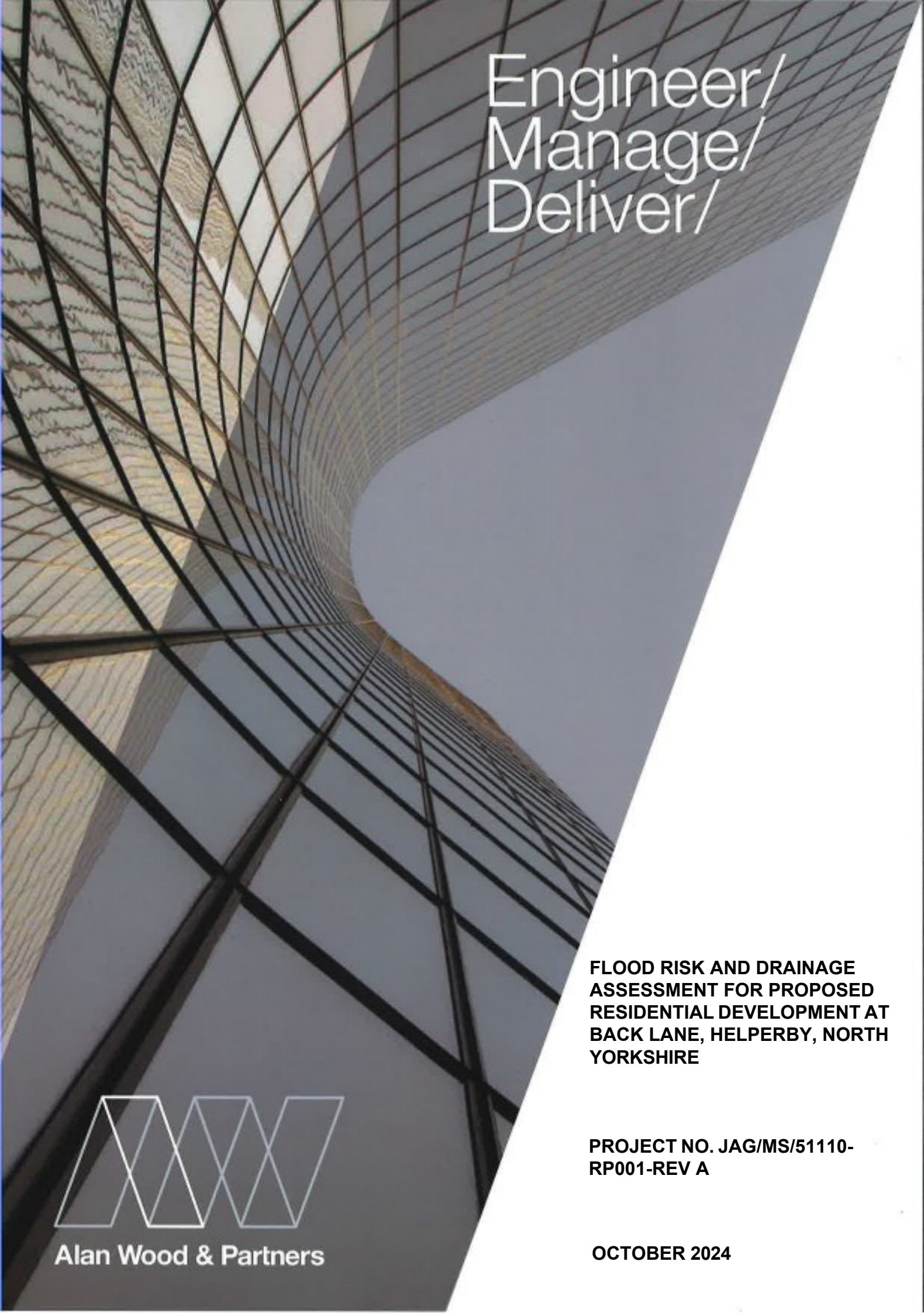

FLOOD RISK AND DRAINAGE ASSESSMENT FOR PROPOSED RESIDENTIAL DEVELOPMENT AT BACK LANE, HELPERBY, NORTH YORKSHIRE

PROJECT NO. JAG/MS/51110-RP001-REV A

OCTOBER 2024

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Issue	Revision	Revised by	Approved by	Revised Date
A	General Revision.	MS	JAG	11/10/24

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APPENDICES

1.0 INTRODUCTION

1.1 Background

1.1.1 Alan Wood & Partners were commissioned by Trustees of The Lady Milnes Coates Limited to prepare a Flood Risk and Drainage Assessment for a proposed residential development at Back Lane, Helperby, North Yorkshire.

1.1.2 The development comprises two detached residential properties on land most recently used as a car park for the nearby public house.

1.2 Layout of Report

1.2.1 Section 1 introduces the FRDA, explains the layout of this FRDA and provides an introduction to flood risk and the latest guidance on development and flood risk in England.

1.2.2 Section 2 introduces the site. The site description is based upon a desktop study and information provided by the developer. In order to obtain further information on flood risk, consultation was undertaken with the Environment Agency.

1.2.3 Section 3 of this report details the information gathered through the consultation.

1.2.4 Section 4 of this report details the development proposals and considers the development proposals in relation to the current planning policy on development and flood risk in England (and what type of development is considered appropriate in different flood risk zones). National Planning Policy Framework (NPPF): and its associated Technical Guidance (Communities and Local Government, July 2021) is the current planning policy on flood risk in England, and an introduction to NPPF is provided below.

1.2.5 Section 5 considers the foul water drainage arrangements for the proposed development.

1.2.6 Section 6 considers the surface water drainage arrangements for the proposed development.

1.2.7 Section 7 considers the operation and maintenance requirements for the proposed development.

1.2.8 Section 8 of this report considers the flood risk to site, and the potential for the development proposals to impact on flood risk. The assessment of flood risk is based on the latest planning policy and utilises all the information gathered in the preparation of the report.

1.2.9 Section 9 of this report provides details of any recommendations for further work to mitigate against possible flooding.

1.2.10 Section 10 of this report provides a summary of the report.

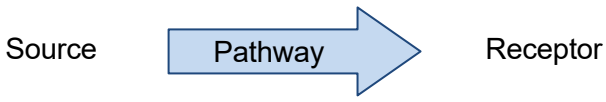
1.3 Flood Risk

1.3.1 Flood risk takes account of both the probability and the consequences of flooding.

1.3.2 Flood risk = probability of flooding x consequences of flooding

1.3.3 Probability is usually interpreted in terms of the return period, e.g. 1 in 100 and 1 in 200-year event, etc. In terms of probability, there is a 1 in 100 (1%) chance of one or more 1 in 100-year floods occurring in a given year. The consequence of flooding depends on how vulnerable a receptor is to be flooded.

The components of flood risk can be considered using a source-pathway-receptor model.



1.3.4 Sources constitute flood hazards, which are anything with the potential to cause harm through flooding (e.g. rainfall extreme sea levels, river flows and canals). Pathways represent the mechanism by which the flood hazard would cause harm to a receptor (e.g. overtopping and failure of embankments and flood defences, inadequate drainage and inundation of floodplains). Receptors comprise the people, property, infrastructure and ecosystems that could potentially be affected should a flood occur.

1.4 National Planning Policy Framework

1.4.1 General

1.4.1.1 NPPF and its associated Technical Guidance replaces Planning Policy Statement 25 and provides guidance on how to evaluate sites with respect to flood risk. A summary of the requirements of NPPF is provided below.

1.4.2 Sources of Flooding

1.4.2.1 NPPF requires an assessment to flood risk to consider all forms of flooding and lists six forms of flooding that should be considered as part of a flood risk assessment. These forms of flooding are listed in Table 1, along with an explanation of each form of flooding.

Table1: Forms of flooding

Flooding from Rivers (Fluvial Flooding)
Watercourses flood when the amount of water in them exceeds the flow capacity of the river channel. Flooding can either develop gradually or rapidly, depending on the characteristics of the catchment. Land use, topography and the development can have a strong influence on flooding from rivers.
Flooding from the Sea (Tidal Flooding)
Flooding to low-lying land from the sea and tidal estuaries is caused by storm surges and high tides. Where tidal defences exist, they can be overtopped or breached during a severe storm, which may be more likely with climate change.
Flooding from Land (Pluvial Flooding)
Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. In developed areas this flood water can be polluted with domestic sewage where foul sewers surcharge and overflow. Local topography and built form can have a strong influence on the direction and depth of flow. The design of development down to a micro-level can influence or exacerbate this. Overland flow paths should be taken into account in spatial planning for urban developments. Flooding can be exacerbated if development increases the percentage of impervious area.

Flooding from Groundwater
Groundwater flooding occurs when groundwater levels rise above ground levels (i.e. groundwater issues). Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). Chalk is the most extensive source of groundwater flooding.
Flooding from Sewers
In urban areas, rainwater is frequently drained into sewers. Flooding can occur when sewers are overwhelmed by heavy rainfall and become blocked. Sewer flooding continues until the water drains away.
Flooding from Other Artificial Sources (i.e. reservoirs, canals, lakes and ponds)
Non-natural or artificial sources of flooding can include reservoirs, canals and lakes. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and /or as a result of dam or bank failure.

1.4.3 Flood Zones

1.4.3.1 For river and sea flooding, the NPPF uses four Flood Zones to characterise flood risk. These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and are detailed in Table 2.

Table 2: Flood zones

Flood Zone	Definition
1	Low probability (less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%).
2	Medium probability (between 1 in 100 and 1 in 1,000 annual probability of river flooding (1%-0.1%) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5%-0.1%) in any year).
3a	High probability (1 in 100 or greater annual probability of river flooding (>1%) in any year or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).
3b	This zone comprises land where water must flow or be stored in times flood. Land which would flood with an annual probability of 1 in 20 (5%) or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

1.4.4 Vulnerability

1.4.4.1 The NPPF classifies the vulnerability of developments to flooding into five categories. These categories are detailed in Table 3.

Table 3: Flood risk vulnerability classification

Flood Risk Vulnerability Classification	Examples of Development Types
Essential Infrastructure	- Essential utility infrastructure including electricity generating power stations and grid and primary substations - Wind turbines
Highly Vulnerable	- Police stations, ambulance stations, fire stations, command centres and telecommunications installations required to be operational during flooding. - Emergency dispersal points. - Basement dwellings. - Caravans, mobile homes and park homes intended for permanent residential use.
More Vulnerable	- Hospitals. - Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. - Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. - Non-residential uses for health services, nurseries and educational establishments. - Sites used for holiday or short-let caravans and camping.
Less Vulnerable	- Building used for shops, financial, professional and other services, restaurants and cafes, hot foot takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable" and assembly and leisure. - Land and buildings used for agriculture and forestry.
Water Compatible	- Docks, marinas and wharves. - Water based recreation (excluding sleeping accommodation). - Lifeguard and coastguard stations. - Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.

1.4.4.2 Based on the vulnerability of a development, NPPF states within what Flood Zones(s) the development is appropriate. The flood risk vulnerability and Flood Zone 'compatibility' of developments is summarised in Table 4.

Table 4: Flood risk vulnerability and flood zone compatibility

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test	✓	✓
	3a	Exception Test	✓	x	Exception Test	✓
	3b	Exception Test	✓	x	x	x

1.4.5 The Sequential Test, Exception Test and Sequential Approach

1.4.5.1 The Sequential Test is a risk-based test that should be applied at all stages of development and aims to steer new development to areas with the lowest probability of flooding (Zone 1). This is applied by the Local Planning Authority by means of a Strategic Flood Assessment (SFRA).

1.4.5.2 The SFRA and NPPF may require the Exception Test to be applied to certain forms of new development. The test considers the vulnerability of the new development to flood risk and, to be passed, must demonstrate that:

- There are sustainability benefits that outweigh the flood risk and;
- The new development is safe and does not increase flood risk elsewhere.

1.4.5.3 The Sequential Approach is also a risk-based approach to development. In a development site located in several Flood Zones or with other flood risk, the sequential approach directs the most vulnerable types of development towards areas of least risk within the site.

1.4.6 Climate Change

1.4.6.1 There is a planning requirement to account for climate change in the proposed design. The recommended allowances should be based on the most relevant guidance from the Environment Agency and the Lead Local Flood Authority.

1.4.7 Sustainable Drainage

1.4.7.1 The key planning objectives in NPPF are to appraise, manage and where possible, reduce flood risk. Sustainable Drainage Systems (SuDS) provide an effective way of achieving some of these objectives, and NPPF and Part H of the Building Regulations (2015 Edition) direct developers towards the use of SuDS wherever possible.

2.0 EXISTING SITE DESCRIPTION

2.1 Location

2.1.1 The development occupies land between Back Lane, Balk Avenue and Craven Court, Helperby on the Northeastern edge of the village.

2.1.2 An aerial photograph is shown in Figure 1 below, which shows the location of the site relative to the existing town.

Figure 1: Aerial Photograph

2.1.3 The Ordnance Survey grid reference for the centre of the site development is approximately SE 43985 70093.

2.2 Site Description & Topography

2.2.1 The area of the proposed development currently comprises a relatively flat area that until recently was used as a car park, crossed by a track which is not positively drained. The site falls from approximately 19.9m OD(N) on the northwest boundary to 18.0m OD(N) on the southeast boundary. A copy of the topographic survey drawing is included in Appendix A.

2.3 Surrounding Features

2.3.1 The site is bounded on the north, and south by existing residential properties, and to the west by Back Lane, a metalled public highway.

2.3.2 The east of the site is currently open fields.

2.3.3 A Yorkshire Water WWTW is located approximately 250m to the east of the site. Sewer Records indicate that the foul and combined public sewers discharge to this treatment plan via a pump station and rising main, before discharging via a final effluent pipe to an unknown location but presumed to be the River Swale approximately 350m to the southwest.

2.4 Ground Conditions

2.4.1 A desk top survey conducted using British Geological Survey mapping (BGS) showed that there were no records of artificial grounds near the proposed site.

2.4.2 Superficial geology is formed of Sand, Clay and Gravel with deposits of peat and Alluvium found throughout.

2.4.3 Bedrock Geology is comprised of Sherwood Sandstone with Mercia Mudstone found East.

2.4.4 The ground lies upon a Principal Aquifer with a Secondary B Aquifer found eastwards; the ground has a groundwater vulnerability rating of ‘Medium-High’.

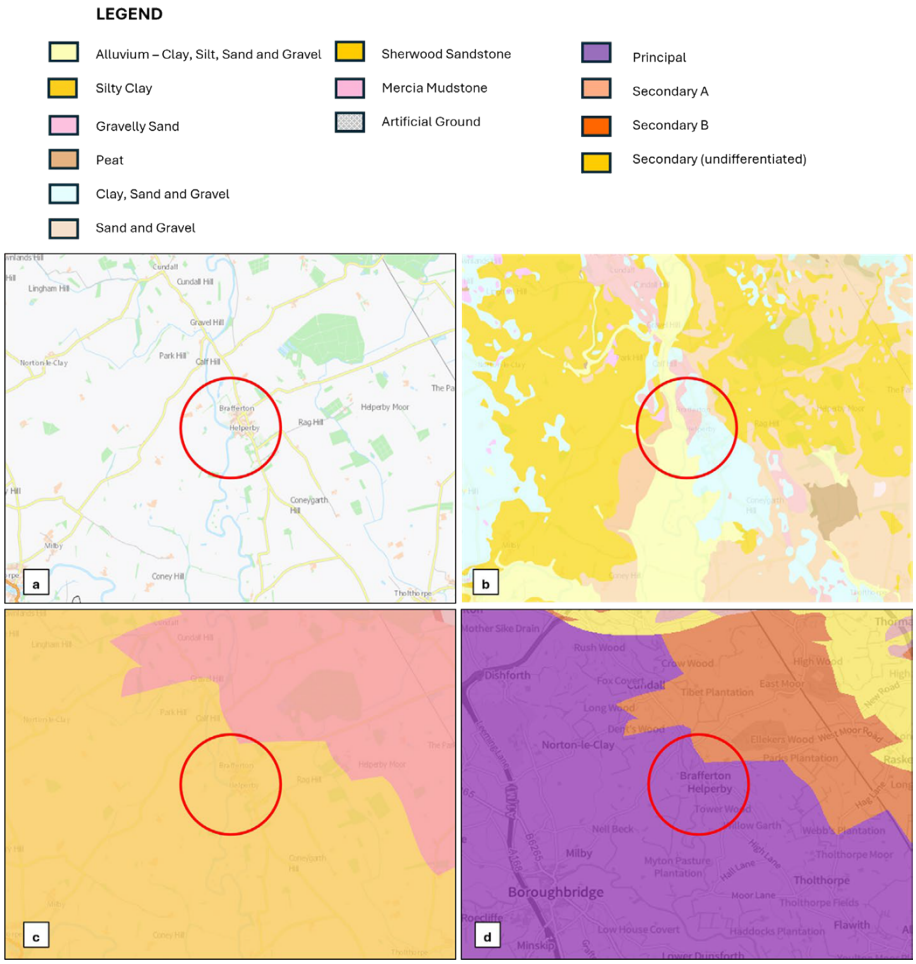


Figure 2: showing artificial ground (a), Superficial and bedrock geology (b), (c) and aquifer designation (d).

2.4.5 A ground investigation and infiltration test has been carried out, the methodology and results of which are presented in Alan Wood & Partners Technical Note App B- 47105-TN-001 Back Lane, Helperby and are summarised below.

2.4.6 The geology comprises 400mm of topsoil overlaying granular superficial deposits of unknown depth.

2.4.7 Infiltration testing to BRE365 showed that infiltration to ground is not a viable option as the water level in both test pits dropped by a maximum of 7.5% on the first of the three required tests in three hours of observations. The second and third tests were not carried out due to failure of the first test.

2.4.8 A copy of the Technical Note is included in Appendix B.

3.0 CONSULTATION

3.1 Consultation has taken place with the Developer to have a clear understanding of the development proposals and to enable a robust strategy to be developed.

3.2 Consultation has taken place with the Environment Agency to obtain flood maps, records and flood mitigation guidance relevant to the development.

3.3 Reference has been made to the North Yorkshire SuDS Guidance.

3.4 Consultation has been undertaken with Yorkshire Water (YWS) in respect of the disposal of foul and surface water from the development. The records provided show foul public sewers crossing the site, a rising main and final effluent pipe close to the eastern boundary of the site that transfer foul sewerage to and from the wastewater treatment works. There are no surface water or combined sewers in the vicinity of the proposed development.

4.0 PROPOSED DEVELOPMENT

4.1 The Development

4.1.1 The proposed development comprises two detached residential dwellings with associated driveways and garages.

4.1.2 The total site area is 0.196Ha, of which 0.097Ha is hard standing, with the contributing areas being;

- 0.029Ha Dwellings
- 0.008Ha Garages
- 0.060Ha Gravel Drives

4.2 Drawing

4.2.1 A drawing showing the indicative site layout is included in Appendix C.

4.3 Flood Risk

4.3.1 The flood risk vulnerability of residential dwellings is classified as 'More Vulnerable'. (Table 3).

4.3.2 In terms of flood zone compatibility the construction 'More Vulnerable' development is appropriate in Flood Zone 1 without a sequential or exception test.

5.0 FOUL WATER DRAINAGE

5.1 Sewer records have been obtained which show that there is a 150mm foul public sewers crossing the site. The proposed layout has taken account of this, and suitable easements and standoff distances have been incorporated into the layout. A copy of the Yorkshire Water PPE is included in Appendix D.

5.2 While the location of foul sewers is known, the invert levels are not recorded on the topographic surveys or information received from Yorkshire Water, but indicative depths are shown on the topographic survey. Invert levels will be required prior to detail design, until the invert levels are confirmed the possibility that a foul water pumping station cannot be discounted.

5.3 The preplanning response from Yorkshire Water states that foul sewerage from the development can discharge into the existing public 150mm sewer crossing the site.

5.4 Based upon a development of approximately 2 dwellings and with a peak flow rate of 4,000 litres per dwelling per day, in accordance with Sewerage Sector Guidance Appendix C – March 2020, the peak foul water flow from the development site would be approximately 1l/s including a peaking factor of 6. However, if a pump station is required to connect to the foul sewer a practicable discharge rate would be approximately 4.0l/s.

5.5 A separate foul sewer network will be designed and built to meet Building Regulations.

5.6 An indicative drainage layout showing the foul water strategy for development is included in Appendix E.

6.0 SURFACE WATER DRAINAGE

6.1 General

6.1.1 The surface water drainage has been designed in accordance with current CIRIA C753 SuDS Manual guidelines.

6.2 Run-off Destination

6.2.1 Requirement H3 of the Building Regulations establishes a preferred hierarchy for disposal of surface water. Consideration should firstly be given to infiltration, watercourse, surface water sewer, and finally combined sewer.

6.2.2 In-situ percolation testing was carried out on the 7th of June 2022 and showed that there was virtually no infiltration with the test pits remaining more than 90% full after 3 hours of observations.

6.2.3 The ground conditions are therefore unsuitable for infiltration methods to be used for the disposal of surface water run-off from the development.

6.2.4 The second preferred option would be to discharge the surface water run-off from the development to a watercourse.

6.2.5 There are no watercourses within, or bounding the site and requisitioning a sewer to watercourse is not permissible as the Water Authorities have no automatic right to discharge to watercourse. Additionally, the River Swale is approximately 350m from the site with multiple third-party landowners and ransom negotiations involved, which is impractical. Therefore, discharge to watercourse is not a viable option for the development.

6.2.6 The third preference would be to discharge the surface water run-off from the development to public surface water sewer. Yorkshire Water sewer records show that there are no surface water sewers within, or in the vicinity of the site.

6.2.7 The fourth preference is to connect to a public combined sewer, as with the surface water option, Water records highlight that there does not appear to be any combined sewers located that are mapped.

6.2.8 In the absence of any other viable points of discharge, it is proposed to discharge surface water into the foul drainage network at the lowest practicable rate.

6.2.9 There are two possible points to connect the surface water drainage to the foul drainage network.

- The 150mm public foul sewer crossing the site.
- Into the trade effluent to the South that conveys foul water.

6.2.10 Based on the Safemove water sewer maps, it's clear that both foul and surface water are directed into combined sewers in the area, as illustrated in Figure 3 below. This suggests that the foul water sewer running through the site could potentially be combined, allowing for discharge into the existing combined sewer network. Additionally, it's possible that there is a combined sewer located to the south or west of the proposed site that is not depicted on the sewer map, or that the foul water network itself is actually a combined sewer.

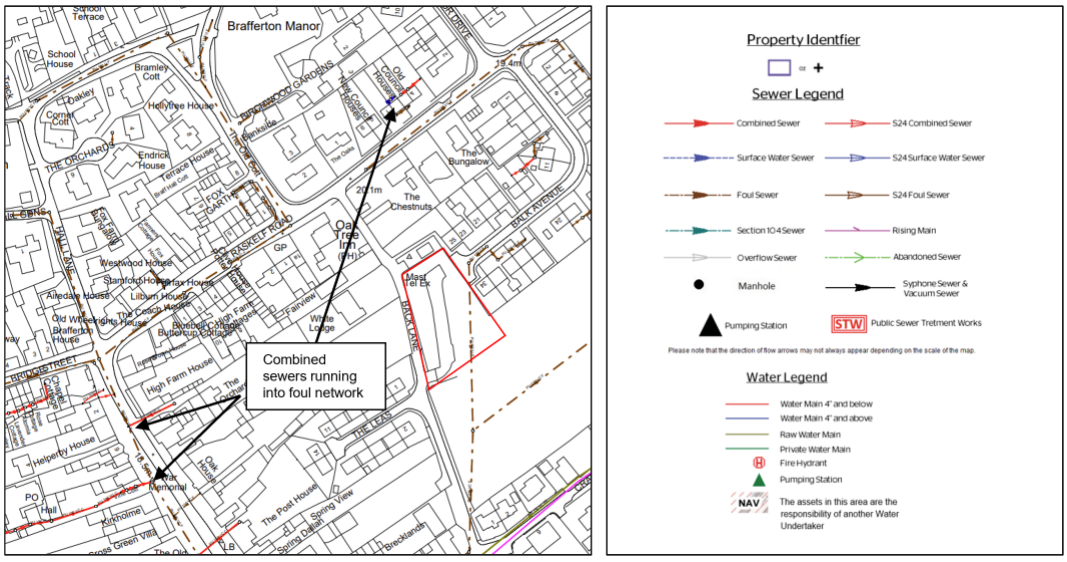


Figure 3: Showing Safemove sewer maps for the proposed development area and for the surrounding area highlighting clashes with combined sewers connecting with foul water networks.

6.2.11 It is understood that the existing development to the south discharges surface water to this effluent pipe.

6.2.12 Discharging surface water to the foul public sewer crossing the site is the simplest option, as the existing sewer is within the site boundary. However, this would result in the pump station and therefore rising main conveying surface water, increasing wear and operational costs of the pump. Additionally, the wastewater treatment plant will be treating surface water. Therefore, the option of discharging surface water to the existing foul sewer is not preferred.

6.2.13 Discharging directly to the final effluent pipe would, as with a connection to rising main require a negotiated or requisitioned sewer crossing 3rd party land, but unlike with the previously outlined options, would bypass the foul pump station, rising main and WWTW, and instead connect directly into the outfall that conveys treated water to the final point of discharge.

6.2.14 Yorkshire Water would need to approve any connection to the foul effluent pipe, and this should be discussed during the consultation process. This option would have no impact on the existing pump station, rising main or wastewater treatment works. It is proposed that the surface water discharge to the final effluent sewer with the agreement of Yorkshire Water.

6.2.15 The invert level of the foul effluent pipe is not known, and therefore the possibility of a surface water pumping station being required cannot be discounted.

6.3 Flood Risk

6.3.1 For new developments, the current design criteria required for the surface water drainage will need to be based upon the critical 1 in 100-year storm event, with an additional allowance to account for climate change resulting from global warming. There should be no above ground flooding for the 1 in 30-year return period and no property flooding or off-site flooding from the critical 1 in 100-year storm event, with the additional allowance to account for climate change over the design life of the development.

6.4 Climate Change

6.4.1 An additional allowance of 40% has been included in the design to account for climate change resulting from global warming in accordance with North Yorkshire & Environment Agency guidance.

6.5 Urban Creep

6.5.1 As the development is residential, an allowance of an additional 10% contributing impermeable area has been included to allow for the potential of urban creep within the surface water drainage design.

6.6 Peak Flow Control

6.6.1 North Yorkshire SuDS guidance states that the peak runoff for up to and including the M100 events, with 40% uplift for climate change and 10% for urban creep the impermeable area would therefore be approximately 0.1067Ha.

6.6.2 QBAR for the site has been calculated using the Source Control module of WinDES with IPC SuDS has been calculated at 0.5l/s, supporting calculations are shown in Appendix F. This is an impracticably low rate, and the M30 greenfield runoff rate of 1.0l/s is proposed.

6.6.3 The impermeable area of the proposed dwellings, garages and accesses is approximately 0.1067Ha.

6.6.4 A WinDES Source Control model has been developed to estimate the volume of storage required to prevent surface water flooding, while restricting the peak discharge to 1l/s.

6.6.5 It is proposed to provide surface water into an attenuation tank to the southwest of the southern property which will be able to accommodate 56m^3 of water with a 95% porosity.

6.6.6 Surface water will then be restricted via an orifice plate at the southern outflow point and restricted to 1l/s before flowing into the final effluent pipe to the south. At this time, it cannot be excluded that there will not be a requirement for a pump/ rising main as the invert levels are not known.

6.6.7 A copy of the hydraulic model calculations is included in Appendix F.

6.6.8 While the control orifices are smaller than the adoptable minimum of 75mm, it is considered that the incoming flow will be roof drainage or be filtered by passing through either a porous block paved drive and subbase material, or gravel drive and subbase. This will virtually eliminate the risk of material capable of blocking the control chambers. Additional measures to reduce risk such as catchpits and filter meshes upstream of each flow control chamber can also be incorporated.

6.7 Drawing

6.7.1 A drawing showing the proposed surface water drainage strategy for the development is included in Appendix E.

6.8 Volume Control

6.8.1 The run-off volume post development will be more than pre-development by the creation of impermeable areas and the formal drainage systems which must be installed. However, due to the limitations on infiltration methods of disposal the total runoff volume will increase from the existing greenfield volume, but the rate of discharge will be limited to a peak of 1l/s for the M100+50% events.

6.9 Designing for Exceedance

6.9.1 Overland flood risk from exceedance flows and from off-site sources will be mitigated largely by the creation of the new surface water sewerage system as described above. Where possible proposed ground levels will be set to channel flows away from the proposed building. Furthermore, the ground floor construction level for the new buildings will be raised by a minimum of 150mm above the adjacent finished ground level which will provide additional clearance above any likely overland flooding.

6.9.2 SuDS guidance states that the existing overland flow routes should generally be maintained within the final layout of the development site without increasing the flood risk to off-site parties.

6.9.3 Any existing flood risk may reduce by the creation of a formal surface water drainage system but cannot be entirely removed.

6.9.4 It is considered that the new development will not create any additional risk of flooding to the development or other parties beyond the curtilage of the site because of the new proposals.

6.9.5 Drawings showing existing and post development flood exceedance routes are shown in Appendix G.

6.10 SuDS Features

6.10.1 The proposed development lends itself to the inclusion of a range of SuDS features that will provide both a flood risk and water quality benefit, including porous paving/gravel and subbase to proposed parking areas that will provide a water quality improvement in addition to reducing the risk of the flow controls becoming obstructed.

7.0 OPERATION AND MAINTENANCE

7.1 The drainage pipework is designed with self-cleansing gradients and consequently the network should require little or no maintenance. The SuDS and flow control elements of the drainage network should be maintained in accordance with the extracts from CIRIA C753 or other manufacturers guidelines reproduced in Table 5 below.

Table 5: Operation and Maintenance Requirements for Silt Traps/Trapped Gullies (Based on CIRIA C753 Table 14.2)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	6 monthly
	Inspect filter media and establish appropriate replacement frequencies	6 monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

7.2 The operation & maintenance requirements for the vortex flow control should be maintained as set out in Table 6 below.

Table 6: Operation and Maintenance Requirements for Vortex Flow Control Device (Based on Manufacturer's recommendations)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Monthly during the first three months, then every 6 months
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months

7.3 Operation and maintenance requirements for the package pumping station are set out in Table 7 below.

Table 7: Operation and Maintenance Requirements for Package Pumping Station (based on CIRIA R182, Section 3) – to be used in conjunction with manufacturer's recommendations

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Basic adjustment to equipment	As recommended by manufacturer
	Lubricate systems	As recommended by manufacturer
	Changeover duty pump	As recommended by manufacturer
	Recording systems (where present) – recover data	As recommended by manufacturer/as required by database
	Standby generators (where present) – run off load	Weekly
	Standby generators (where present) – run on load	Monthly
Remedial actions	Clear blockages in pipework	As required
	Clean walls, floor, electrodes and floats	As required
	Replace malfunctioning or worn components	As required

Monitoring	Check operation of non-return valves	6 monthly
	Inspect pump and control equipment for evidence of poor operation or failure	Monthly during the first 6 months of operation, then every 3 months
	Inspect the sump for silt/grease accumulation rate and establish appropriate removal frequencies	Monthly during the first 6 months of operation, then 6 monthly
	Inspect for structural failure of pump chamber(s) and general condition of any ancillary equipment	6 monthly
	Check the pump and pipework seals for leaks	Monthly during the first 6 months of operation, then 6 monthly
Note:- Pump to be isolated from electrical supply prior to maintenance works being undertaken		

7.4 Operation and maintenance requirements for the storage tanks are set out in Table 8 below.

Table 8: Operation and Maintenance Requirements for Attenuation Storage Tanks (Based on CIRIA C753 Table 21.3)

Maintenance schedule	Required action	Typical frequency*
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

7.5 The operation and maintenance requirements for the pervious paving should be carried out in accordance with Table 9 below.

Table 9: Operation and Maintenance Requirements for Pervious Pavements (Based on CIRIA C753 Table 20.15)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is the most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months*
	Inspect silt accumulation rates and establish appropriate removal frequencies	Annually*
	Monitor inspection chambers	Annually*

7.6 Operation and maintenance requirements of the drainage components, as listed above, should be undertaken in accordance with Chapter 32 of the CIRIA SuDS Manual, along with the relevant tables and any relevant manufacturer's recommendations. See also BS 8582:2013 Code of Practice for Surface Water Management for Development Sites Section 11 and Susdrain Fact Sheet on SuDS Maintenance and Adoption Options (England) dated September 2015.

7.7 The personnel undertaking the maintenance should have appropriate experience of SuDS and drainage maintenance and should be capable of keeping sufficiently detailed records of any inspections. An example of a checklist for SuDS maintenance can be found within Appendix B of the CIRIA C753 SuDS Manual v2. If personnel do not have appropriate experience, then specific inspection visits may be necessary. During the first year of operations of SuDS, inspections should usually be carried out at monthly intervals (and after significant storm events).

7.8 The responsibility for the operation and maintenance of the drainage and SuDS will remain the responsibility of the site owner.

8.0 FLOOD RISK ASSESSMENT

8.1 Flood Zone

8.1.1 A copy of the Environment Agency Flood Map for Planning is included in Figure 4 below which identifies the development site to be located within an area designated as Flood Zone 1, (low probability of flooding), with a less than 1 in 1000 annual probability of flooding in any year.

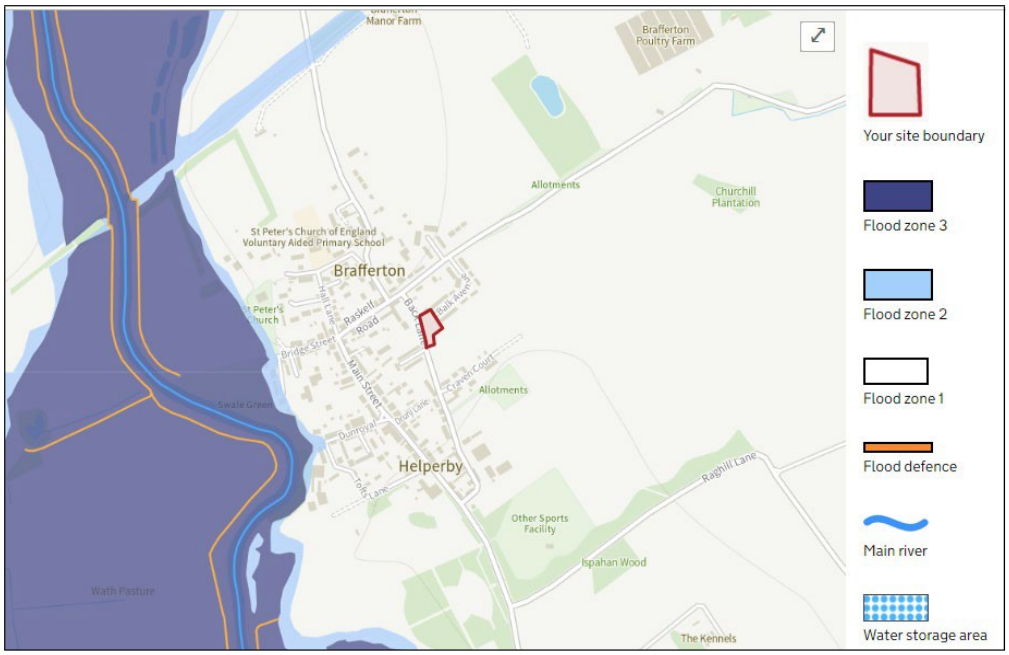


Figure 4: Environment Agency Flood Map for Planning dated August 2024

8.2 Historic Flooding

8.2.1 An abstract from the Environment Agency Recorded Flood Outlines dataset is shown in Figure 5. The dataset collates flood records of historic flooding from rivers, the sea, ground water and surface water since 1946. The proposed development area has not been recorded to have flooded in this time.

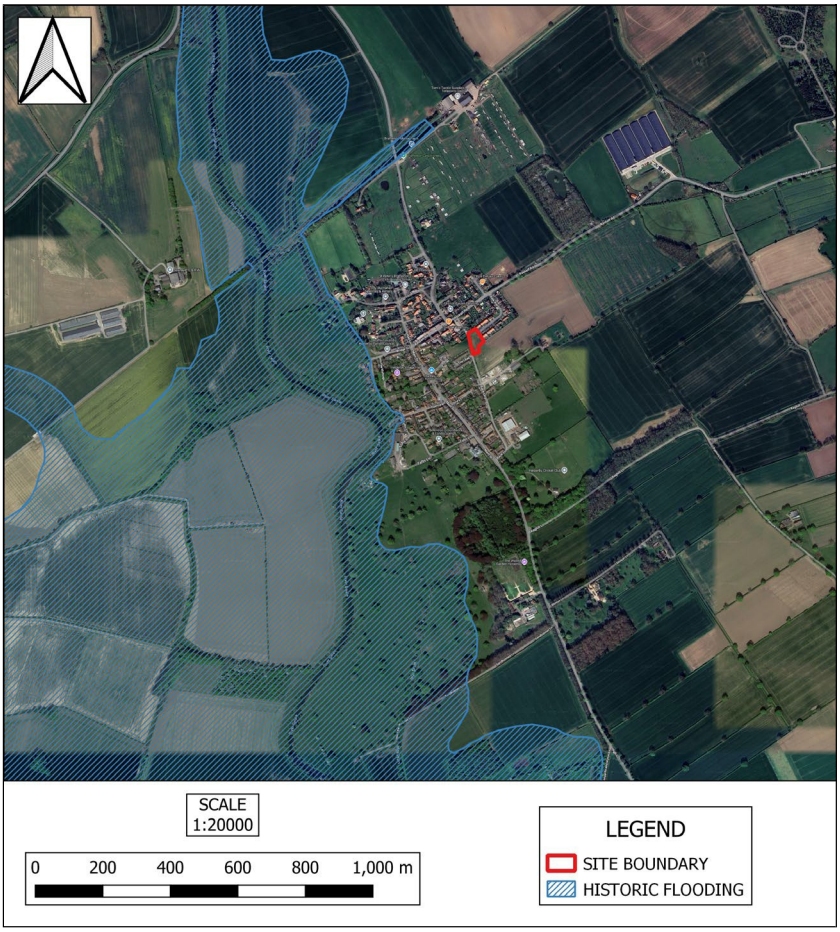


Figure 5: *Environment Agency Historic Flood Map dated August 2024.*

8.3 Fluvial Flooding

8.3.1 Approximately 380m to the west lies the River Swale, which is shown in the EA flood map for fluvial flooding in Figure 6.

8.3.2 As shown in Figure 6, the site lies outside of the boundaries of modelled fluvial flooding, and as such, is considered to be low and acceptable in this case.

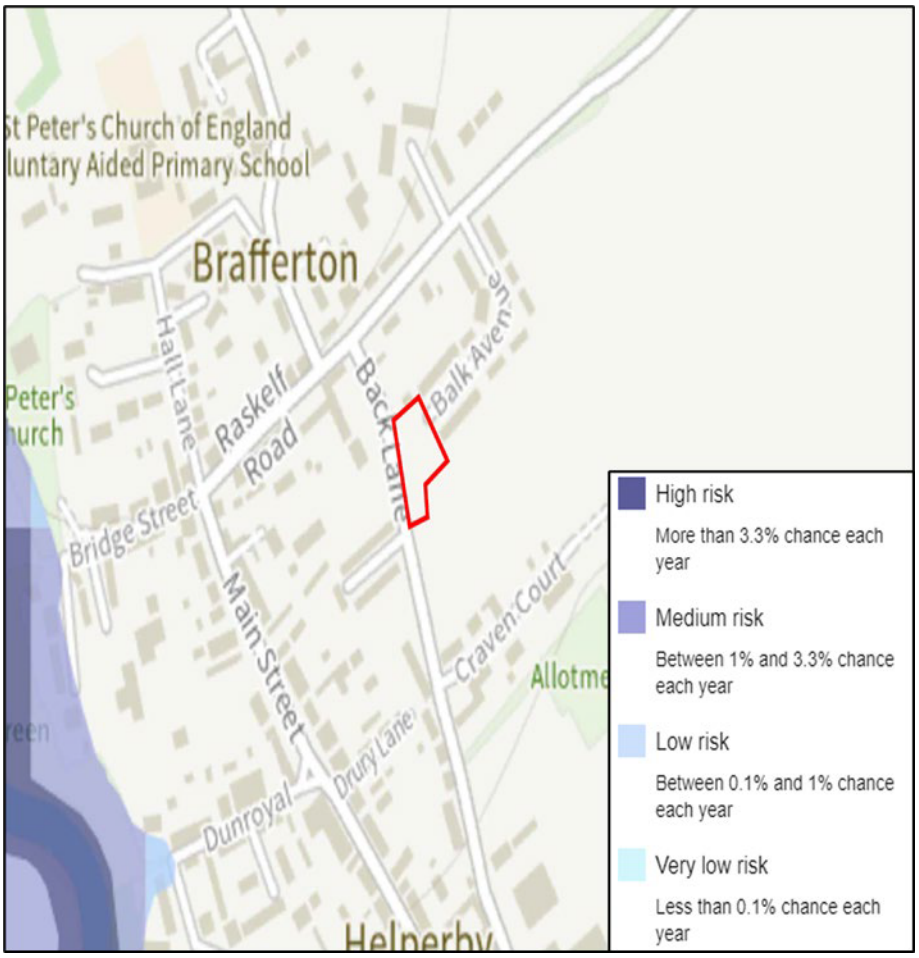


Figure 6: Environment Agency Flood Map showing the extent of Fluvial Flooding dated August 2024

8.4 Groundwater Flooding

8.4.1 Groundwater flooding can occur when the sub-surface water levels are high and emerges above ground level. The Environment Agency Recorded Flood Outlines dataset shows there have been no recorded instances of flooding due to ground water emergence in the vicinity of the site.

8.5 Surface Water Flooding

8.5.1 A copy of the Environment Agency map showing the extent of flooding from surface water is included in Figure 7 below.

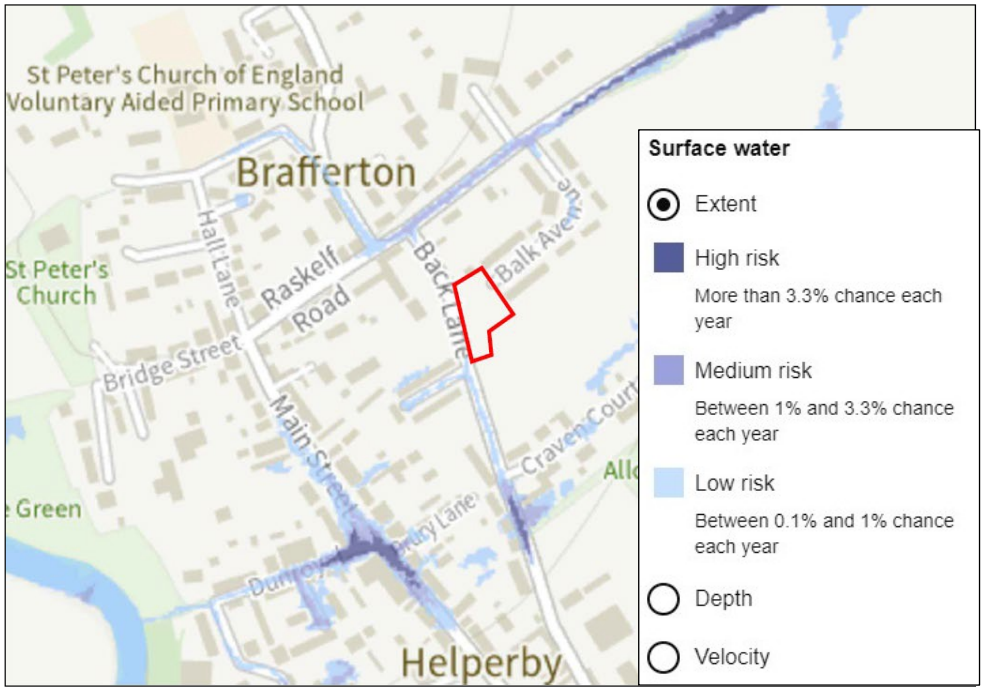


Figure 7: Environment Agency Flood Map showing the extent of Surface Water Flooding dated August 2024

8.5.2 The map indicates that the site is outside areas considered to be at risk of surface water flooding.

8.5.3 Due to there being no risk of surface water flooding within the site boundaries, the risk is considered to be low and acceptable.

8.6 Flood Risk from Existing Water Mains

8.6.1 There are likely to be existing small diameter water mains supplying potable water to the existing buildings adjacent to the proposed development. While there have been no recorded instances of flooding due to failure of these mains present within the vicinity of the development serving the existing buildings, however given their likely size and capacity the rate and volume of water released in the event of a burst would be insignificant.

8.7 Flood Risk from Existing Sewers

8.7.1 The Yorkshire Water PPE indicates that there are no surface or combined sewers in, or adjacent to the site. There is a 150mm foul sewer crossing the site, but there are no known instances of flooding from this sewer.

8.8 Flood Risk from Reservoirs, Canals and Other Artificial Sources

8.8.1 The Environment Agency extent of flooding map shows that the closest area at risk from flooding due to failure of a reservoir is Eppleworth Road, located approximately 1Km to the south, the source of this potential flooding is likely to be from a failure of the WADFAS and COPFAS flood alleviation schemes.

8.8.2 A copy of the map produced by the Environment Agency showing the extent of flooding from reservoirs is included in Figure 8 below.

Figure 8: Environment Agency map showing the extent of flooding from Reservoirs dated August 2024

8.9.3 Given the distance from the areas indicated to be at risk of flooding, and the changes in elevation, the risk to the site from reservoir flooding is insignificant.

9.0 FLOOD MITIGATION MEASURES

9.1 The development site is shown to lie within an area classified as 'low probability' of flooding on the maps produced by the Environment Agency, it also falls outside areas at risk of flooding from surface water, ground water emergence, reservoirs, and the rivers & sea.

9.2 On this basis, it is considered that the flood levels to all the new buildings incorporated within the proposed development can be constructed at traditional levels of construction, normally approximately 150mm above adjacent external ground level, with external ground levels designed to direct rainwater away from the buildings.

9.3 No other specific flood mitigation measures are considered necessary in respect of the proposed development.

10.0 SUMMARY

10.1 The report has been prepared to assess the flood risk implications for a new residential development comprising 2 detached dwellings at Back Lane, Helperby, North Yorkshire.

10.2 The area of the proposed development is shown to lie in Flood Zone 1 (low probability of flooding). Residential dwellings are classified as being 'more vulnerable' which is permitted in Flood Zone 1.

10.3 This report has considered other potential sources of flooding to the site, including groundwater, surface water, fluvial, existing sewers, water mains and other artificial sources and found that the site is at very low risk from any of these sources.

10.4 No other specific flood risk to the development has been identified in the preparation of the report.

10.5 The report also demonstrates that the foul and surface water drainage networks for the new development can be designed and constructed to meet the requirements of local planning policies.

10.6 Foul water run-off will be discharged to the existing foul public sewer crossing the site.

10.7 The substrata is not suitable for infiltration, and there are no suitable public sewers or watercourses in the vicinity of the site, therefore it is proposed to discharge to a nearby Yorkshire Water final effluent drain at a peak rate of 1.0l/s, discharge to the public foul sewer or final effluent pipe will be subject to Yorkshire Water approval.

10.8 Attenuation will be provided in cellular storage systems located within the development footprint, with the connection to the final effluent pipe being laid by negotiation or requisition.

10.9 The provision of gravel drives will provide a water quality improvement in accordance with good SuDS practice, if they are constructed in accordance with the SuDS manual and provide an element of filtration to the surface water runoff from the parking areas.

10.10 Suitably worded conditions can be applied to the grant of planning permission to control the delivery of the development in the usual manner.

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APPENDIX A

Topographic Survey Drawing

REV	DATE ISSUED	SURVEYED	DRAWN	CHKD
A	09/03/2022	FC	MM	FC

DESCRIPTION

FIRST ISSUE

NOTES

LEVELS ARE RELATED TO O.D. (NEWLYN).

CO-ORDINATES ARE RELATED TO NATIONAL GRID DERIVED VIA GPS - OSGB36(15) SYSTEM.

UTILITY CONFIDENCE LEVELS
(LISTED FROM HIGH TO LOW)

(A) HORIZONTAL AND VERTICAL POSITION VERIFIED VISUALLY (ACCURACY: HORIZONTAL ±25mm, VERTICAL ±25mm)

(B1P) HORIZONTAL AND VERTICAL POSITION DETECTED BY MULTIPLE METHODS WITH POST PROCESSING OF GPR DATA (ESTIMATED ACCURACY ±150mm OR ±15% OF DETECTED DEPTH)

(B1) HORIZONTAL AND VERTICAL POSITION DETECTED BY MULTIPLE METHODS (ESTIMATED ACCURACY ±150mm OR ±15% OF DETECTED DEPTH)

(B2P) HORIZONTAL AND VERTICAL POSITION DETECTED BY POST PROCESSING OF GPR DATA (ESTIMATED ACCURACY ±250mm OR ±40% OF DETECTED DEPTH)

(B2) HORIZONTAL AND VERTICAL POSITION DETECTED BY A SINGLE METHOD (ESTIMATED ACCURACY ±250mm OR ±40% OF DETECTED DEPTH)

(B3P) HORIZONTAL POSITION DETECTED BY POST PROCESSING OF GPR DATA (ESTIMATED ACCURACY: HORIZONTAL ±50mm, DEPTH IS UNDEFINED)

(B3) HORIZONTAL POSITION DETECTED BY A SINGLE METHOD (ESTIMATED ACCURACY: HORIZONTAL ±500mm, DEPTH IS UNDEFINED)

(C) ROUTE TRANSCRIBED FROM UTILITY ASSET PLANS AND CORRELATED TO VISUAL INDICATORS & SURFACE FEATURES (ACCURACY UNDEFINED)

(D) ROUTE TRANSCRIBED FROM UTILITY ASSET PLANS (ACCURACY UNDEFINED)

LEGEND

- SPOT LEVELS
- SURVEY STATION
- TREE (CONIFEROUS)
- TREE (DECIDUOUS)
- BANK
- BUILDING
- BUILDING (3D)
- EDGE OF LAND USAGE
- FENCE
- FOUL DRAINAGE PIPELINE
- GRIDLINE
- HEDGE (CENTER)
- HEDGE (EDGE)
- KERB TOP
- OVERHEAD WIRE
- ROAD
- SURFACE
- TRACK
- UTILITY
- WALL

ABBREVIATIONS

CBF	CLOSE BOARD FENCE
CL	COVER LEVEL
FH	FIRE HYDRANT
FHM	FIRE HYDRANT MARKER
G	GULLY
H	HEIGHT
LP	LAMP POST
MH	MANHOLE
PGM	PERMANENT GROUND MARKER
RL	ROOF LEVEL
SP	SIGN POST
TC	TELECOM COVER
TP	TELECOM POLE
UTL	UNABLE TO LIFT
WM	WATER METER

CLIENT

MULGRAVE PROPERTY GROUP LTD

PROJECT

BACK LANE
HELPERBY

TITLE

TOPOGRAPHICAL SURVEY

SCALE	1:200 (UNLESS OTHERWISE STATED)	DRAWN	MM
DATE SURVEYED	28/02/2022	CHECKED	FC
DATE ISSUED	09/03/2022	APPROVED	DBe

LSTC GROUP
http://www.lstc.co.uk
Tel - 01377 253617

ORIGINAL SIZE	DRAWING NUMBER	REV
A0	06_220053_01	A

470150N
470100N
470050N
470000N
443900E
443950E
444000E
444050E
0 2 4 6 8 10 12 14 16 20
METRES 1:200

Alan Wood & Partners

APPENDIX B

Infiltration Testing Technical Note

Engineer/
Manage/
Deliver/

Alan Wood & Partners

Alan Wood & Partners

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TECHNICAL NOTE – SOAKAWAY TESTING

For Mulgrave Property Group Ltd

Back Lane, Helperby, North Yorkshire

Prepared by: **A. Clark** *BSc (Hons) MSc FGS*

[redacted]

Approved by: **S. L. Roberts,** *BEng (Hons) MSc MICE CEnv*

[redacted]

Date: 21st June 2022

1.0 INTRODUCTION

1.1.1 Alan Wood & Partners were appointed by Mulgrave Property Group Limited (the 'Client') to undertake soakaway testing for a proposed residential development at a site located off Back Lane, Helperby, North Yorkshire.

1.1.2 This report provides geotechnical information in relation to the proposed redevelopment of the site for a residential end-use. Interpretation and recommendations should not be assumed valid for adjacent areas of land, or for alternative land uses. Should the proposed site usage change, the recommendations and conclusions presented in this report may need to be re-assessed.

1.2.3 The findings and recommendations given in this report are based on fieldwork undertaken on the 7th of June 2022, comprising the completion of two machine excavated trial pits to complete soakaway testing.

1.2.4 The report has been prepared for the titled project and Alan Wood and Partners can accept no responsibility or liability for the consequences of the use of this document, wholly or in part, for any other purpose than that for which it was commissioned.

1.2.5 The conclusions and recommendations presented in this report are based on site-specific information obtained during the investigation to include the ground conditions encountered and tests undertaken on site and are considered reasonable on the basis of available information at the time the assessment was carried out. They should not necessarily be relied upon to represent site conditions at a substantially later date.

1.2.6 The findings and opinions provided in this report are given in good faith and are subject to the limitations and constraints imposed by the methods and information sources described. Factual information has been obtained from a variety of sources. Alan Wood and Partners assumes that third party data is reliable, but has not independently confirmed this. The validity and accuracy of this information is therefore outside the control of Alan Wood and Partners. Professional judgement and experience are however used to ensure that uncertainties are reduced to a level appropriate to the site conditions, the purpose of the investigation and the resources devoted to it by the Client.

1.2.7 Whilst every effort has been made to carry out an assessment that enables a realistic characterisation of the geotechnical parameters at the site, the possibility of significant spatial variation in actual ground, groundwater and environmental (gas and contamination) conditions existing between or beyond exploratory hole locations cannot be discounted. Where information or opinion is given this is for guidance only. Further information, ground investigation, construction activities, change of site use or the passage of time may reveal conditions that were not indicated in the data and therefore could not have been considered in the preparation of this report. Where such information might impact upon stated opinions, Alan Wood and Partners cannot accept responsibility for conditions not encountered and reserves the right to modify or retract the opinions expressed in this report. Where opinions expressed are based on current available guidelines and legislation, no

liability can be accepted by AWP for the effects of any future changes to such guidelines and legislation. New information of improved practices and changes in legislation may require reinterpretation of the report as a whole, or in part.

1.2.8 All ground investigation works and soil descriptions were undertaken in general accordance with BS EN ISO 14688-1 'Geotechnical Investigation and Testing – Identification and Classification of Soil' (2018), BS10175 (2011), BS 5930 (2015) and/or BS EN 1997-1:2004 (Part 1, General Rules) and BS EN 1997-2:2007 (Part 2, Ground Investigation and Testing).

2.0 SITE DETAILS AND DESCRIPTION

2.1 Site Location and Description

2.2.1 The site is located to the north east of Back Lane on the eastern fringe of Helperby village and is centred at National Grid Reference (NGR) 443991 470080. A site location plan is shown appended on Figure 46179/002.

2.2.2 The soakaway testing was undertaken to the south of the development site, with the location of the tests shown on Figure 47105/006.

2.2.2 The site is currently an agricultural field.

2.2.3 Published geological mapping for the site indicates superficial deposits of The Vale of York Formation comprising glacial sandy clay, clayey sand and clay with gravel and/or boulders. Bedrock is recorded as the Sherwood Sandstone Formation.

2.2.4 The superficial soils below the site are designated as a Secondary B aquifer. The bedrock aquifer is a Principal aquifer.

3.0 GROUND INVESTIGATION FIELDWORK

3.1 Ground Investigation Objectives

3.1.1 A ground investigation was carried out to undertake percolation testing to determine the suitability of soakaway drainage. The scope of works consisted of advancing two trial pits (TP1 and TP2) to a maximum depth of 1.60m bgl and performing a soakaway test in each trial pit.

3.1.2 The positions of the exploratory locations were advised by the client and are shown on the appended ground investigation plan, Figure 47105/006.

3.1.3 Standard strata descriptions of the soils encountered are in general compliance with BS EN 1997:2004, BS EN 1997:2007, BS EN ISO 14688-1:2018, BS EN ISO 14688-2:2018 and BS EN ISO 14689:2003. The individual strata depths recorded on each trial pit log are those from existing ground levels.

3.1.4 Soakaway testing was carried out in accordance with BRE DG 365 (2016) by SOCOTEC UK Ltd.

4.0 RESULTS OF THE INVESTIGATION

4.1 Ground Conditions Encountered

4.1.1 The ground conditions encountered are summarised in Table 1, while discussion about each one is given in the following paragraphs. A copy of the ground investigation logs is appended to this report.

Table 1 - Summary of Encountered Ground Conditions

Lithology	Exploration Location	Depth to base (m bgl)	Approximate Thickness (m)
Topsoil	All	0.40	
Granular Superficial Deposits*	All	1.20 – 1.60	0.80 – 1.20
Bedrock	No bedrock was encountered at any location.		
Groundwater	No groundwater was encountered at any location.		

* Base not proven.

4.1.2 **Topsoil**: Topsoil was encountered at both locations to a depth of 0.40m. This typically comprised gravelly sand.

4.1.3 **Made Ground**: No made ground was recorded in the investigation.

4.1.4 **Natural Strata**: The underlying natural strata of the site comprised a medium dense slightly clayey gravelly sand, with gravel of both mudstone and sandstone.

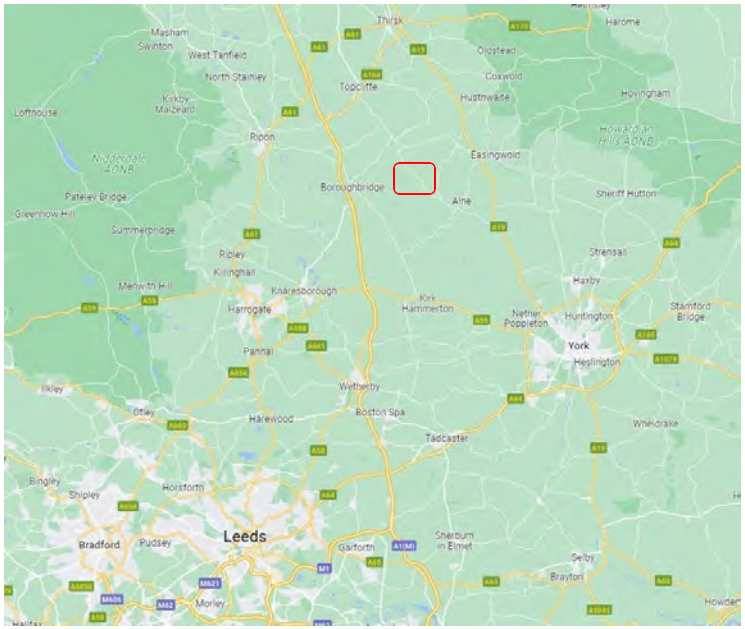
4.1.5 **Groundwater**: No groundwater was encountered during the investigation.

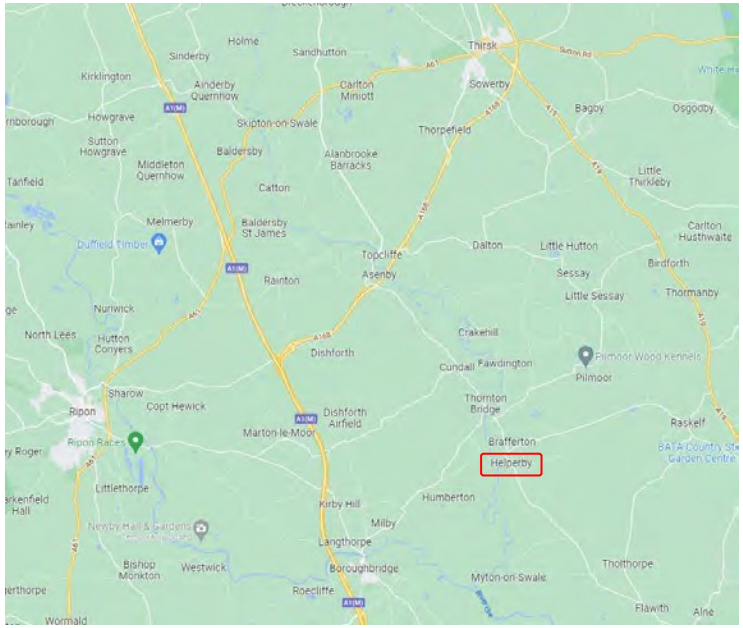
4.1.6 No visual or olfactory evidence of gross contamination, such as hydrocarbons, was recorded during the ground investigation.

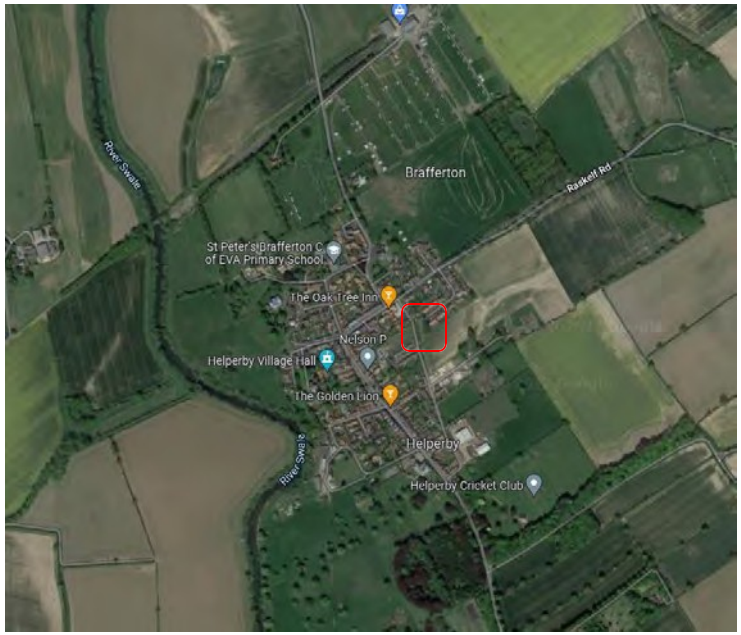
4.2 Drainage and Soakaways

5.3.1 An infiltration rate could not be determined given that a 25% effective depth was not achieved (i.e. 75% of the water did not drain away).

5.3.2 On the basis of these results, soakaway drainage is not suitable and alternative drainage methods need to be devised.







Key

Approximate site location.

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DO NOT SCALE

Client.	**Mulgrave Property Group Limited**		
Project.	**Back Lane, Helperby, YO61 2PN**		
Drawing.	**Site Location Plan**		
Date. **28.03.2022**		Scale. **NTS**	
Drawn by. **NMG**	Check by. **JMS**	Approved by. **JMS**	
Status:	**FINAL**		
Job no. **47105**	Fig. no. **002**	Rev.	

Key

Approx. location of soakaway test carried out on 07.06.22.

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DO NOT SCALE

Client.	**Mulgrave Property Group Limited**		
Project.	**Back Lane, Helperby, YO61 2PN**		
Drawing.	**Exploratory Hole Location Plan**		
Date. **17.06.2022**		Scale. **NTS**	
Drawn by. **AC**	Check by. **SLR**	Approved by. **SLR**	
Status:	**FINAL**		
Job no. **47105**	Fig. no. **006**	Rev.	

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Trial Pit Log

Trialpit No
TP1
Sheet 1 of 1

Project Name: Back Lane, Helperby	Project No. 47105	Co-ords: 443996.00 - 470019.00 Level: 18.25	Date 07/06/2022
Location: North Yorkshire, YO61 2PN		Dimensions (m): 2 × 0.9 Depth 1.20	Scale 1:25
Client: Mulgrave Property Group Limited			Logged LAF

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40	17.85		TOPSOIL: Grey brown gravelly SAND. Gravel is fine to coarse subrounded and rounded mudstone.
				0.80	17.45		Medium dense brown slightly clayey gravelly SAND. Gravel is fine to coarse subrounded and rounded mudstone.
				1.20	17.05		Medium dense orange brown slightly clayey gravelly SAND. Gravel is fine to coarse subrounded and rounded mudstone.
							End of pit at 1.20 m

Remarks: 1. No groundwater encountered. 2. Soakaway undertaken at 1.20m bgl.

Stability: Stable

AGS

Alan Wood & Partners

Trial Pit Log

Trialpit No
TP2
Sheet 1 of 1

Project Name: Back Lane, Helperby	Project No. 47105	Co-ords: 444027.00 - 470008.00 Level: 17.79	Date 07/06/2022
Location: North Yorkshire, YO61 2PN		Dimensions (m): 1.8 x 0.9 Depth 1.60	Scale 1:25
Client: Mulgrave Property Group Limited			Logged LAF

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							TOPSOIL: Grey brown slightly clayey gravelly SAND.
				0.40	17.39		Medium dense orange brown clayey gravelly SAND. Gravel is fine to coarse subangular to rounded mudstone and sandstone.
				0.80	16.98		Medium dense orange brown slightly clayey gravelly SAND. Gravel is medium subangular red mudstone.
				1.60	16.18		End of pit at 1.60 m

Remarks: 1. No groundwater encountered. 2. Soakaway undertaken at 1.60m bgl.

Stability: Stable

AGS

Soakaway Test

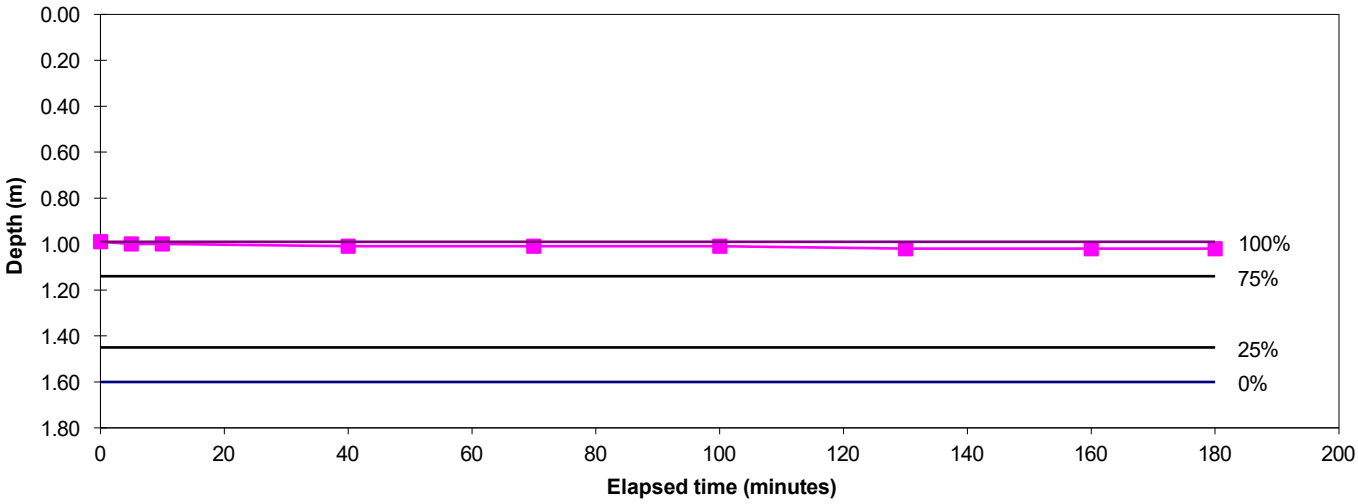
Trial Pit No: SA01 Test No: 1 Date: 07/06/2022

Length (m): 1.80 Datum height: 0.00 m agl

Width (m): 0.90 None

Depth (m): 1.60

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.99		
5	1.00		
10	1.00		
40	1.01		
70	1.01		
100	1.01		
130	1.02		
160	1.02		
180	1.02		



Start water depth for analysis (mbgl): 0.99

75% effective depth (mbgl): 1.14

50% effective depth (mbgl): 1.30

25% effective depth (mbgl): 1.45

Base of soakage zone (mbgl): 1.60

Volume outflow between 75% and 25% effective depth (m3):

Mean surface area of outflow (m^2): 3.24

(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate:	**Unable to reliably determine soil infiltration rate as 25% effective depth not achieved.**
Remarks	Results processed following BRE DG 365 (2016).

Notes:	Project: Helperby Project No.: 51068640 Carried out for: Alan Wood and Partners	Figure

Soakaway Test

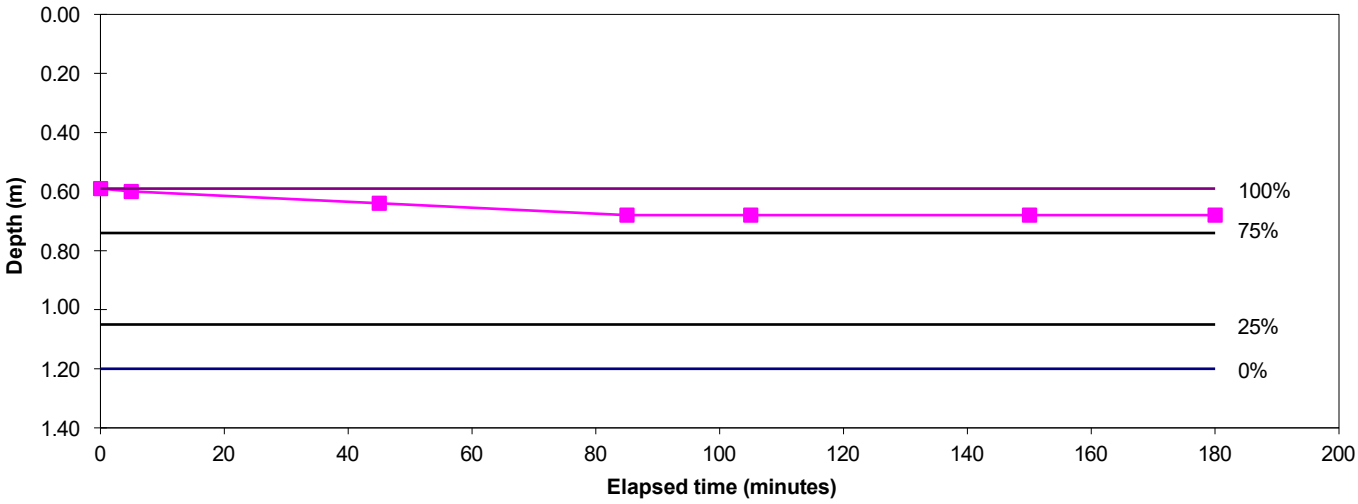
Trial Pit No: SA02 Test No: 1 Date: 07/06/2022

Length (m): 2.00 Datum height: 0.00 m agl

Width (m): 0.50 None

Depth (m): 1.20

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.59		
5	0.60		
45	0.64		
85	0.68		
105	0.68		
150	0.68		
180	0.68		



Start water depth for analysis (mbgl): 0.59

75% effective depth (mbgl): 0.74

50% effective depth (mbgl): 0.90

25% effective depth (mbgl): 1.05

Base of soakage zone (mbgl): 1.20

Volume outflow between 75% and 25% effective depth (m3):

Mean surface area of outflow (m^2): 2.50

(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate:	**Unable to reliably determine soil infiltration rate as 25% effective depth not achieved.**
Remarks	Results processed following BRE DG 365 (2016).

Notes:

Project: Helperby

Project No.: 51068640

Carried out for: Alan Wood and Partners

Figure

Alan Wood & Partners

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01482.442138	0113 531.1098	01522.300210
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London	West Ayton	Hayland Street
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Historic Building Services
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Planning Applications
Project Managers
Renewable Energy
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Structural Engineering
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Topographic & Measured Surveys
Traffic Assessments

Quality Assurance Accreditation
ISO 9001 Registered firm
Certificate no. GB.02/07

Environmental Accreditation
ISO 14001Registered firm
Certificate no. GB.09/277b

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APPENDIX C

Indicative Site Layout Drawing

Back Lane, Helperby

Enclosures

1.2m high timber post and rail fence

1.8m high close boarded fence

Electric car charging Point.

Mode 3 electric vehicle charging point with a type 2 outlet socket. E

Schedule of Accommodation

Self Build Plot 1	2 Storey	Circa 02,600SqFt
Self Build Plot 2	2 Storey	Circa 02,600SqFt
Total		Circa 05,200SqFt

Gross site area = 0.18 Ha (0.46 Acres)

Rev	By	Note	Date

Status: Planning

Sketch | Planning | Tender | Construction | As Built

PRA. Architecture

55 The Tannery . Lawrence Street . York . YO10 3WH T:01904 653772
E:mail@pra-architecture.com W: www.pra-architecture.com

PROJECT Back Lane, Helperby

TITLE Proposed Site Layout

CLIENT The Helperby Estate

DATE 20.08.24 SCALE 1:500@A3

DRAWING 1357.05 REVISION -

DRAWN JD CHECKED JD

Proposed Site Layout

Alan Wood & Partners

APPENDIX D

Yorkshire Water Pre-Planning Response

YORKSHIRE WATER
PROTECTION OF MAINS AND SERVICES

1. The position of Yorkshire Water Services Ltd (YWS) apparatus shown on the existing mains record drawing(s) indicates the ***general*** position and nature of our apparatus and the accuracy of this information cannot be guaranteed. Any damage to YWS apparatus as a result of your works may have serious consequences and you will be held responsible for all costs incurred. Prior to commencing major works, the exact location of apparatus must be determined on site, if necessary by excavating trial holes. The actual position of such apparatus and that of service pipes which have not been indicated must be established on site by contacting the Customer Helpline on 0845 124 24 24 for both water and sewerage.

2. The public sewer and water network is lawfully retained in its existing position and the sewerage and water undertaker is entitled to have it remain so without any disturbance. The provisions of section 159 of the Water Industry Act 1991 provides that the undertaker may "inspect, maintain, adjust, repair or alter" the network. Those rights are given to enable the undertaker to perform its statutory duties. Any development of the land or any other action that unacceptably hindered the exercise of those rights would be unlawful. The provisions contained in Section 185 of the Water Industry Act 1991 state that where it is reasonable to do so, a person may require the water supply undertaker to alter or remove a pipe where it is necessary to enable that person to carry out a proposed change of use of the land. The provisions contained in Section 185 also require the person making the request to pay the full cost of carrying out the necessary works.

3. Ground levels over existing YWS apparatus are to be maintained. Sewers in highways will ***generally*** be laid to give 1200mm of cover from finished ground level working to kerb races, other permanent identification of the limits of the road or to an agreed line and level. Substantial increases or decreases to this 1200mm depth of cover will result in the sewer being re-laid at your expense. Water mains and services will ***generally*** be laid with a minimum of 750mm depth of cover however some mains and services usually those installed over 50 years ago may have less ground cover.

4. If surface levels are to be decreased / increased significantly the effects on existing water supply apparatus will be carefully considered and if any alterations are necessary, the costs of the alterations will be recharged to you in full. Outlets on fire hydrants must be no more than 300mm below the new levels and all surface boxes must be adjusted as part of the scheme.

5. To enable future repair works to be carried out without hindrance; any pipe, cable, duct, etc. installed parallel to a water main or service pipe should not be installed directly over or within 300mm of a water main or service pipe or 1000mm of a waste water asset. Where a pipe, cable, duct, etc. crosses a main or service it should preferably cross perpendicular or at an angle of no less than 45o and with a minimum clearance of 150mm. These requirements apply to activities within an existing highway and are relevant to the installation of pipes, cables, ducts, etc. up to and including 250mm in diameter *(see illustration below).* Necessary protection measures for installations greater than 250mm in diameter and/or in private land will need to be agreed on an individual basis. Installations within a new development site must comply with the National Joint Utilities Group publication Volume 2: NJUG Guidelines On The Positioning Of Underground Utilities Apparatus For New Development Sites.

6. All excavation works near to YW apparatus should be by hand digging only.

7. Backfilling with a suitable material to a minimum 300mm above YW apparatus is required.

8. Adequate support must be provided where any works pass under YW apparatus.

9. Jointing chambers, lighting columns and other structures must be installed in such a way that future repair or maintenance works to YW apparatus will not be hindered.

10. Apparatus such as; railings, sign posts, etc. must not be placed in such a way that they prevent access to or full operation of controlling valves, hydrants or similar apparatus. YWS surface boxes must not be covered or buried. Any adjustment, alteration or replacement of manhole covers must be agreed on site prior to the commencement of the works with a YWS Inspector who may be contacted via our Call Centre on 0845 124 24 24.

11. Explosives shall not be used within 100 metres of any Yorkshire Water Services apparatus or installations.

12. Vibrating plant should not be used directly over any apparatus. Movement or operation by vehicles or heavy plant is not to be permitted in the immediate vicinity of YWS plant or apparatus unless there has been prior consultation and, if necessary, adequate protection provided without cost to YWS.

13. ***Under no circumstances*** should thrust boring or similar trenchless techniques commence until the actual position of the Company's mains/services along the proposed route have been confirmed by trial holes.

14. Any alterations to the highway should be notified following the procedures outlined in the New Road and Street Works Act 1991 Code of Practice; Measures Necessary Where Apparatus Is Affected By Major Works (Diversionary Works).

15. You will be held responsible for any damage or loss to YWS apparatus during and after completion of work, caused by yourselves, your servant or agent. Any damage caused or observed to YWS plant or apparatus should be immediately reported to YWS. Should YW incur any costs as a result of non-compliance with the above, all costs will be rechargeable in full.

16. You should ensure that nothing is done on the site to prejudice the safety or operation of YWS employees, plant or apparatus.

17. In accordance with the New Roads and Street Works Act 1991, Chapter 22, Part 3, Section 80. The location of any identified YW asset "*which is not marked, or is wrongly marked, on the records made available*" should be communicated back to Yorkshire Water. The location of the apparatus should be identified on copies of the supplied plans which should be returned to Yorkshire Water (Asset Records Team) with photographic supporting evidence where possible.

18. The Government has decided that responsibility for private sewers serving two or more properties and lateral drains (the section of pipe beyond the boundary of a single property, connecting it to the public sewer) will be transferred to the water companies on Oct 1 2011.

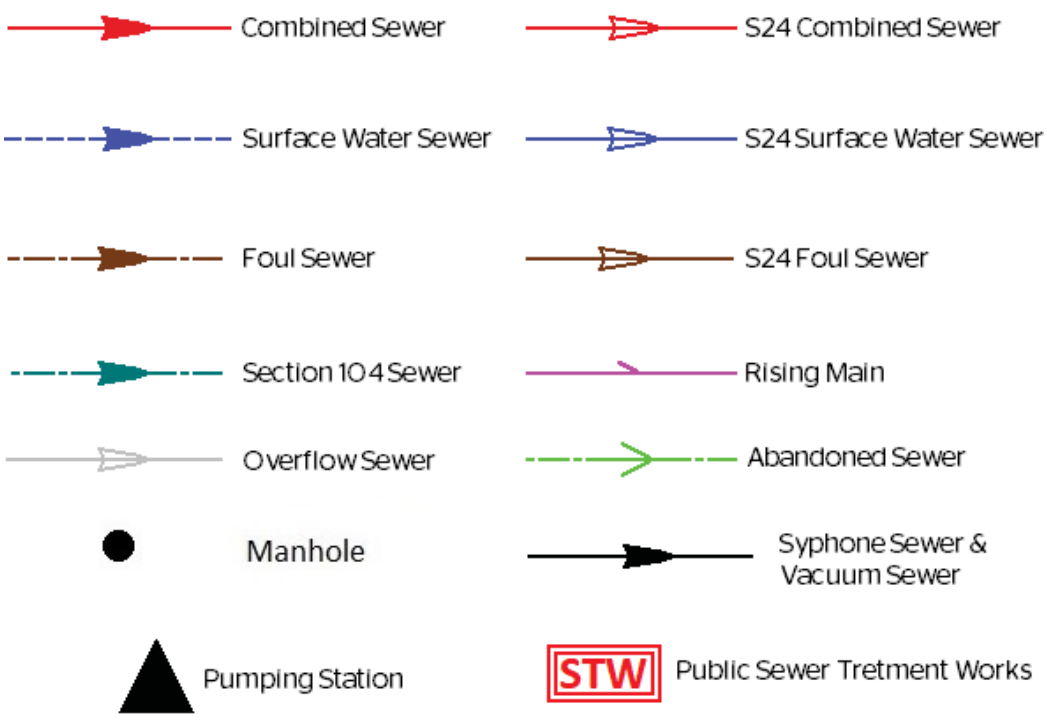
Private pumping stations will also transfer during the period 1 October 2011 – 1 Oct 2016. Records of these assets may not yet be shown on the existing mains record drawing(s). If you encounter any of these assets you must inform Yorkshire Water Services Ltd (YWS).

19. Please note that the information supplied on the enclosed plans is reproduced from Ordnance Survey material with the permission of the Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 1000019559.

20. This information is for guidance only and the position and depth of any YW apparatus is approximate only. Likewise, the nature and condition of any YW apparatus cannot be guaranteed. YW has no responsibility for recording the locations of privately owned apparatus. As of 1 October 2011, there may be some lateral drains and/or public sewers which are not documented on YW records but may still be present. For the avoidance of doubt, this information is not a substitute for appropriate professional and/or legal advice. YW accepts no responsibility for any inaccuracy or omissions in this information. The actual position of YW apparatus must be determined on site by excavating trail holes by hand. YW requires a minimum of two working days' written notice of the intention to excavate any trial holes before any excavation can be undertaken. If there are any queries in this respect please contact Yorkshire Water on 0845 124 24 24.

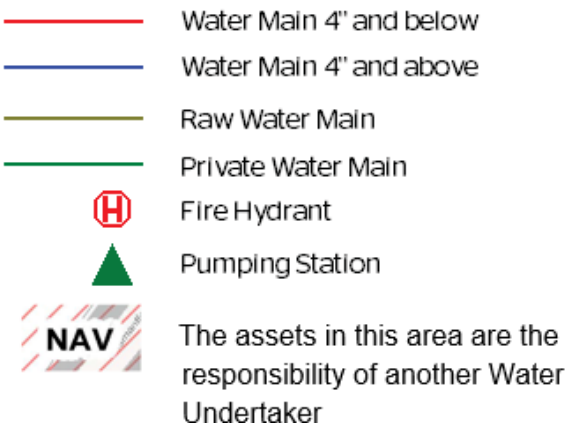
Property Identfier

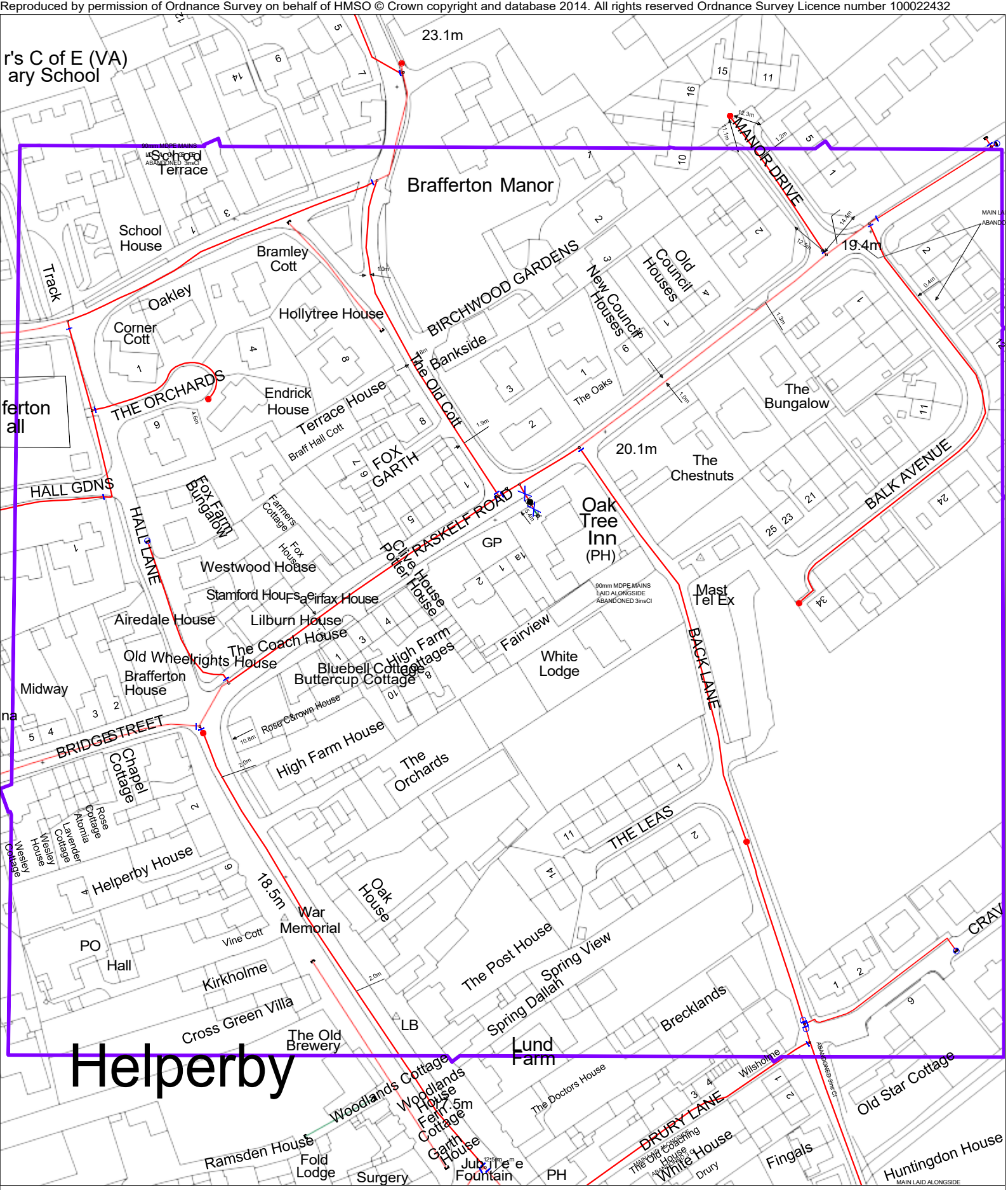
Sewer Legend

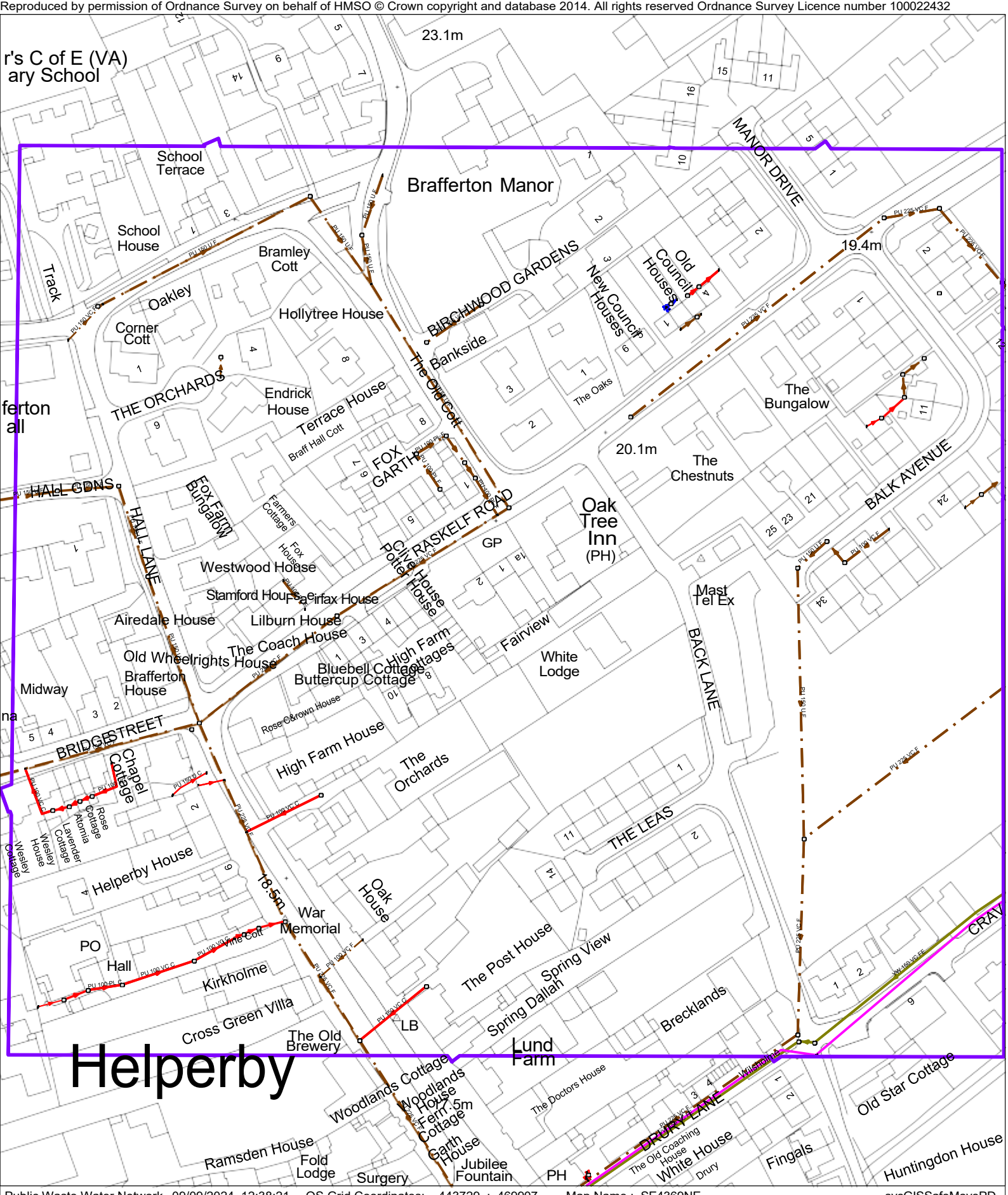


Please note that the direction of flow arrows may not always appear depending on the scale of the map.

Water Legend



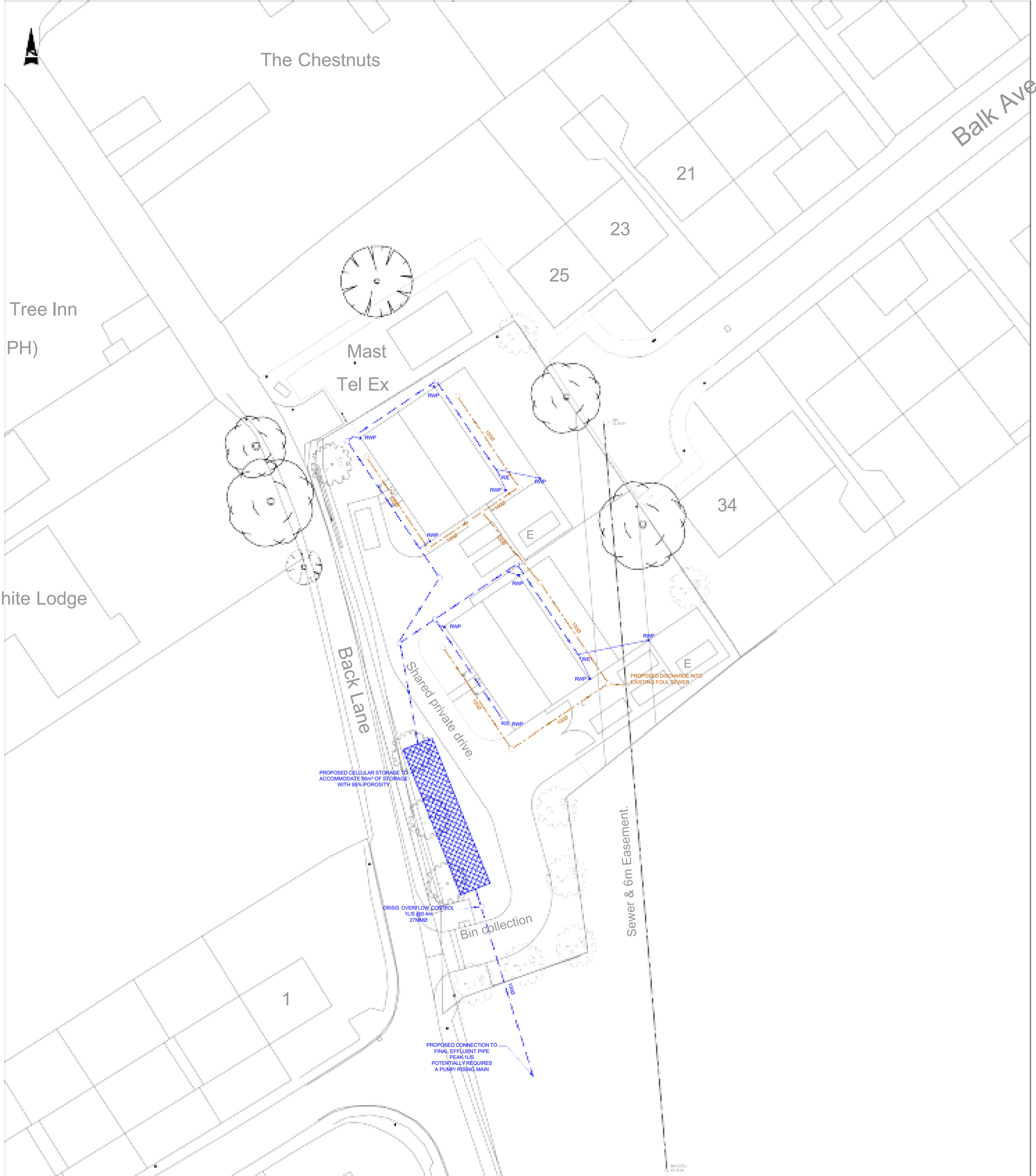




Public Waste Water Network 09/09/2024 12:38:21 OS Grid Coordinates: 443729 : 469907 Map Name : SE4369NE svcGISSafeMovePD

APPENDIX E

Drainage Strategy Drawing



NOTES:

1. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.
3. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.
4. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

DRAINAGE LEGEND:

- FOUL WATER PIPEWORK
- FOUL WATER MANHOLE
- SURFACE WATER PIPEWORK
- SURFACE WATER MANHOLE
- EXISTING FOUL SEWER

100mm at A1

Rev	Description	Date	By	Chk	App
P1	FIRST ISSUE	20.08.24	HD	AD	--

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Project Managers
Building Surveyors

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Lincoln T. 01522 300210
Scarborough T. 01723 865484
Sheffield T. 01142 440077
York T. 01904 611594

Project: Land off Back Lane, Helperby, York, North Yorkshire

Client: The Helperby Estate

Drawing: Proposed Drainage Layout

Role: Civil Engineer

Drawing Status: FOR APPROVAL | Suitability Code: -

Job. no. 51110 | Scale@ A1: 1:200 | Rev. P1

Project	Originator	Volume	Level	Type	Role	Number
BLH	AWP	ZZ	XX	DR	C	3300

Alan Wood & Partners

APPENDIX F

Hydraulic Model Calculations

Summary of Results for 1 year Return Period (+40%)

Half Drain Time : 157 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.650	0.150	0.0	0.8	0.8	8.3	O K
30 min Summer	8.689	0.189	0.0	0.8	0.8	10.4	O K
60 min Summer	8.726	0.226	0.0	0.8	0.8	12.4	O K
120 min Summer	8.751	0.251	0.0	0.8	0.8	13.8	O K
180 min Summer	8.758	0.258	0.0	0.8	0.8	14.2	O K
240 min Summer	8.761	0.261	0.0	0.8	0.8	14.4	O K
360 min Summer	8.759	0.259	0.0	0.8	0.8	14.3	O K
480 min Summer	8.751	0.251	0.0	0.8	0.8	13.8	O K
600 min Summer	8.741	0.241	0.0	0.8	0.8	13.3	O K
720 min Summer	8.730	0.230	0.0	0.8	0.8	12.7	O K
960 min Summer	8.708	0.208	0.0	0.8	0.8	11.5	O K
1440 min Summer	8.670	0.170	0.0	0.8	0.8	9.3	O K
2160 min Summer	8.626	0.126	0.0	0.8	0.8	6.9	O K
2880 min Summer	8.597	0.097	0.0	0.8	0.8	5.3	O K
4320 min Summer	8.567	0.067	0.0	0.7	0.7	3.7	O K
5760 min Summer	8.555	0.055	0.0	0.6	0.6	3.0	O K
7200 min Summer	8.548	0.048	0.0	0.5	0.5	2.6	O K
8640 min Summer	8.542	0.042	0.0	0.4	0.4	2.3	O K
10080 min Summer	8.539	0.039	0.0	0.4	0.4	2.1	O K
15 min Winter	8.650	0.150	0.0	0.8	0.8	8.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	40.459	0.0	8.7	18
30 min Summer	26.283	0.0	11.3	32
60 min Summer	16.619	0.0	14.4	62
120 min Summer	10.297	0.0	17.9	120
180 min Summer	7.744	0.0	20.2	150
240 min Summer	6.320	0.0	21.9	182
360 min Summer	4.742	0.0	24.7	250
480 min Summer	3.844	0.0	26.7	318
600 min Summer	3.265	0.0	28.3	386
720 min Summer	2.857	0.0	29.8	454
960 min Summer	2.315	0.0	32.2	586
1440 min Summer	1.722	0.0	35.9	838
2160 min Summer	1.281	0.0	40.1	1192
2880 min Summer	1.039	0.0	43.4	1552
4320 min Summer	0.773	0.0	48.3	2244
5760 min Summer	0.626	0.0	52.3	2944
7200 min Summer	0.532	0.0	55.5	3672
8640 min Summer	0.466	0.0	58.4	4408
10080 min Summer	0.417	0.0	60.8	5136
15 min Winter	40.459	0.0	8.7	18

Summary of Results for 1 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	8.689	0.189	0.0	0.8	0.8	10.4	O K
60 min Winter	8.726	0.226	0.0	0.8	0.8	12.4	O K
120 min Winter	8.751	0.251	0.0	0.8	0.8	13.9	O K
180 min Winter	8.757	0.257	0.0	0.8	0.8	14.1	O K
240 min Winter	8.757	0.257	0.0	0.8	0.8	14.2	O K
360 min Winter	8.751	0.251	0.0	0.8	0.8	13.8	O K
480 min Winter	8.736	0.236	0.0	0.8	0.8	13.0	O K
600 min Winter	8.720	0.220	0.0	0.8	0.8	12.1	O K
720 min Winter	8.703	0.203	0.0	0.8	0.8	11.2	O K
960 min Winter	8.671	0.171	0.0	0.8	0.8	9.4	O K
1440 min Winter	8.621	0.121	0.0	0.8	0.8	6.6	O K
2160 min Winter	8.577	0.077	0.0	0.7	0.7	4.2	O K
2880 min Winter	8.561	0.061	0.0	0.6	0.6	3.3	O K
4320 min Winter	8.545	0.045	0.0	0.5	0.5	2.5	O K
5760 min Winter	8.538	0.038	0.0	0.4	0.4	2.1	O K
7200 min Winter	8.534	0.034	0.0	0.3	0.3	1.9	O K
8640 min Winter	8.531	0.031	0.0	0.3	0.3	1.7	O K
10080 min Winter	8.529	0.029	0.0	0.3	0.3	1.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	26.283	0.0	11.3	32
60 min Winter	16.619	0.0	14.4	60
120 min Winter	10.297	0.0	17.9	116
180 min Winter	7.744	0.0	20.2	166
240 min Winter	6.320	0.0	21.9	188
360 min Winter	4.742	0.0	24.7	266
480 min Winter	3.844	0.0	26.7	340
600 min Winter	3.265	0.0	28.3	412
720 min Winter	2.857	0.0	29.8	482
960 min Winter	2.315	0.0	32.2	616
1440 min Winter	1.722	0.0	35.9	854
2160 min Winter	1.281	0.0	40.1	1188
2880 min Winter	1.039	0.0	43.4	1528
4320 min Winter	0.773	0.0	48.3	2208
5760 min Winter	0.626	0.0	52.3	2936
7200 min Winter	0.532	0.0	55.5	3680
8640 min Winter	0.466	0.0	58.4	4328
10080 min Winter	0.417	0.0	60.8	5072

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	58.0	0.0	1.001	0.0	0.0
1.000	58.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	8.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0
Flush-Flo™	0.205	0.8
Kick-Flo®	0.415	0.7
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 419 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.880	0.380	0.0	0.8	0.8	20.9	O K
30 min Summer	8.989	0.489	0.0	0.8	0.8	26.9	O K
60 min Summer	9.093	0.593	0.0	0.8	0.8	32.7	O K
120 min Summer	9.182	0.682	0.0	0.8	0.8	37.6	O K
180 min Summer	9.219	0.719	0.0	0.9	0.9	39.6	O K
240 min Summer	9.233	0.733	0.0	0.9	0.9	40.4	O K
360 min Summer	9.230	0.730	0.0	0.9	0.9	40.2	O K
480 min Summer	9.218	0.718	0.0	0.9	0.9	39.6	O K
600 min Summer	9.205	0.705	0.0	0.9	0.9	38.8	O K
720 min Summer	9.190	0.690	0.0	0.8	0.8	38.0	O K
960 min Summer	9.161	0.661	0.0	0.8	0.8	36.4	O K
1440 min Summer	9.104	0.604	0.0	0.8	0.8	33.3	O K
2160 min Summer	9.023	0.523	0.0	0.8	0.8	28.8	O K
2880 min Summer	8.943	0.443	0.0	0.8	0.8	24.4	O K
4320 min Summer	8.780	0.280	0.0	0.8	0.8	15.4	O K
5760 min Summer	8.682	0.182	0.0	0.8	0.8	10.1	O K
7200 min Summer	8.625	0.125	0.0	0.8	0.8	6.9	O K
8640 min Summer	8.593	0.093	0.0	0.7	0.7	5.1	O K
10080 min Summer	8.574	0.074	0.0	0.7	0.7	4.1	O K
15 min Winter	8.880	0.380	0.0	0.8	0.8	20.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	99.134	0.0	21.4	19
30 min Summer	64.584	0.0	27.9	33
60 min Summer	40.269	0.0	35.0	64
120 min Summer	24.400	0.0	42.4	122
180 min Summer	18.022	0.0	47.0	182
240 min Summer	14.479	0.0	50.3	240
360 min Summer	10.575	0.0	55.1	348
480 min Summer	8.465	0.0	58.8	402
600 min Summer	7.118	0.0	61.8	464
720 min Summer	6.176	0.0	64.4	528
960 min Summer	4.934	0.0	68.6	664
1440 min Summer	3.591	0.0	74.9	940
2160 min Summer	2.611	0.0	81.8	1360
2880 min Summer	2.081	0.0	86.9	1760
4320 min Summer	1.511	0.0	94.5	2464
5760 min Summer	1.203	0.0	100.4	3120
7200 min Summer	1.007	0.0	105.1	3816
8640 min Summer	0.871	0.0	109.1	4488
10080 min Summer	0.771	0.0	112.6	5144
15 min Winter	99.134	0.0	21.4	18

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	8.989	0.489	0.0	0.8	0.8	27.0	O K
60 min Winter	9.094	0.594	0.0	0.8	0.8	32.7	O K
120 min Winter	9.184	0.684	0.0	0.8	0.8	37.7	O K
180 min Winter	9.222	0.722	0.0	0.9	0.9	39.8	O K
240 min Winter	9.238	0.738	0.0	0.9	0.9	40.7	O K
360 min Winter	9.238	0.738	0.0	0.9	0.9	40.7	O K
480 min Winter	9.223	0.723	0.0	0.9	0.9	39.8	O K
600 min Winter	9.205	0.705	0.0	0.9	0.9	38.9	O K
720 min Winter	9.187	0.687	0.0	0.8	0.8	37.9	O K
960 min Winter	9.147	0.647	0.0	0.8	0.8	35.7	O K
1440 min Winter	9.064	0.564	0.0	0.8	0.8	31.1	O K
2160 min Winter	8.935	0.435	0.0	0.8	0.8	23.9	O K
2880 min Winter	8.792	0.292	0.0	0.8	0.8	16.1	O K
4320 min Winter	8.637	0.137	0.0	0.8	0.8	7.5	O K
5760 min Winter	8.577	0.077	0.0	0.7	0.7	4.2	O K
7200 min Winter	8.561	0.061	0.0	0.6	0.6	3.3	O K
8640 min Winter	8.552	0.052	0.0	0.5	0.5	2.8	O K
10080 min Winter	8.546	0.046	0.0	0.5	0.5	2.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	64.584	0.0	27.9	33
60 min Winter	40.269	0.0	35.0	62
120 min Winter	24.400	0.0	42.4	120
180 min Winter	18.022	0.0	47.0	178
240 min Winter	14.479	0.0	50.3	234
360 min Winter	10.575	0.0	55.1	344
480 min Winter	8.465	0.0	58.8	444
600 min Winter	7.118	0.0	61.8	476
720 min Winter	6.176	0.0	64.4	554
960 min Winter	4.934	0.0	68.6	710
1440 min Winter	3.591	0.0	74.9	1012
2160 min Winter	2.611	0.0	81.8	1468
2880 min Winter	2.081	0.0	86.9	1792
4320 min Winter	1.511	0.0	94.5	2424
5760 min Winter	1.203	0.0	100.4	3048
7200 min Winter	1.007	0.0	105.1	3680
8640 min Winter	0.871	0.0	109.1	4400
10080 min Winter	0.771	0.0	112.6	5104

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	58.0	0.0	1.001	0.0	0.0
1.000	58.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	8.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0
Flush-Flo™	0.205	0.8
Kick-Flo®	0.415	0.7
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 494 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.995	0.495	0.0	0.8	0.8	27.3	O K
30 min Summer	9.143	0.643	0.0	0.8	0.8	35.4	O K
60 min Summer	9.287	0.787	0.0	0.9	0.9	43.4	O K
120 min Summer	9.415	0.915	0.0	1.0	1.0	50.4	O K
180 min Summer	9.470	0.970	0.0	1.0	1.0	53.4	O K
240 min Summer	9.494	0.994	0.0	1.0	1.0	54.8	O K
360 min Summer	9.498	0.998	0.0	1.0	1.0	55.0	O K
480 min Summer	9.483	0.983	0.0	1.0	1.0	54.2	O K
600 min Summer	9.466	0.966	0.0	1.0	1.0	53.2	O K
720 min Summer	9.448	0.948	0.0	1.0	1.0	52.2	O K
960 min Summer	9.412	0.912	0.0	1.0	1.0	50.2	O K
1440 min Summer	9.343	0.843	0.0	0.9	0.9	46.4	O K
2160 min Summer	9.249	0.749	0.0	0.9	0.9	41.3	O K
2880 min Summer	9.164	0.664	0.0	0.8	0.8	36.6	O K
4320 min Summer	9.013	0.513	0.0	0.8	0.8	28.3	O K
5760 min Summer	8.847	0.347	0.0	0.8	0.8	19.1	O K
7200 min Summer	8.732	0.232	0.0	0.8	0.8	12.8	O K
8640 min Summer	8.662	0.162	0.0	0.8	0.8	8.9	O K
10080 min Summer	8.619	0.119	0.0	0.8	0.8	6.6	O K
15 min Winter	8.995	0.495	0.0	0.8	0.8	27.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	128.336	0.0	27.8	19
30 min Summer	84.360	0.0	36.5	34
60 min Summer	52.892	0.0	45.9	64
120 min Summer	32.091	0.0	55.8	122
180 min Summer	23.662	0.0	61.7	182
240 min Summer	18.958	0.0	65.9	242
360 min Summer	13.760	0.0	71.7	360
480 min Summer	10.974	0.0	76.3	430
600 min Summer	9.199	0.0	79.9	490
720 min Summer	7.961	0.0	83.0	554
960 min Summer	6.333	0.0	88.0	684
1440 min Summer	4.580	0.0	95.4	964
2160 min Summer	3.307	0.0	103.5	1380
2880 min Summer	2.622	0.0	109.5	1788
4320 min Summer	1.888	0.0	118.2	2592
5760 min Summer	1.494	0.0	124.8	3288
7200 min Summer	1.245	0.0	130.0	3960
8640 min Summer	1.073	0.0	134.4	4584
10080 min Summer	0.946	0.0	138.1	5248
15 min Winter	128.336	0.0	27.8	19

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	9.143	0.643	0.0	0.8	0.8	35.5	O K
60 min Winter	9.289	0.789	0.0	0.9	0.9	43.5	O K
120 min Winter	9.417	0.917	0.0	1.0	1.0	50.6	O K
180 min Winter	9.475	0.975	0.0	1.0	1.0	53.7	O K
240 min Winter	9.523	1.023	0.0	1.0	1.0	55.1	O K
360 min Winter	9.840	1.340	0.0	1.1	1.1	55.5	Flood Risk
480 min Winter	9.496	0.996	0.0	1.0	1.0	54.9	O K
600 min Winter	9.472	0.972	0.0	1.0	1.0	53.6	O K
720 min Winter	9.452	0.952	0.0	1.0	1.0	52.5	O K
960 min Winter	9.408	0.908	0.0	1.0	1.0	50.0	O K
1440 min Winter	9.315	0.815	0.0	0.9	0.9	44.9	O K
2160 min Winter	9.182	0.682	0.0	0.8	0.8	37.6	O K
2880 min Winter	9.061	0.561	0.0	0.8	0.8	30.9	O K
4320 min Winter	8.793	0.293	0.0	0.8	0.8	16.2	O K
5760 min Winter	8.646	0.146	0.0	0.8	0.8	8.1	O K
7200 min Winter	8.586	0.086	0.0	0.7	0.7	4.8	O K
8640 min Winter	8.566	0.066	0.0	0.7	0.7	3.6	O K
10080 min Winter	8.557	0.057	0.0	0.6	0.6	3.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	84.360	0.0	36.5	33
60 min Winter	52.892	0.0	45.9	62
120 min Winter	32.091	0.0	55.8	120
180 min Winter	23.662	0.0	61.7	178
240 min Winter	18.958	0.0	65.9	236
360 min Winter	13.760	0.0	71.7	344
480 min Winter	10.974	0.0	76.3	454
600 min Winter	9.199	0.0	79.9	540
720 min Winter	7.961	0.0	83.0	568
960 min Winter	6.333	0.0	88.0	722
1440 min Winter	4.580	0.0	95.4	1026
2160 min Winter	3.307	0.0	103.5	1472
2880 min Winter	2.622	0.0	109.5	1904
4320 min Winter	1.888	0.0	118.2	2636
5760 min Winter	1.494	0.0	124.8	3224
7200 min Winter	1.245	0.0	130.0	3816
8640 min Winter	1.073	0.0	134.4	4408
10080 min Winter	0.946	0.0	138.1	5136

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	58.0	0.0	1.001	0.0	0.0
1.000	58.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	8.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0
Flush-Flo™	0.205	0.8
Kick-Flo®	0.415	0.7
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

APPENDIX G

Surface Water Exceedance Flood Routing Drawings

NOTES:

1. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.
3. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.
4. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

KEY

= EXISTING SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

Rev	Description	Date	By	Chk	App
P1	FIRST ISSUE	20.08.24	HD	AD	--

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Sheffield T. 01142 440077
York T. 01904 611594

Project: Land off Back Lane, Helperby, York, North Yorkshire

Client: The Helperby Estate

Drawing: Existing Surface Water Exceedance

Role: Civil Engineer

Drawing Status: FOR APPROVAL | Suitability Code: -

Job. no. 51110 | Scale@ A1: 1:200 | Rev. P1

Project Originator Volume Level Type Role Number
BLH - AWP - ZZ - XX - DR - C - 3401

NOTES:

1. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.
3. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.
4. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES

ARE SAFE IN THE TEMPORARY CONDITION.

KEY

= PROPOSED SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

Rev	Description	Date	By	Chk	App
P1	FIRST ISSUE	20.08.24	HD	AD	--

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Sheffield T. 01142 440077
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Project: Land off Back Lane, Helperby, York, North Yorkshire

Client: The Helperby Estate

Drawing: Proposed Surface Water Exceedance

Role: Civil Engineer

Drawing Status: FOR APPROVAL

Suitability Code: -

Job. no. 51110

Scale@ A1: 1:200

Rev. P1

Project	Originator	Volume	Level	Type	Role	Number
BLH	AWP	ZZ	XX	DR	C	3400

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