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FLOOD RISK ASSESSMENT

ON

**CLOUGH ROAD,
SLAITHWAITE**

FOR

SB HOMES

E25/8187/FR01

DECEMBER 2025

1.0 INTRODUCTION

- 1.1 This report is commissioned to investigate and report on the Flood Risk for this site in accordance Planning Practise Guidance- Flood Risk and Coastal Change April 2022 and the proposals for drainage of this site when redeveloped as residential land. The report is based on information supplied by the client and from relevant authorities in both written and verbal format. Some of this information is in verbal form only. No liability can be accepted for information supplied by third parties which is subsequently found to be inaccurate or incorrect.

2.0 THE SITE

- 2.1 The site is located to the east of Clough Road, Slaithwaite. It is situated around Ordnance Survey grid reference 408143, 414614. A site location plan is included in Appendix A.
- 2.2 The site is irregularly shaped, with boundaries formed by Clough Road to the west, which has an open watercourse running north to south on its western side. A new trash screen has recently been constructed on the watercourse. To the north and south are residential properties, and to the east is open field. Access to the site is from Clough Road in the north western corner. The total site area is approximately 0.87ha.
- 2.3 At the time of the site investigation, the site was slightly overgrown with clearance work required to get around. Clearing the undergrowth revealed a made ground surface consisting of soil, brick and stone with occasional stockpiles of demolition material dotted around site.
- 2.4 The site falls with irregular slopes north to south and east to west. The land to the east is approximately 4.5-5.0m higher than the site and is occupied by self seeded tree growth. There is a small length of retaining wall in the north east, but the majority of the east boundary steeply banks up. On the western boundary, the site banks down by 2-3m to Clough Road. A high point of approximately 157.4m AOD is located in the north east and a low point of approximately 147.5m AOD is located in the south adjacent Clough Road.
- 2.5 The site investigation generally proved 0.2-2.1m of made ground and clays overlying a mudstone/sandstone bedrock that was encountered at 0.45-2.3m below ground levels.

Deeper made ground was encountered within the infilled former mill pond, and former concrete floor slabs were encountered intact within the made ground.

3.0 PROPOSED DEVELOPMENT AND DRAINAGE CONSTRAINTS

- 3.1 It is understood that the proposed development is for a series of detached and semi-detached, houses with associated car parking and access roads. An engineering feasibility site layout is attached in the appendices.
- 3.2 The buildings on site have been demolished for a considerable amount of time. The surface water for the previous buildings originally discharged to the watercourse to the west of Clough Road. The extant surface water connections would have a minimal discharge currently. Surface water run-off from the development would currently discharge onto Clough Road on the western boundary, and then to the watercourse to the west.
- 3.3 There are no recorded adopted surface water sewers crossing or serving the site. An adopted 450mm diameter combined sewer is shown running north to south in Clough Road on the western boundary of the site.
- 3.4 Due to the extent of made ground encountered on site, the eastern two thirds of the site being underlain by clays and mudstone, along with its elevated nature in relation to Clough Road on the western boundary, it is considered that infiltration methods will not be a suitable method of surface water disposal for the development.
- 3.5 Kirklees Council LLFA have previously confirmed in their planning response of February 2023 that they consider infiltration methods would be unsuitable for the development and have confirmed that they will accept a restricted discharge rate of 4.5 l/s to the watercourse on the western edge of Clough Road. Copy correspondence from the LLFA is included in Appendix C.
- 3.6 As the surface water sewer will need to cross Clough Road to discharge to the watercourse, the invert level of the existing combined sewer within Clough Road, as well as that of any services present, will need to be confirmed to ensure there is no clash with the proposed new surface water outfall to the watercourse.

- 3.7 The proposed foul sewer will need to connect to the existing 450mm combined sewer shown running within Clough Road to the west of the site.. Due to the relative levels of the site to the sewer, it should be possible to achieve a gravity connection to the sewer.

4.0 **FLOOD RISK**

- 4.1 On reviewing the Environment Agency websites flood risk maps, the site currently falls within flood zone 1: which is designated as low probability of flooding from sea or rivers less than 0.1% (ie 1 in 1000 year) probability of flooding see Fig 1. Clough Road on the western boundary, which is at a lower level than the site, is shown to be within Flood Zone 2 and 3. The flooding on Clough Road coincides with where the watercourse on the western edge of Clough Road is culverted as it passes beneath a side road. This has recently had a trash screen fitted which should reduce blockages and the flood risk to Clough Road.

The hierarchy of flood zones are described as:

Flood Zone 1: Low Probability. Land assessed as having a less than 1 in 1000 chance of river and sea flooding in any year (<0.1%).

Flood Zone 2: Medium Probability. Land assessed as having between a 1 in 100 and 1 in 1000 chance of river flooding (1% 0.1%) and between a 1 in 200 and 1 in 1000 chance of sea flooding (0.5% 0.1%) in any year.

Flood Zone 3: High Probability. Land assessed as having a 1 in 100 or greater chance of river flooding (>1%) and 1 in 200 or greater chance of sea flooding (>0.5%) in any year.

The site is therefore considered not to be at risk from fluvial flooding from rivers or sea for the 1 in 100 or 1 in 1000 year flood event. The proposed use of the site would be classified as More Vulnerable in Table 2: Flood Risk Vulnerability Classification in the Planning Practise Guidance- Flood Risk and Coastal Change April 2022. In accordance with that table the proposed development would be considered to be appropriate for the site.

- 4.2 The available EA plans indicate that the site not subject to flooding from rainfall directly on site (Fig 2). However, there is anecdotal evidence from the LLFA correspondence in Appendix C that there is surface water run-off entering the site from the higher level ground to the east of the site, and that there are temporary works on site to prevent run-off from flooding the properties on Crowther Close to the south of the site.

- 4.3 The site does not appear to fall within an area subject to flooding from reservoirs according to the EA maps. We consider the risk of such a source of flooding would be low. The site does not fall within a flood warning zone.
- 4.4 Due to the size of the development being in excess of 1Ha, it would be necessary to prepare a site specific Flood Risk Assessment for the site.

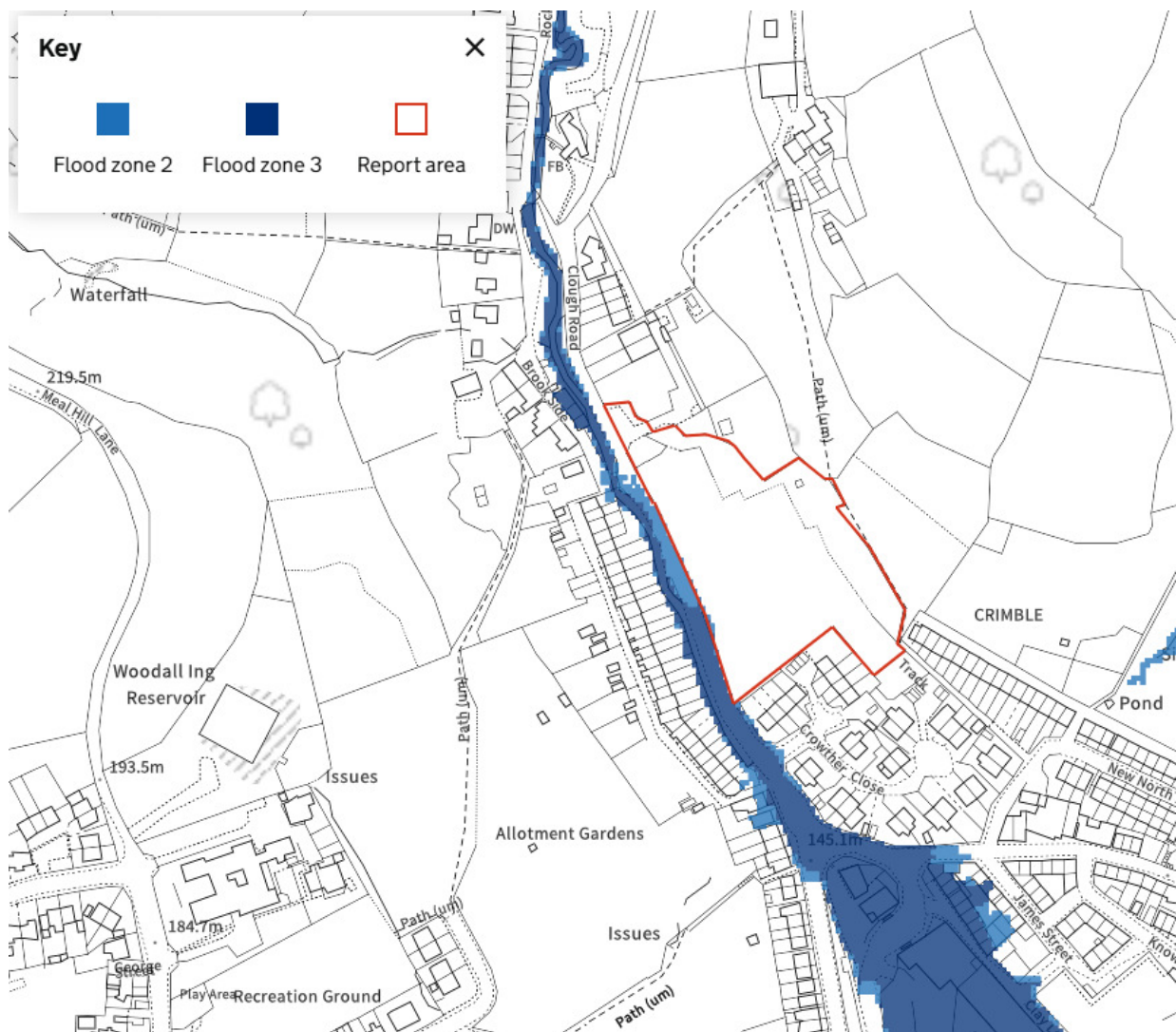


Fig 1 Flood Risk Map – Environment Agency Plan



Fig 2 Surface Water Flood Risk Map

- 4.5 There are a number of potential flooding mechanisms that the Planning Practise Guidance- Flood Risk and Coastal Change April 2022 now requires to be evaluated for each proposed development site. Each method of flooding requires an assessment to be made on its probability relative to the site development. The normal requirement of the document is for no flooding of properties for storms up to a 1% probability or a once in a 100 years storm. The risk assessment also includes for flooding both on site and off site, and the effects of the development on the downstream catchment or the flow regime of the watercourse. NPPG also requires that the effects of severe storms above the normal 1% probability are reviewed together with the effects of climatic change relating to the design life of the development.
- 4.6 It also requires that the effects of climate change are taken into account together with the impacts of extreme events and flood defence failures. Prior to this the Sequential Test, and where necessary, the Exception test as outlined in Planning Practise Guidance- Flood Risk and Coastal Change April 2022, must also be applied to each development site. These aspects are

not covered in this report but the proposed site being in Flood Zone 1, would mean these requirements are already met and do not apply.

4.7 The Planning Practise Guidance- Flood Risk and Coastal Change April 2022 requires that each flooding mechanism is addressed and levels of risk evaluated. We consider there are three main risks of flooding to the site. The alternative mechanisms are not applicable to this site.

- Inundation from floodwaters leaving watercourses or rivers entering the site. This can include the effects on culverted watercourses and where the risk of blockage can occur and from breach scenarios.
- Rainwater falling on the site and not being able to leave the site at sufficient rate to prevent flooding on the site.
- Overland flows from adjacent land sites due to surcharging of sewerage systems or other watercourses.
- The impact of the developed site on the existing drainage systems and off-site surface water systems must also be assessed as part of this flood risk assessment.

5.0 DISCUSSION OF FLOOD RISKS

5.1 Flood Risk from Watercourses, River & Tidal

5.1.1 The proposed site does not fall within the 0.1% or the 1% probability Flood Risk Maps (Zone 2 and 3) as published by the Environment Agency. The site is therefore considered not to be at risk from fluvial flooding for the once in 100 year flood event. We therefore consider the risk of flooding of the site from River and Sea is acceptable for this type of development on this site.

5.1.2 Clough Road on the western boundary is shown to be located in Flood Zone 2 and 3. The flooding on Clough Road coincides with where the watercourse on the western edge of Clough Road is culverted as it passes beneath a side road. Improvement works in the form of a new trash screen to the culvert entrance should help alleviate this flooding, and the steep nature of the existing highway means any flooding should be short lived and will not impede access to and from site for a significant period of time.

5.2 Risk of Flooding from overland flows from adjacent land.

5.2.1 The site lies on an area land sloping from north to south and east to west, with the ground to the east elevated above the site. The flood maps do not show any areas of surface water flooding in the vicinity of the site to the higher ground to the east and south, there is therefore considered to be little risk of flooding from overland flows from adjacent land.

5.2.2 However, there is evidence that surface water enters the site from the retaining wall on the eastern boundary. Consideration should therefore be given to providing flood routing through the site from east to west, and of providing land drainage on the eastern boundary to catch any run-off and discharge it to the watercourse on the eastern edge of Clough Road.

5.2.3 In addition to the above, the source of the feed to the former mill pond on site should be investigated to confirm if this has previously been blocked off/diverted and allow any additional remedial works to be carried out.

5.3 **Risk of Flooding from Rainwater Falling on Site**

- 5.3.1 The existing risk of flooding from water falling on site is shown to be low on the EA maps, with no areas of localised flooding. Correspondence from the LLFA in Appendix C states that remedial works have previously been undertaken on site to provide additional pipework and a dip to store surface water run-off and reduce the risk of flooding to Crowther Close to the south. The source of the water should be investigated. This should hopefully become redundant once the site is developed.
- 5.3.2 The impermeable area of the site will increase significantly due to the development, and this would increase the run off from the site. This would increase the flood risk to down stream properties unless attenuation measures and restriction of flows took place.
- 5.3.3 The normal hierarchy for surface water discharge in accordance with current planning and SUDS policies is as follows:
1. The use of infiltration systems such as Soakaways.
 2. Discharge to nearby rivers or watercourses with the use of attenuation.
 3. Discharge to existing public sewer network with the use of attenuation.
- 5.3.3 The site had proven to have a considerable amount of made ground and is elevated above Clough Road on the western boundary. The eastern two thirds of the site have proved to be underlain by impermeable clays and mudstone. Infiltration methods as a method of surface water disposal are therefore not considered suitable.
- 5.3.4 Kirklees Council LLFA have previously confirmed that they consider that infiltration methods will not be suitable for the development and that the surface water run-off from the development should discharge to the watercourse on the western edge of Clough Road at a restricted rate of 4.5 l/s. Correspondence from the LLFA confirming this is included in Appendix C.
- 5.3.5 Therefore the development should drain to the existing watercourse located to west of the site via a gravity connection at a maximum discharge rate of 4.5 l/s with storage provided for the 1 in 100 year + 45% climate change allowance in accordance with Kirklees Council policies.

However, further investigation works will be required to the existing services and utilities within Clough Road to ensure that the proposed surface water outfall does not clash.

- 5.3.6 With attenuation of flows there would have to be a storm-water storage facility. With the recent implementation of the Codes for Adoption, there is greater scope for a regulatory body to adopt and maintain the above ground storage facilities than previously. However there is detailed criteria to be met to able this to take place. For the onsite sewerage system to be adopted there would still be a need for underground tanks to provide sufficient attenuation storage for the site so that pipework does not surcharge for the 1 in 2 year event. Based on this criteria, the estimated volumes of storage required are shown in the attached calculation sheets. For this run off the storage volumes require 85 cu.m for the 30 year storm, and 170 cu.m for the 100 year storm when 45% extra for climatic change is allowed.
- 5.3.7 The use of above storage systems such as swales, detention basins or ponds, would provide the most sustainable urban drainage system. However, due to the relatively small nature of the site, providing open surface water attenuation basin would represent a significant land uptake. In addition to this, due to the sites elevation above Clough Road to the west, a breach in the basin would flood Clough Road and potentially properties downstream of the site. The use of above ground storage facilities is therefore not considered feasible
- 5.3.8 The use of below ground storage facilities on their own, may not provide a suitable level of treatment of the run off from the site and biological systems, at source, may be needed to ensure contaminants are dealt with prior to discharge of site. The use of open swales and ponds would allow the use of reed beds and other organic systems to be employed. However, the use of open water features is not considered feasible for the main development due to the reasons discussed in 5.3.7. Primary treatment for the roads would therefore be the use of trapped gullies for all hard standings. The use of filter drains adjacent to private drives or permeable paving on private drives would also provide a first stage treatment of run off from drives and allow a discharge into the top soils on site. Rainwater butts may also be provided to enable some recycling of run off from the roofs and paved areas. The use of green roofs is not considered appropriate in this development. Please note that Yorkshire Water, or similar approved body, will require an easement and access for future maintenance as part of the Section 104 Agreement.

5.3.9 The size of the storm water storage facilities would need to be determined accurately in the final detailed designs. These should be all in accordance with the current PPG. The volumes of storage can include flooding to roads and designated areas such as carpark areas or public open space for the 100 year storm with 45% allowance for climate change, but must ensure that no buildings are flooded.

5.3.10 The position and levels of the attenuation has been considered to ensure that any failure or blockage of the outfall will not affect any of the new or existing properties. The final discharge rate will be reduced to a maximum of 4.5 l/s. Finally, the position of the attenuation tank has been determined to allow accessibility for future maintenance.

5.3.11 During the construction of the site, it is recommended that temporary works are established to prevent surface run-off affecting the existing properties at a lower level and from flooding Clough Road and the open watercourse to the west.

5.4 **Impact on existing drainage systems.**

5.4.1 Attenuation has been provided for a significantly increased return period of 1 in 100 years plus 45% climate change as well as the discharge rate for the development being greatly reduced to the agreed discharge rate of 4.5 l/s. In real terms this would lead to a reduced flood risk offsite due to the restricted flows off-site for these storm events. This will ensure that there should be no increase in the flood risk to properties off site or in the drainage networks downstream of the site.

6.0 **FUTURE MAINTENANCE**

- 6.1 It is proposed for the surface water system serving the development to be adopted by Yorkshire Water or similar approved body under a Section 104 Agreement, this will include the attenuation tanks, flow controls, and outfall sewer.
- 6.2 The maintenance of the attenuation tank should be in line with the SUDS manual (CIRIA C753, 2015) as detailed in table 21.3 below.

Operation and Maintenance Requirements for Attenuation Storage Tanks		
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
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	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

- 6.3 The developer will be responsible to maintain the drainage systems on site until final adoption by the relevant authority ensuring that they are working effectively in the intervening period between construction and adoption.

7.0 CONCLUSIONS

- 7.1 The area of the site to be developed for residential use currently falls within Flood Zone 1 as defined by the EA Flood maps. The area of the site to be developed is not at risk of flooding from river or tidal water up to a 1% return period. The flood risk is considered to be acceptable for residential development. The location of the site ingress/egress is shown to be in Flood Zone 2 and 3, associated with the short section of culverted watercourse to the north west of the site. Improvement works in the form of a new trash screen to the culvert entrance should help alleviate this flooding, and the steep nature of the existing highway means any flooding should be short lived and will not impede access to and from site for a significant period of time.
- 7.2 Preliminary site investigation works undertaken on site have proved that that infiltration methods would be an unsuitable form of surface water disposal. The use of attenuation systems to reduce the run-off from the site will be required to ensure there is no increase in flood risk to the downstream catchment.
- 7.3 The risk of overland flows entering the site is considered to be low due to the topography of the area around the site. However, it is recommended that land drainage is provided on the eastern boundary and the floor levels of the proposed houses should be a minimum of 300mm above the adjacent road levels or existing ground level, with flood routing provided through the site to the west.
- 7.4 Investigation works should be undertaken to confirm the location of the feed to the former mill pond and confirm any works required to ensure this will not affect the future development of the site. The temporary drainage works to prevent flooding to Crowther Close to the south of the site will need to be investigated and the source of the flooding will need to be dealt with as part of the proposed site works.

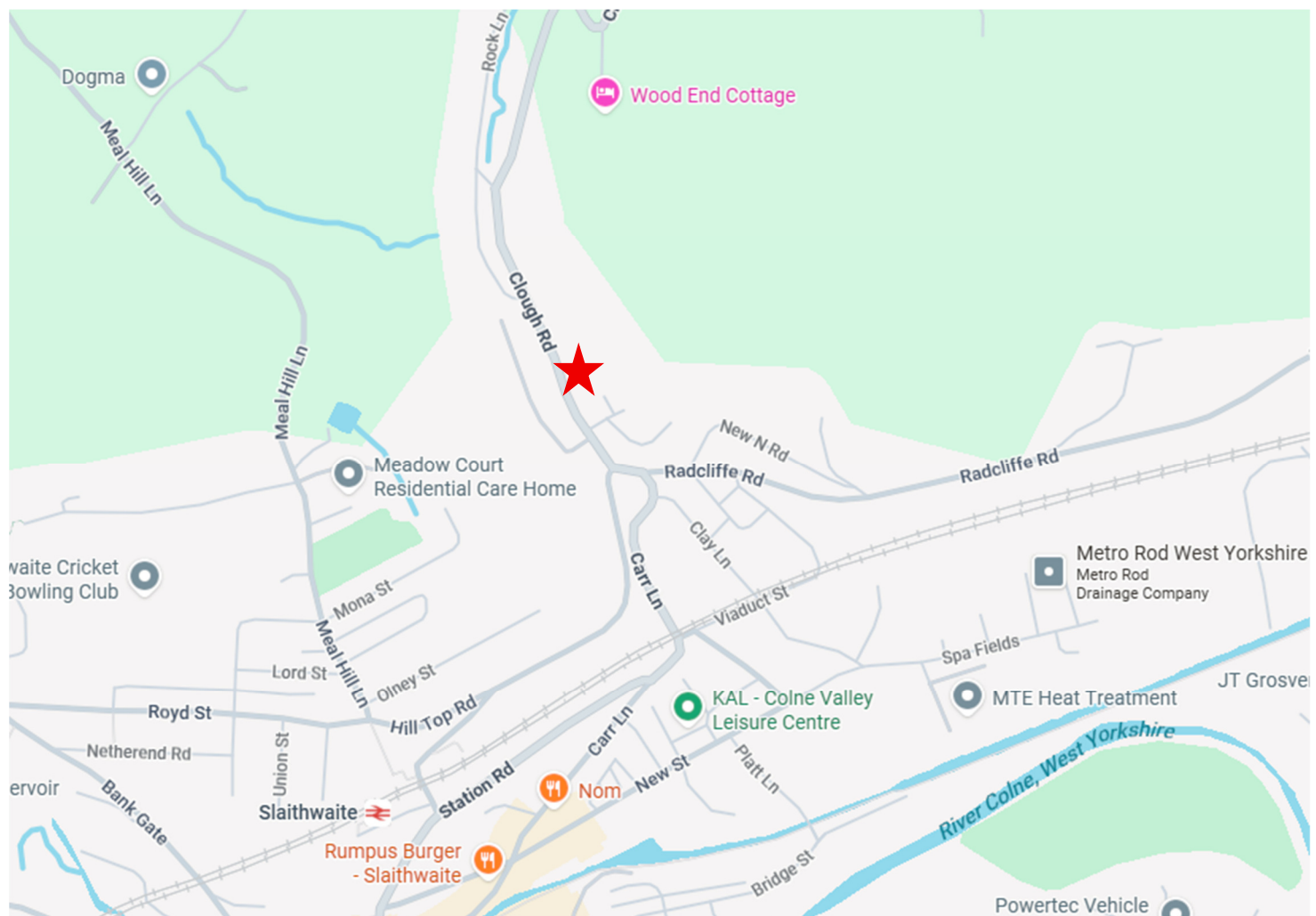
- 7.5 If the recommendations within this report are adopted for providing attenuation up to and including the 1 in 100 year + 45% climate change storm events and the flow from site restricted to a maximum of 4.5 l/s, there will be a reduction in the flood risk both to the proposed properties on site, as well as the existing properties downstream of the site.

A handwritten signature in black ink, appearing to read 'M. Huddleston', with a stylized, cursive script.

MARTIN HUDDLESTON. Meng

APPENDIX A

LOCATION PLAN



CLOUGH ROAD
SLAITHWAITE
HUDDERSFIELD
HD7 5BU

APPENDIX B

EA FLOOD MAP

Flood map for planning

Your reference	Location (easting/northing)	Created
8187 CLOUGH ROAD	408142/414616	24 November 2025 17:29

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see <https://www.gov.uk/guidance/flood-risk-assessment-standing-advice>)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2025 AC0000807064. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

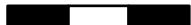
Your reference
8187 CLOUGH ROAD

Location (easting/northing)
408142/414616

Scale
1:2,500

Created
24 Nov 2025 17:29

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area


0 20 40 60m

APPENDIX C

LLFA CORRESPONDENCE

**Consultation Response from KC,
Lead Local Flood Authority**

2023/90157 Land at the site of former Clough Mill, Clough Road, Slaithwaite, Huddersfield

Erection of residential development comprising 23 dwellings with associated car parking and formation of new access

Date Responded: 21st February 2023

Responding Officer: Paul Farndale

Responding Ref:

Summary

Kirklees Flood Management and Drainage acting as Lead Local Flood Authority OBJECTS to this application on the grounds of inadequate assessment of flood risk and making space for attenuation requirements in the layout.

Detailed Response

Flood Risk

Although we recognise that the site is located in main river flood zone 1 (low risk) and experience tells us the flooding from Crimble Clough can only effect downstream properties from the raised site, we also hold records of flooding of the site from other sources.

On numerous occasions water has come off the site and flooded gardens and garages of properties at Crowther Close. As a result of this, new pipework was laid by the then owners to deliberate divert flowing water that was previously getting into redundant pipes previously serving the building and took it to a dud depression within the site and away from existing properties. The source of this water will have to be dealt with in the new design.

We also experience ponding of water to the rear of the site. Flows were observed coming through a retaining wall. This source of water will have to be dealt with in the new design.

Former Mill Pond

Assessment of where the feed to the former mill pond came from and how it was dealt with needs to be explained as part of the application process.

Infiltration Drainage Strategy

The submission talks generically about the potential use of infiltration techniques to remove surface water from the site and offers not testing or specific drainage layout alongside the promoted site layout.

British Geological Survey Reports show the site has various areas rated zone 2,3, and 4. Zone 3 is unlikely to promote viable infiltration solutions. Also zone 4 extends off the site across Clough Road and to Crimble Clough itself. Given the elevation of the site from the road, re-emergence is a distinct possibility, and the presence of a watercourse shows that water will appear at the surface in this location.

There is significant made ground on site and other submissions discuss the possibility of leachate and perched water.

The LLFA therefore rule out the use of infiltration techniques.

Watercourse Drainage Strategy

A watercourse drainage strategy is therefore required and Crimble Clough is accessible. An exact connection point would need to be agreed with the LLFA as part of a site visit. There is a trial level monitoring station on the watercourse, and we would want to make sure no construction work interfered with this programme.

As the mill was demolished over a decade ago, brownfield rules for drainage no longer apply and greenfield rates will be set. This means a restricted flow of 4.5l/s is recommended for this site. As a complication, part of the access road may not be able to drain by gravity to any attenuation and may need to discharge freely beyond any flow control. The allowance for flow restriction from the majority of the site will need to come down to accommodate this. If a solution is not viable that a discussion needs to had with the LLFA.

With attenuation required for the 1 in 100-year storm event with an allowance for climate change, it must be demonstrated and signed off by a Principal Designer that a safe workable solution can be delivered within a specific layout.

Any attenuation under the adoptable highway with a span greater than 900mm will be classed as a structure and may result in problems with Kirklees Council adopting the on-site road network. Early dialogue with Farhad Khatibi from our structures department is advised.

A surface water connection to sewer should not be considered.

Flood Routing

In addition to capturing and protecting properties from flows coming from outside or emerging from inside the site, an assessment is required to show that if there is an exceedance event or blockage scenario that flows overspilling from the attenuation tank most avoid property curtilage. This same applies for blockage scenarios where water is escaping from gullies and manholes. At the moment we do not believe this has been considered at all, and the promoted layout creates a low spot near plots 4-5 and plots 12-14 look vulnerable. The use of the road network and public open space to convey safe overland flood routing is expected.

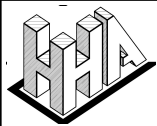
APPENDIX D

ENGINEERING FEASIBILITY PLAN



APPENDIX E

PRELIMINARY DRAINAGE CALCULATIONS



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
1	0.160	5.00	152.774	1500	408105.978	414628.968	1.575	151.199
2	0.025	5.00	154.261	1500	408135.478	414643.045	3.171	151.090
3	0.018	5.00	154.530	1500	408150.664	414632.441	3.502	151.028
4	0.034	5.00	154.742	1500	408159.469	414613.992	3.782	150.960
8	0.127	5.00	153.450	1500	408141.215	414596.194	4.150	149.300
5	0.000		153.800	2100	408137.741	414603.473	4.577	149.223
6	0.000		150.639	1200	408112.698	414591.526	1.763	148.876
7			150.600		408105.942	414587.864	1.775	148.825

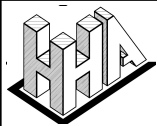
Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	32.687	0.600	151.199	151.090	0.109	300.0	375	5.52	63.9
1.001	2	3	18.522	0.600	151.090	151.028	0.062	300.0	375	5.82	62.5
1.002	3	4	20.442	0.600	151.028	150.960	0.068	300.0	375	6.15	60.9
1.003	4	5	24.140	0.600	150.960	150.880	0.080	300.0	375	6.53	59.2
2.000	8	5	8.066	0.600	149.300	149.273	0.027	300.0	600	5.10	66.2
1.005	5	6	27.747	0.600	149.223	148.876	0.347	80.0	225	6.85	57.9
1.006	6	7	7.685	0.600	148.876	148.825	0.051	150.0	225	6.97	57.4

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	32.687	300.0	375	Circular_Default Sewer Type	152.774	151.199	1.200	154.261	151.090	2.796
1.001	18.522	300.0	375	Circular_Default Sewer Type	154.261	151.090	2.796	154.530	151.028	3.127
1.002	20.442	300.0	375	Circular_Default Sewer Type	154.530	151.028	3.127	154.742	150.960	3.407
1.003	24.140	300.0	375	Circular_Default Sewer Type	154.742	150.960	3.407	153.800	150.880	2.545
2.000	8.066	300.0	600	Circular_Default Sewer Type	153.450	149.300	3.550	153.800	149.273	3.927
1.005	27.747	80.0	225	Circular_Default Sewer Type	153.800	149.223	4.352	150.639	148.876	1.538

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1500	Manhole	Adoptable	2	1500	Manhole	Adoptable
1.001	2	1500	Manhole	Adoptable	3	1500	Manhole	Adoptable
1.002	3	1500	Manhole	Adoptable	4	1500	Manhole	Adoptable
1.003	4	1500	Manhole	Adoptable	5	2100	Manhole	Adoptable
2.000	8	1500	Manhole	Adoptable	5	2100	Manhole	Adoptable
1.005	5	2100	Manhole	Adoptable	6	1200	Manhole	Adoptable

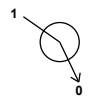
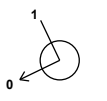
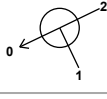
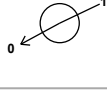


Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.006	7.685	150.0	225	Circular_Default Sewer Type	150.639	148.876	1.538	150.600	148.825	1.550

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.006	6	1200	Manhole	Adoptable	7		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	408105.978	414628.968	152.774	1.575	1500		0	1.000	151.199	375
2	408135.478	414643.045	154.261	3.171	1500		1	1.000	151.090	375
3	408150.664	414632.441	154.530	3.502	1500		0	1.001	151.090	375
4	408159.469	414613.992	154.742	3.782	1500		1	1.002	151.028	375
8	408141.215	414596.194	153.450	4.150	1500		0	1.003	150.960	375
5	408137.741	414603.473	153.800	4.577	2100		1	2.000	149.300	600
6	408112.698	414591.526	150.639	1.763	1200		2	1.003	149.273	375
7	408105.942	414587.864	150.600	1.775			0	1.005	149.223	225
							1	1.005	148.876	225
							0	1.006	148.876	225
							1	1.006	148.825	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
Rainfall Events	Singular	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	19.000	Starting Level (m)	
Ratio-R	0.400	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Detailed		



Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

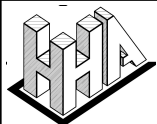
Node 5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	149.223	Product Number	CTL-SHE-0085-4500-2200-4500
Design Depth (m)	2.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	4.5	Min Node Diameter (mm)	1200

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	149.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

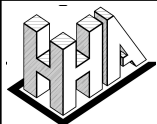
Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	82.0	82.0	2.000	82.0	146.2	2.001	0.0	146.2



Results for 2 year Critical Storm Duration. Lowest mass balance: 99.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	151.326	0.127	27.7	0.4824	0.0000	OK
15 minute winter	2	11	151.234	0.144	31.4	0.2767	0.0000	OK
15 minute winter	3	11	151.178	0.150	34.2	0.2810	0.0000	OK
15 minute winter	4	11	151.117	0.157	39.5	0.3049	0.0000	OK
120 minute winter	8	116	149.734	0.434	15.4	32.5767	0.0000	OK
120 minute winter	5	116	149.734	0.511	12.9	1.7707	0.0000	SURCHARGED
30 minute summer	6	32	148.920	0.044	3.4	0.0500	0.0000	OK
30 minute summer	7	32	148.868	0.043	3.4	0.0000	0.0000	OK

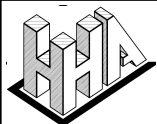
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	27.1	0.768	0.235	1.1570	
15 minute winter	2	1.001	3	31.3	0.782	0.272	0.7414	
15 minute winter	3	1.002	4	34.0	0.802	0.296	0.8665	
15 minute winter	4	1.003	5	38.8	0.954	0.338	0.9831	
120 minute winter	8	2.000	5	-8.5	0.389	-0.021	1.8184	
120 minute winter	5	1.005	6	3.4	0.709	0.059	0.1352	
30 minute summer	6	1.006	7	3.4	0.638	0.081	0.0415	33.6



Results for 30 year Critical Storm Duration. Lowest mass balance: 99.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	151.385	0.186	52.3	0.7054	0.0000	OK
15 minute winter	2	11	151.306	0.215	59.4	0.4148	0.0000	OK
15 minute winter	3	11	151.253	0.225	64.4	0.4208	0.0000	OK
15 minute winter	4	11	151.190	0.230	74.8	0.4471	0.0000	OK
180 minute winter	8	180	150.320	1.020	23.1	81.9839	0.0000	SURCHARGED
180 minute winter	5	180	150.320	1.097	18.1	3.7990	0.0000	SURCHARGED
15 minute summer	6	113	148.920	0.044	3.4	0.0500	0.0000	OK
15 minute summer	7	113	148.868	0.043	3.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	51.2	0.868	0.445	1.9403	
15 minute winter	2	1.001	3	58.8	0.880	0.512	1.2458	
15 minute winter	3	1.002	4	64.3	0.920	0.559	1.4282	
15 minute winter	4	1.003	5	73.7	1.139	0.641	1.5669	
180 minute winter	8	2.000	5	-13.5	0.389	-0.034	2.2720	
180 minute winter	5	1.005	6	3.4	0.709	0.059	0.1351	
15 minute summer	6	1.006	7	3.4	0.638	0.081	0.0415	48.8



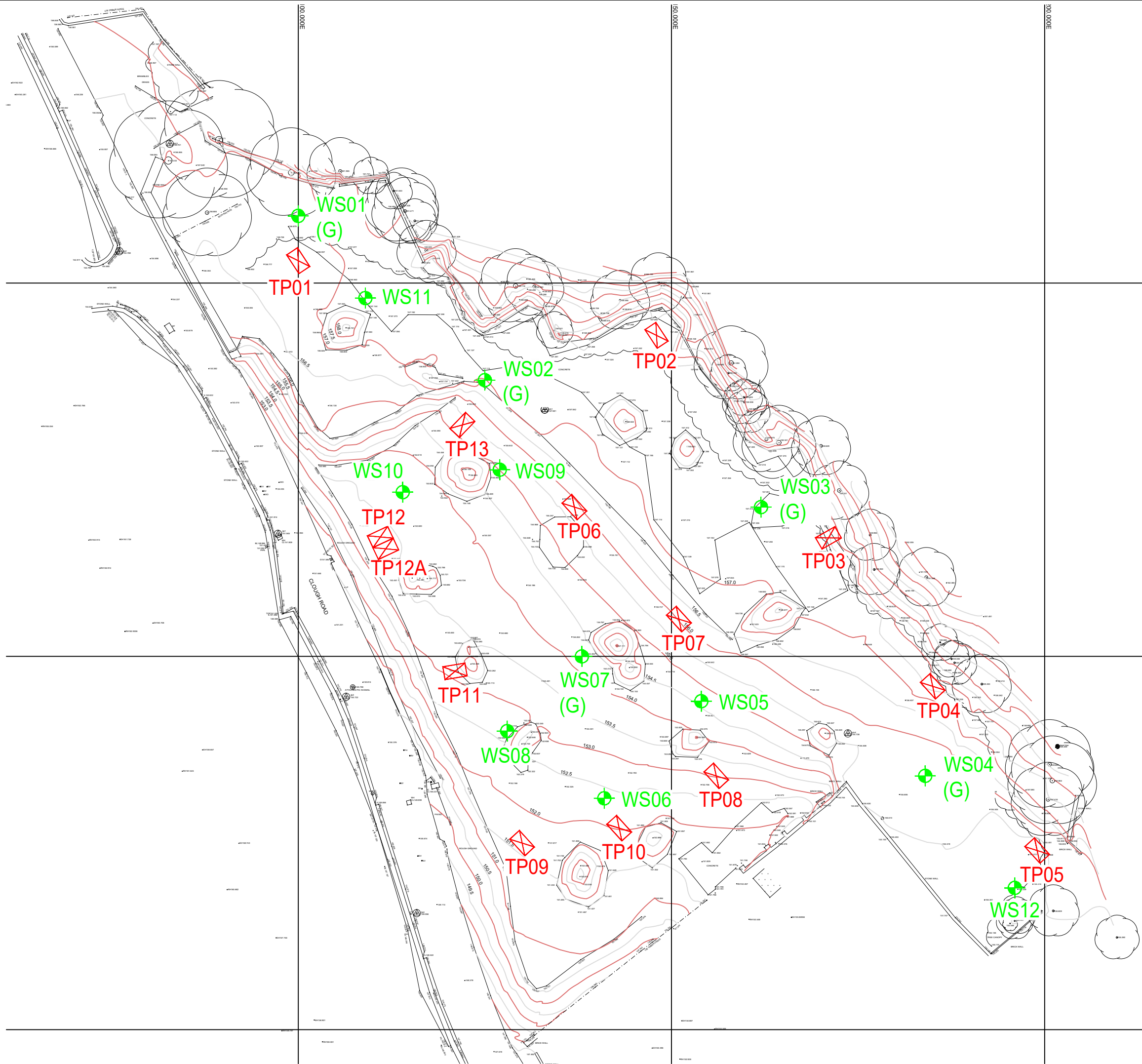
Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	151.541	0.341	98.4	1.2972	0.0000	OK
15 minute winter	2	11	151.472	0.382	108.0	0.7360	0.0000	SURCHARGED
240 minute winter	3	236	151.462	0.434	23.6	0.8114	0.0000	SURCHARGED
240 minute winter	4	236	151.461	0.501	27.6	0.9755	0.0000	SURCHARGED
240 minute winter	8	236	151.459	2.159	37.4	169.2181	0.0000	SURCHARGED
240 minute winter	5	236	151.459	2.236	27.5	7.7457	0.0000	SURCHARGED
240 minute winter	6	236	148.927	0.051	4.5	0.0573	0.0000	OK
240 minute winter	7	236	148.874	0.049	4.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	92.6	0.946	0.806	3.5249	
15 minute winter	2	1.001	3	104.3	0.962	0.907	2.0420	
240 minute winter	3	1.002	4	23.6	0.731	0.205	2.2547	
240 minute winter	4	1.003	5	27.5	0.866	0.240	2.6626	
240 minute winter	8	2.000	5	-22.6	0.385	-0.057	2.2720	
240 minute winter	5	1.005	6	4.5	0.765	0.077	0.1637	
240 minute winter	6	1.006	7	4.5	0.689	0.106	0.0503	110.1

APPENDIX F

SITE INVESTIGATION INFORMATION



Rev	Description	Date	Initials

**Haigh Huddleston & Associates**
Civil Structural Engineering Consultants
Unit 4 Midgley Business Park, Bar Lane, Wakefield WF4 4JJ
e Martin@haighhuddleston.co.uk

t 01924 574074

Client			
SB HOMES			
Project			
CLOUGH ROAD, SLAITHWAITE			
Detail			
SITE INVESTIGATION PLAN			

Dwn	Chkd	Date	Scale	Dwg No.
HN	-	JUL 25	1/500 @A3	E24/8187/003



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

TRIAL HOLE NO. 1

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
	0.2	Made ground, soil, fines with occasional brick
		Concrete base of former wash tank NB concrete base 1.5m above Clough Road level
0.5		
	0.8	Sample taken
1.0		
1.5		
2.0		
		END OF TRIAL PIT
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation

NO

Sample taken

YES 0.8m

Sides of excavation remained stable

YES

Level

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NOTES:

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.....

TRIAL HOLE NO. 2



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
	0.12	Stone flags with screed
		Ashy stone subbase
	0.3	
0.5		Firm brown clay with numerous mudstone gravels
	0.6	Sample taken
1.0		
	1.1	
1.5		
	1.9	
2.0		Moderately strong dark grey iron-stained shaly mudstone excavated as horizontally bedded shale
	2.2	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation

NO

Sample taken

YES 0.6m

Sides of excavation remained stable

YES

Level

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NOTES:

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TRIAL HOLE NO. 3



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
	0.15	(Slab stone flags) Clays and gravels re-engineered
		Re-engineered clays and gravels
	0.3	Sample taken
	0.45	
0.5		Moderately weak dark grey slightly iron stained mudstone excavated as horizontal bedded gravels
	0.8	Land drain 600mm Dia
1.0		
1.5		
		END OF TRIAL PIT
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation

NO

Sample taken

YES 0.3m

Sides of excavation remained stable

YES

Level

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NOTES:

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TRIAL HOLE NO. 4



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
		Brambles over made ground consisting of clay, gravel stones
	0.3	Sample taken
0.5		
	0.75	
	0.85	Concrete slab (100mm thick)
1.0		Slab sub base clean stone
		Firm dark reddish brown sandy clay
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:	
Ground water encountered during excavation	NO
Sample taken	YES 0.3m
Sides of excavation remained stable	YES
Level	
NOTES:	
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TRIAL HOLE NO. 5



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
		Brambles over made ground consisting of bricks, stones with some ashy gravels
	0.3	Sample taken
0.5		
1.0		
	1.3	Sample taken
1.5		
		Firm yellowish brown sandy clay
2.0		
2.5		
	2.6	
3.0		
3.5		
4.0		

REMARKS:	
Ground water encountered during excavation	NO
Sample taken	YES 0.3m and 1.30m
Sides of excavation remained stable	YES
Level	
NOTES:	
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.....	

TRIAL HOLE NO. 6



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
0.3		Made ground material, bricks, stone, ashy gravels (Slightly unstable) Sample taken
0.5		
1.0		
1.5		
1.6		
		Moderately weak dark grey iron stained mudstone, excavated as horizontally bedded shale
2.0		
2.5		
2.6		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation

NO

Sample taken

YES 0.3m

Sides of excavation remained stable

NO (0 – 1.6m unstable)

Level

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NOTES:

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TRIAL HOLE NO. 7



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
	0.3	Overgrown grass over made ground consisting of bricks and stones with ashy gravels
		Sample taken
0.5		
1.0		
	1.3	Firm yellowish brown slightly sandy clay [rear of Trial Pit]
1.5		
	1.6	
	2.6	Concrete slab from former mill building – unable to excavate
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken YES 0.3m
Sides of excavation remained stable YES
Level

NOTES:

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.....

TRIAL HOLE NO. 8



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
		Made ground – loosely consolidated gravels, stones, bricks
	0.4	
0.5		Firm yellowish brown sandy clay (potentially re-engineered)
1.0		
	1.3	
1.5	1.5	Weak blueish/ grey mudstone, gravels potentially contaminated with hydrocarbons (no significant odour) Sample taken
2.0		
2.5		
	2.6	
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken YES 1.5m
Sides of excavation remained stable YES
Level

NOTES:

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.....

Civil & Structural Engineering Consultants

t 01924 574074 e info@haighhuddleston.co.uk

0.0

		Made ground brick
		Stones, gravels occasional roots, clay pipe

	2.3	Moderately weak orangish brown horizontal bedded sandstone

REMARKS:	
Ground water encountered during excavation	NO

Ground water encountered during excavation NO

NO

Sample taken NO

NO

Sides of excavation remained stable YES

YES

Level

.....

TRIAL HOLE NO. 10



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
	0.2	Made ground, re-engineered soils, gravels
		Buried concrete slab (200mm thick)
0.5	0.5	Clean stone sub base
		Re-engineered dark brown clay with some gravels and occasional ash
1.0		
1.5		
2.0		
2.5		
	2.6	
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 11



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
	0.3	Made ground backfilled loosely consolidated bricks, soils, stones
		Sample taken
0.5		
	0.7	
	1.7	Firm orangish brown very sandy clay with numerous stones
1.0		
1.5		
	1.9	Moderately strong orangish brown sandstone
2.0	4.0	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken YES at 0.3m
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 12



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
		200mm made ground over 150mm concrete slab
	0.35	Sample at 0.3m
		Re-engineered dark brown slightly sandy clay
0.5		
		Moderately weak brown shaley mudstone
1.0		
		Strong light brown horizontally bedded sandstone
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken YES at 0.3m
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 12A



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
		Made ground re-engineered clays, gravels, stones with occasional ash (Sides unstable)
0.5		
1.0		
1.5		
2.0		
	2.1	
		Moderately strong light brown sandstone
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable NO
Level

NOTES:

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.....

TRIAL HOLE NO. 13



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client :	SB HOMES	Job No :	8187
Site :	CLOUGH ROAD, SLAITHWAITE	Date :	29 July 2025

0.0		
	0.3	Made ground comprising of loosely consolidated bricks, stone, cooper wire, metal pipes with stone and brick walling Sides of excavation unstable Sample taken
0.5		
1.0		
1.5	2.1	Moderately strong dark grey horizontally bedded mudstone, slight groundwater seepage
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation YES
Sample taken YES at 0.3m
Sides of excavation remained stable NO
Level

NOTES:

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