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
RP907.6	Clopyralid	< 0.020	ug/l	0.100	
RP907.6	Dicamba	< 0.006	ug/l	0.100	
RP907.6	Dichlorprop	< 0.010	ug/l	0.100	
RP907.6	2,4,5-TP	< 0.010	ug/l	0.100	
RP907.6	Fluoxypyr	< 0.017	ug/l	0.100	
RP907.6	Imazapyr	< 0.040	ug/l	0.100	
RP907.6	Ioxynil	< 0.006	ug/l	0.100	
RP907.6	MCPA	< 0.004	ug/l	0.100	
RP907.6	MCPB	< 0.023	ug/l	0.100	
RP907.6	MCPD	< 0.005	ug/l	0.100	
RP907.6	Triclopyr	< 0.005	ug/l	0.100	
RP907.6	Pentachlorophenol	< 0.006	ug/l		
RP907.5	Carbetamide	< 0.007	ug/l	0.100	
RP907.5	Chlorpropham	< 0.006	ug/l	0.100	
RP907.5	Chlorotoluron	< 0.007	ug/l	0.100	
RP907.5	Diuron	< 0.007	ug/l	0.100	
RP907.5	Isoproturon	< 0.009	ug/l	0.100	
RP907.5	Linuron	< 0.006	ug/l	0.100	
RP907.5	Monuron	< 0.006	ug/l	0.100	
RP907.3	Aldrin	< 0.0053	ug/l	0.0300	

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Sample Received: 05/12/02
Analysis Completed: 31/12/02

Batch Number: 2005740

KPW 619
Shepley Springs, BH4

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
RP907.3	trans-Chlordane	< 0.0059	ug/l		
RP907.3	cis-Chlordane	< 0.0045	ug/l		
RP907.3	Chlordane	< 0.010	ug/l	0.100	
RP907.3	Chlorothalonil	< 0.0041	ug/l	0.100	
RP907.3	DDE (pp)	< 0.0013	ug/l	0.100	
RP907.3	DDT (op)	< 0.0047	ug/l	0.100	
RP907.3	DDT (pp)	< 0.0036	ug/l	0.100	
RP907.3	Dieldrin	< 0.0022	ug/l	0.0300	
RP907.3	Endosulphan a	< 0.0022	ug/l	0.100	
RP907.3	Endosulphan b	< 0.0040	ug/l	0.100	
RP907.3	Endrin	< 0.0032	ug/l	0.100	
RP907.3	Hexachlorobenzene	< 0.0014	ug/l	0.100	
RP907.3	Hexachloro-1,3-butadiene	< 0.0052	ug/l		
RP907.3	HCH - alpha	< 0.0018	ug/l	0.100	
RP907.3	HCH - beta	< 0.0019	ug/l	0.100	
RP907.3	HCH - delta	< 0.0016	ug/l	0.100	
RP907.3	HCH - gamma	< 0.0008	ug/l	0.100	
RP907.3	Heptachlor	< 0.0024	ug/l	0.100	
RP907.3	Heptachlor epoxide B	< 0.0022	ug/l		
RP907.3	Heptachlor epoxide A	< 0.0021	ug/l		
RP907.3	Heptachlor epoxide	< 0.004	ug/l	0.100	

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SE20/44

Kirklees Metropolitan Council
Environmental Health Department
West Riding House
9 Manchester Road
Huddersfield
HD1 3HH

Sample Date: 05/12/02
Sample Received: 05/12/02
Analysis Completed: 31/12/02

Batch Number: 2005740

KPW 619
Shepley Springs, BH4

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
RP907.3	Isodrin	< 0.0054	ug/l	0.100	
RP907.3	Methoxychlor	< 0.0033	ug/l	0.100	
RP907.3	Quintozene	< 0.0017	ug/l	0.100	
RP907.3	op-DDE	< 0.0020	ug/l	0.100	
RP907.3	TDE (op)	< 0.0028	ug/l	0.100	
RP907.3	Tecnazene	< 0.0022	ug/l	0.100	
RP907.3	TDE (pp)	< 0.0027	ug/l	0.100	
RP907.3	Trifluralin	< 0.0037	ug/l	0.100	
RP908.B	Copper	< 3	ug/l Cu	3000	
RP908.D	Lead	< 0.3	ug/l Pb	50.0	
RP908.B	Zinc	< 6	ug/l Zn	5000	
RP902.0.3	Chloride	28.5	mg/l Cl	400	
RP908.B	Sulphate	37.1	mg/l SO4	250	
RP908.B	Calcium	55.9	mg/l Ca	250	
RP908.B	Magnesium	11.5	mg/l Mg	50.0	
RP908.B	Sodium	14.0	mg/l Na	150	
RP908.B	Potassium	1.93	mg/l K	12.0	
RP911.2	Solids dissolved at 180C	278	mg/l	1500	
RP905.3	Permanganate index	4.11	mg/l O2		
RP903.13	Total Organic Carbon	1.11	mg/l C		

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SE20/44

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West Riding House
9 Manchester Road
Huddersfield
HD1 3HH

Sample Date: 05/12/02
Sample Received: 05/12/02
Analysis Completed: 31/12/02

Batch Number: 2005740

KPW 619
Shepley Springs, BH4

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
RP908.B	Boron	22	ug/l B	2000	
RP906.3	Surfactants	< 20	ug/l	200	
RP908.B	Phosphorus	113	ug/l P	2200	
RP903.4	Fluoride	276	ug/l F	1500	
RP908.B	Barium	148	ug/l Ba	1000	
RP908.D	Silver	< 0.5	ug/l Ag	10.0	
RP908.D	Arsenic	1.32	ug/l As	50.0	
RP908.D	Cadmium	< 0.09	ug/l Cd	5.0	
RP902.2	Cyanide (Free)	< 5.0	ug/l CN	50.0	
RP908.D	Chromium	1.13	ug/l Cr	50.0	
RP908.D	Mercury	< 0.100	ug/l Hg	1.00	
RP908.D	Nickel	< 1.0	ug/l Ni	50.0	
RP908.D	Antimony	< 0.05	ug/l Sb	10.0	
RP908.D	Selenium	< 0.3	ug/l Se	10.0	
RP908.B	Hardness total	75	mg/l Ca		
RP902.0.7	Alkalinity total	178.1	mg/l HCO3		
BP50.3	Total coliforms	0	No/100ml	0	
BP50.3	Faecal coliforms	0	No/100ml	0	
	Chlorine free	< 0.05	mg/l Cl		
	Chlorine total	< 0.05	mg/l Cl		

Page 8 of 9

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Batch Number: 2005740

KPW 619
Shepley Springs, BH4

Laboratory Number: 99432524

Method	Determination	Result	Units	PCV	Note
BP50.5	Colonies 1 day 37c	5	No/ml		
BP50.5	Colonies 3 day 22c	38	No/ml		

COMMENTS

Slight Odour Of Sulphide Present On Opening The Bottle, This Odour Was Lost When The Sample Was Warmed For The Quantitative Test.

Approved By (Sig: **Redacted**)

Steve Scott (Operations Manager)
02/01/03

Page 9 of 9

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SURVEY OF EXISTING BOREHOLES



B.G.S. Ref. No. N.G.R. SE 2002 0955

Licence No.

Owners Name SHEPLEY SPRING WATER - BOREHOLES
Address THE KNOWLE SHEPLEY HUDDERSFIELD

App No.

Authorised Abstraction

tcma

cu m/d

cu m/h

STRATA DETAILS	Thick m	Depth m
Top soil	0.30	0.30
Clay Sandstone bands	2.50	2.80
Grey mudstone	5.20	8.00
Sandstone	6.60	14.60
Grey mudstone, Sandstone bands	13.70	28.30
Sandstone	1.30	29.60
Grey mudstone, Sandstone bands	7.90	37.50
Black shale	2.70	40.20
Grey mudstone, Sandstone bands	3.30	43.50
Sandstone	17.10	60.60
Black shale	11.30	71.90
Grey mudstone, Sandstone bands	14.10	86.00
Sandstone	4.60	90.60
Grey mudstone, Sandstone bands	15.60	106.00
Sandstone	11.80	117.80
Grey mudstone, Sandstone bands	22.20	140.00

Dia. 170mm from 0 to 11m depth
281mm from 11 to 18m depth
250mm from 18 to 20m depth
170mm from 20 to 140m depth

Depth 140m

Lining STEEL to 18.00m depth

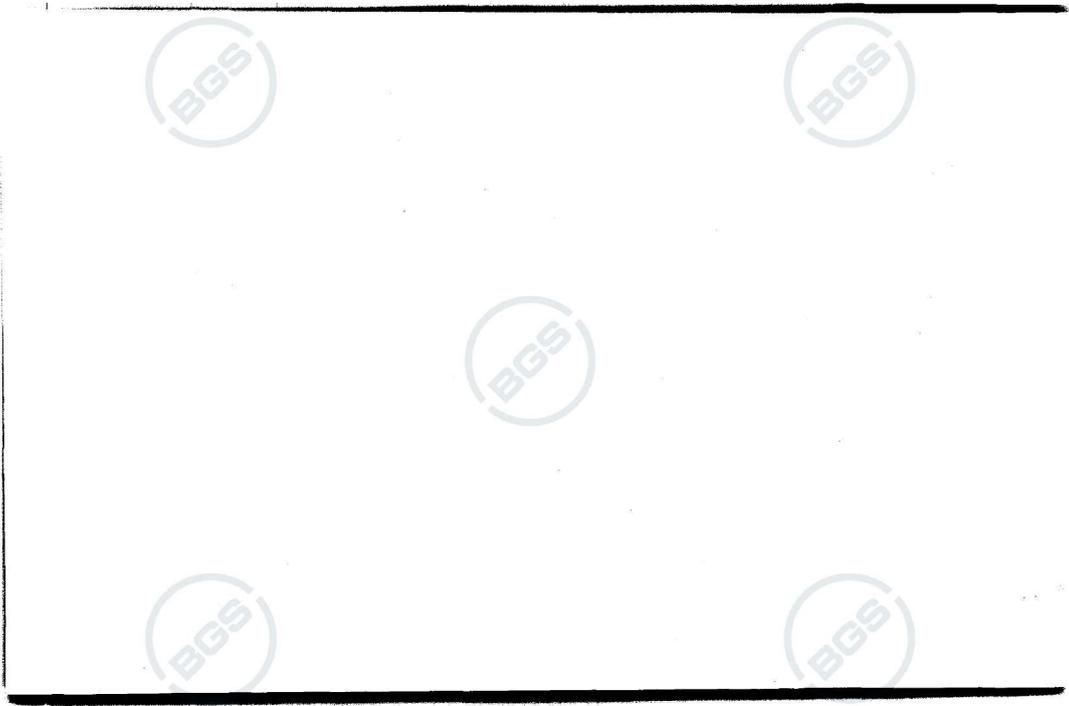
Well Sinker M&D Drilling

Date 17-11-2002 - 20-12-2002

R.W.L. 9.5.83m

P.W.L.

Rate



FORM WR - 38

Agency No:



ENVIRONMENT AGENCY

BOREHOLE RECORD

A. SITE DETAILS

Bore Hole S. 86

SE20/45

SE20/MW39

Borehole drilled for	SUGLEY SPRING WATER	
Location	THE KNOWLE SUGLEY HUDDERSFIELD	
NGR (8 fig) Ground Level (if known)	SE 2002 0955.	Please attach site plan
Drilling Company	MCD DRIVING.	
Date of drilling	Commenced: 17-11-2002 Completed: 20-12-2002	

B. CONSTRUCTION DETAILS

Borehole datum (if not ground level).....	GROUND LEVEL	above
(point from which all measurements of depth are taken eg flange, edge of chamber, etc)		m below GL
Borehole drilled diameter	381 mm from 0	to 18.00 m/depth
	250 mm from 18.00	to 130.00 m/depth
	170 mm from 130.00	to 140.00 m/depth
Casing material <u>STEEL</u> diameter	250 mm from 0	to 18.00 m/depth
and type (eg plain steel, plastic slotted)		
_____ diameter	_____ mm from _____	to _____ m/depth
_____ diameter	_____ mm from _____	to _____ m/depth
_____ diameter	_____ mm from _____	to _____ m/depth
Grouting details	ANNULUS GROUTED	
Water struck at	8.00	m (depth below datum - mbd)
	120.00 - 130.00	m (depth below datum - mbd)
Rest water level on completion	95.83	m (depth below datum - mbd)

SE20/45

C. TEST PUMPING SUMMARY (Please supply fully details on Form WR - 39)

Test Pumping Datum (if different from borehole datum)	_____	above m below borehole datum (mbd)
Pump Suction Depth	_____	mbd
Water Level (Start of Test)	_____	mbd
Water Level (End of Test)	_____	mbd
Pumping rate	_____	m ³ /d : l/s
for	_____	days/hours
Recovery to (from end of pumping)	_____ mbd in _____	mins : hrs : days
Date(s) of measurements	_____	
Please Supply Chemical Analysis If Available		
ANALYSIS TO FOLLOW.		

D. STRATA LOG

Geological Classification	Description of Strata	Thickness	Depth
(BGS only)		m	m
	TOP SOIL	0-30	0-30
	CLAY, SANDSTONE BANDS	2-50	2-80
	GREY MUDSTONE	5-20	8-80
	SANDSTONE	6-60	14-60
	GREY MUDSTONE, SANDSTONE BANDS	13-70	28-30
	SANDSTONE	1-30	29-60
	GREY MUDSTONE, SANDSTONE BANDS	7-90	37-50
	BLACK SHALE	2-70	40-20
	GREY MUDSTONE, SANDSTONE BANDS	3-30	43-50
	SANDSTONE	17-10	60-60
	BLACK SHALE	11-30	71-90
	GREY MUDSTONE, SANDSTONE BANDS	14-10	86-80
	SANDSTONE	4-60	90-60
	GREY MUDSTONE, SANDSTONE BANDS	15-40	106-80
	SANDSTONE	11-80	117-80
	GREY MUDSTONE, SANDSTONE BANDS	22-20	140-80
[continue on separate page if necessary]			
Other Comments (eg gas encountered, saline water intercepted, etc)			

FOR OFFICIAL USE ONLY

FILE	CONSENT NO	BGS REF NO
LICENCE NO	USE OF BH	NGR.....

FORM WR - 38

Agency No:

ACC NO 45274

86

BOREHOLE RECORD



ENVIRONMENT AGENCY

SE20/47

A. **SITE DETAILS**
(NORTHCAST EA)

SE20 NW/40

Borehole drilled for	SHEPLEY SPRING	
Location	THE KNOWLE, SHEPLEY, HUDDERSFIELD, HD8 8EA	
NGR (8 fig) Ground Level (if known)	SE 2010 0980.	Please attach site plan
Drilling Company	MED DRILLING DONCASTER	
Date of drilling	Commenced: 29-9-2004 Completed: 21-10-2004	

B. **CONSTRUCTION DETAILS**

Borehole datum (if not ground level).....	<u>GROUND LEVEL</u>	above
(point from which all measurements of depth are taken eg flange, edge of chamber, etc)		m below GL
Borehole drilled diameter	<u>350</u> mm from <u>0</u>	to <u>19.00</u> m/depth
	<u>200</u> mm from <u>19.00</u>	to <u>120.00</u> m/depth
	mm from _____	to _____ m/depth
Casing material <u>STEEL</u> diameter	<u>200</u> mm from <u>0</u>	to <u>19.00</u> m/depth
and type (eg plain steel, plastic slotted)		
_____ diameter	mm from _____	to _____ m/depth
_____ diameter	mm from _____	to _____ m/depth
_____ diameter	mm from _____	to _____ m/depth
Grouting details	<u>ANNULUS GROUTED</u>	
Water struck at	<u>69.00</u>	m (depth below datum - mbd)
		m (depth below datum - mbd)
Rest water level on completion	<u>65.00</u>	m (depth below datum - mbd)

SE20/47

C. TEST PUMPING SUMMARY (Please supply fully details on Form WR - 39)

Test Pumping Datum (if different from borehole datum)	_____	above m below borehole datum (mbd)
Pump Suction Depth	_____	mbd
Water Level (Start of Test)	_____	mbd
Water Level (End of Test)	_____	mbd
Pumping rate	_____	m ³ /d : l/s
for	_____	days/hours
Recovery to (from end of pumping)	_____ mbd in _____	mins : hrs : days
Date(s) of measurements	_____	
Please Supply Chemical Analysis if Available		

D. STRATA LOG

Geological Classification (BGS only)	Description of Strata	Thickness	Depth
		m	m
	TOP SOIL	0-40	0-40
	CLAY	2-30	2-70
	GREY MUONSTONE	15-10	17-80
	SANDSTONE	2-40	20-20
	GREY MUONSTONE	9-80	30-00
	BLACK SHALE, COAL TRACES	0-50	30-50
	GREY MUONSTONE	1-50	32-00
	SANDSTONE	18-70	50-70
	BLACK SHALE	10-90	61-60
	GREY MUONSTONE	1-20	62-80
	SANDSTONE, MUONSTONE BANDS	34-40	97-20
	SANDSTONE	7-50	104-70
	GREY MUONSTONE, SANDSTONE BANDS	15-30	120-00
(continue on separate page if necessary)			
Other Comments (eg gas encountered, saline water intercepted, etc) BOREHOLE DRILLED FOR OBSERVATION. ONLY NO PUMP FITTED.			

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FILE	CONSENT NO	BCS REF NO
LICENCE NO	USE OF BH	NGR.....

SHEPLEY SPRINGS
NO 12

WR38: Borehole record form

Borehole record form



British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL



Environment Agency

Water Resources Act 1991 (as amended by the Water Act 2003)

A Site details

Borehole drilled for PANMORIS UK
Location THE KNOWLE SHEPLEY FLOOD HD 88EA
NGR (ten digits) SE 20169 09331 Please attach site plan
Ground level (if known) - metres Above Ordnance Datum
Drilling company MOSS DRILLING LTD
Date drilling commenced 6-6-2019 (DD/MM/YYYY) Completed 17-6-2019 (DD/MM/YYYY)

B Construction details

Borehole datum (if not ground level) GROUND LEVEL metres (m). Please tick if this is above or below ground level.
(point from which all measurements of depth are taken, for example, flange, edge of chamber)

Borehole drilled diameter
250 mm from 0 to 19.50 m/depth
150 mm from 19.50 to 129.50 m/depth
mm from to m/depth
mm from to m/depth

Casing material diameter mm from to m/depth
and type (for example, if plain steel, plastic slotted). Please record permanent casing details, not temporary casing.

Casing material STEEL diameter 150 mm from 0 to 19.50 m/depth

Casing material PLASTIC - PLAIN diameter 100 mm from 0 to 129.50 m/depth

Casing material SLOTTED diameter mm from to m/depth

Grouting details ANNULUS GROUTED

Water struck at 1. 39.50 m (depth below datum - mbd) 2. m (mbd)
3. m (mbd) 4. m (mbd)

C Test pumping summary (Please supply full details on form WR39)

Test pumping datum m. Please tick if this is above or below ground level.
(if different from borehole datum)

Pump suction depth mbd

Water level (start of test) 78.40 mbd

Water level (end of test) mbd

Type of test (for example, bailer, step, constant rate)

Pumping rate m³/hour or litres/second . Please tick as appropriate.
for days, hours, mins

Recovery to mbd in days, hours, mins
(from end of pumping)

Date(s) of measurements Pump started (DD/MM/YYYY)

Pump stopped (DD/MM/YYYY)

Please supply chemical analysis if available. If you have included this please tick this box

WR38: Borehole record form

D Strata log

Geological classification (BGS only)	Description of strata	Thickness m	Depth (to base of strata) m
	TOP SOIL	0-30	0-30
	CLAY	1-50	1-80
	SANDSTONE MUDSTONE BANDS	4-30	6-10
	BLACK SHALE	1-10	7-20
	GREY MUDSTONE	5-10	12-30
	COAL	0-60	12-90
	GREY MUDSTONE	22-70	35-60
	BLACK SHALE	1-20	36-80
	GREY MUDSTONE	8-20	45-00
	BLACK SHALE	5-20	50-20
	COAL	0-30	50-50
	GREY MUDSTONE	4-70	55-20
	SANDSTONE	17-80	72-70
	BLACK SHALE	12-30	85-00
	GREY MUDSTONE	3-30	88-30
	SANDSTONE	3-50	91-80
	GREY MUDSTONE, SANDSTONE BANDS	22-20	114-00
	SANDSTONE	5-50	129-50
(continue on separate page if necessary)			
Other comments (for example, gas encountered, saline water intercepted)			

E Completing this form

How long did it take you to fill in this form? _____

For Official use only

Date received (DD/MM/YYYY)	File	Consent number	BGS reference number
_____	_____	_____	_____
Accession number	Wellmaster number	SOBI number	NGR
_____	_____	_____	_____
LIC NO	Purpose	EA reference number	
_____	_____	_____	
Copy number	Entered by		
_____	_____		

SAMPLE SPAN WAS
BOTTOM CORNER

WR38: Borehole record form

Borehole record form



British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL



Environment Agency

Water Resources Act 1991 (as amended by the Water Act 2003)

A Site details

Borehole drilled for PEANMORE UK
Location THE KNOWLES Shepley HUDD'S HD 8 8AA
NGR (ten digits) SE 20204 09611 Please attach site plan
Ground level (if known) _____ metres Above Ordnance Datum
Drilling company MOD DRILLING LTD
Date drilling commenced 18-6-2019 (DD/MM/YYYY) Completed 21-6-2019 (DD/MM/YYYY)

B Construction details

Borehole datum (if not ground level) _____ metres (m). Please tick if this is above or below ground level.
(point from which all measurements of depth are taken, for example, flange, edge of chamber)

Borehole drilled diameter _____ mm from _____ to _____ m/depth
_____ mm from _____ to _____ m/depth
_____ mm from _____ to _____ m/depth
_____ mm from _____ to _____ m/depth

Casing material _____ diameter _____ mm from _____ to _____ m/depth
and type (for example, if plain steel, plastic slotted). Please record permanent casing details, not temporary casing.

Casing material _____ diameter _____ mm from _____ to _____ m/depth

Casing material _____ diameter _____ mm from _____ to _____ m/depth

Casing material _____ diameter _____ mm from _____ to _____ m/depth

Grouting details _____

Water struck at 1. 10-00 m (depth below datum - mbd) 2. _____ m (mbd)
3. _____ m (mbd) 4. _____ m (mbd)

C Test pumping summary (Please supply full details on form WR39)

Test pumping datum _____ m. Please tick if this is above or below ground level.
(if different from borehole datum)

Pump suction depth _____ mbd

Water level (start of test) _____ mbd

Water level (end of test) _____ mbd

Type of test (for example, bailer, step, constant rate)

Pumping rate _____ m³/hour or litres/second . Please tick as appropriate.
for _____ days, _____ hours, _____ mins

Recovery to _____ mbd in _____ days, _____ hours, _____ mins
(from end of pumping)

Date(s) of measurements Pump started _____ (DD/MM/YYYY)

Pump stopped _____ (DD/MM/YYYY)

Please supply chemical analysis if available. If you have included this please tick this box

WR38: Borehole record form

D Strata log

Geological classification (BGS only)	Description of strata	Thickness m	Depth (to base of strata) m
	TOP SOIL	0-40	0-40
	CLAY	1-30	1-70
	GREY MUDSTONE	7-30	9-00
	GREY MUDSTONE, SANDSTONE BANDS	4-60	13-60
	BLACK SHALE	3-30	16-90
	GREY MUDSTONE	4-10	21-00
	BLACK SHALE	2-10	23-10
	GREY MUDSTONE, SANDSTONE BANDS	7-00	30-10
	BLACK SHALE	8-40	38-50
	GREY MUDSTONE, SANDSTONE BANDS	1-90	40-40
	SANDSTONE	18-30	58-70
	BLACK SHALE	12-10	70-80
	GREY MUDSTONE	1-90	72-70
	SANDSTONE, MUDSTONE BANDS	17-80	90-50
B/HOLE BACKFILLED			
(continue on separate page if necessary)			
Other comments (for example, gas encountered, saline water intercepted)			

E Completing this form

How long did it take you to fill in this form? _____

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_____	_____	_____	_____
Accession number	Wellmaster number	SOBI number	NGR
_____	_____	_____	_____
LIC NO	Purpose	EA reference number	
_____	_____	_____	
Copy number	Entered by		
_____	_____		

