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Consulting Engineers

Report on Flood Risk Assessment

Thongsbridge Mills
Thongsbridge
HD9 7RW

For Robert Halstead Chartered
Surveyors

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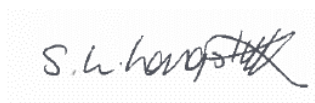
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1 INTRODUCTION

- 1.1.1 **jnp group** were instructed by Robert Halstead Chartered Surveyors to undertake a Flood Risk Assessment (FRA) of a site known as 'Thongsbridge Mills' (hereinafter referred to as 'the site'). The purpose of the report is to support an Outline Planning Application.
- 1.1.2 It is understood that the site is currently undeveloped although a metalled access road has been constructed in the site and the foundation of a former building exists. An outline planning application is being submitted to construct B1 and /or Light Industrial Units across the site with associated parking areas and access roads. The site location is shown in Appendix A. Any comments given are based on the understanding that the proposed redevelopment will be as described.
- 1.1.3 This report is confidential and has been prepared solely for the benefit of Robert Halstead Chartered Surveyors and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from JNP; a charge may be levied against such approval. JNP accepts no responsibility or liability for the consequences of this document being used for any purpose or project other than for which it was commissioned, and this document to any third party with whom an agreement has not been executed.
- 1.1.4 This report has been prepared following information gathered up to the 15th November 2016. **jnp group** warrants the accuracy of this report up to and including that date. Additional information, improved practices or changes in legislation may necessitate this report having to be reviewed in whole or in part after that date. If necessary, this report should be referred back to **jnp group** for re-assessment and, if necessary, re-appraisal.
- 1.1.5 The scope of work comprised desk study research and site walkover.

1.2 Methodology

- 1.2.1 The flood risk proposals have been prepared in accordance with the National Planning Policy Framework (NPPF). The NPPF came into effect on the 1st April 2012 and contains guidance for development and flood risk, keeping key elements of the now superseded PPS 25.
- 1.2.2 The following documents have been consulted and considered in formulating the Flood Risk Assessment:

-  The National Planning Policy Framework (NPPF) – March 2012;
-  Planning Practice Guidance, - March 2014;
-  Technical Guidance to the National Planning Policy Framework – March 2012;
-  Flood risk assessments: climate change allowances, Environment Agency – February 2016;
-  Calder Catchment Flood Management Plan, Environment Agency – December 2010;
-  Kirklees Local Flood Management Strategy, Kirklees Council – February 2013;
-  Kirklees Local Flood Risk Management Strategy, SEA Report, LUC – February 2013;
-  Calder Catchment Strategic Flood Risk Assessment (SFRA) Volume II (Kirklees Council), JBA – July 2016;
-  SFRA User Guide, JBA – July 2016;
-  Kirklees Surface Water Management Plan, Kirklees Council – February 2011;

-  Kirklees Preliminary Flood Risk Assessment, Kirklees Council – 2011;
-  Hydrology of the December 2015 Flood in Yorkshire, EA – April 2016;
-  Geo-environmental Risk Report at Thongsbridge Mill, ARP Geotechnical Ltd, August 2005,
-  British Geological Survey GeoIndex; and
-  Environment Agency 'What's in Your Backyard', accessed October 2016.

2 SITE INFORMATION

2.1 Site Description

- 2.1.1 The site is located 1.5km to the north east of Holmfirth town centre, to the east of Huddersfield Road. The site is accessed via an entrance off Huddersfield Road with a metalled road currently running to the site entrance. The topographic survey of the site shows foundations in the western part of the site with much of the remainder of the area covered by vegetation or hardcore. The River Holme is located close to the eastern site boundary.
- 2.1.2 A Phase 1 for the site indicates that the site was formerly a dam containing water to power turbines in a mill which was formerly located immediately to the north. These mill buildings are no longer present and the dam was drained c. 1990.
- 2.1.3 At the time of site walkover (14/11/2016), the site had been cleared and levelled using clean hardcore. The development area was flat and surrounded on the east and north sides by a small bank, which was the former dam walls. The southern end was level with the access road and there was a steep bank on the western side with Huddersfield Road and some properties up to approximately 4m higher than the site.

Photo 1: Site looking north east from Huddersfield Road



Photo 2: Site looking south from close to the northern boundary



- 2.1.4 Residential and commercial properties were located to the north west of the site fronting onto Huddersfield Road. The site was bordered by Huddersfield Road to the south east.
- 2.1.5 The land to the south was undeveloped. Similarly, the land to the east was also undeveloped and was being used to store materials. This was at a lower level than the site with the former dam wall between the site (Photo 3) and this area. A former mill building was located to the north east of the site. The River Holme was located to the east of this area, contained within stone walls (Photo 4).

Photo 3: Land to the east with the former dam wall along the eastern site boundary



Photo 4: River Holme to the east of the site



- 2.1.6 To the north of the site were a yard and former mill buildings. The yard was at a considerably lower level than the site with the former dam wall between the two areas.
- 2.1.7 Two former dam drainage structures remain in the north and north east corners of the site. In the dam wall on the northern side of the site, the former outlet to the mill turbines is present in the form of a square chamber in the wall with a pipe from the chamber which would have fed the turbines. This is currently bricked up. A small bypass channel also exists in this area which would have allowed water to bypass the turbines when required. Both these flowed into a large culvert which took water from the site to the River Holme discharging into the river approximately 260m to the north of the site. This culvert is still in existence and is located beneath buildings to the north of the site and below a bank bordering the River Holme. A plan showing the approximate location of the culvert is included in Appendix B. In places, the culvert is exposed and can be seen to be of stone construction, of considerable size and be partially silted up. A small flow was still apparent in the culvert.

Photo 5: Outlet in the dam wall for the turbine water



Photo 6: Culvert (to the left) shortly before the confluence with the River Holme (to the right)



Photo 7: Culvert formerly used for the turbine water



- 2.1.8 To the north east of the site is another discharge structure which took excess water from the dam to the River Holme, close to the site. This was a square culvert flowing into a chamber and then flowing into another square culvert. This then became a brick arched culvert before flowing into the River Holme at bed level approximately 25m to the east of the site. The upper part of the culvert has been infilled with the hardcore on the site but a plastic drainage pipe has been placed in the culvert to take surface water from the site.

Photo 8: Upper part of the culvert taking excess water from the former dam. Surface water pipe just visible.



Photo 9: Lower part of the culvert taking dam overflow.



2.1.9 The SFRA indicates a drain just to the north of the site which discharges into the River Holme. The location of this indicates that it must be culverted beneath several properties to the north of the site. The SFRA also shows the northern end of the culvert from the former turbines to the north of the site.

2.1.10 Table 2.1 summarises the details of the site location and area. Appendix A contains a Site Location Plan.

Table 2.1: Site Summary

Item	Remarks
Site Area	c. 0.9ha
OS X (Eastings)	414731
OS Y (Northings)	409683
Nearest Postcode	HD9 7RW

2.1.11 The surrounding land uses are summarised in the following table.

Table 2.2: Surrounding Land Use

Direction	Land Use
North	Stone retaining wall, industrial / commercial units beyond.
East	River Holme.
South	Industrial units.
West	Huddersfield Road, residential properties beyond.

2.2 Topography

- 2.2.1 A topographical survey has been undertaken on the site and is included in Appendix C.
- 2.2.2 The site consists of flat platform at c. 127.3m to 128.1m above Ordnance Datum (aOD). The dam sidewall to the east is at an elevation of 128.1m to 128.3m aOD and the wall to the north at c. 127.5m aOD.

2.3 Site Ground Conditions

- 2.3.1 The geology of the site has been determined by reference to the 1:50,000 scale British Geological Survey (BGS) online GeoIndex Tool (<http://mapapps2.bgs.ac.uk/geoindex/home.html>).
- 2.3.2 The site is not shown to be underlain by Artificial Deposits. However, the site has recently been levelled using clean hardcore to a level that would have been similar to the former dam water level. There is therefore a considerable thickness of Made ground underlying the site.
- 2.3.3 Superficial deposits are present beneath the site comprising Alluvium associated with the River Holme close to the watercourse and River Terrace Deposits to the west of these. These may also be present below the Alluvium. Superficial deposits are not present beneath the western margin of the site.
- 2.3.4 The bedrock underlying the site is the Marsden Formation which is part of the Millstone Grit Group. The geology map indicates that the northern part of the site is underlain by a sub-division of this, the Huddersfield White Rock. The strata appear to be dipping shallowly to the north. The BGS describe the Marsden Formation as:

‘Fine- to very coarse-grained and pebbly feldspathic sandstone, interbedded with grey siltstone and mudstone, and subordinate marine black shales, thin coals and seatearths.’
- 2.3.5 The Huddersfield White Rock is described as:

‘A medium- to coarse-grained, massive to flaggy, cross-bedded, micaceous sandstone.’
- 2.3.6 The GeoIndex map is shown in Appendix D.
- 2.3.7 An investigation undertaken in 2005 found 0.5m to 0.8m of soft silt overlying organic clay with sandstone bedrock beneath. This is consistent with the geology recorded in the BGS maps.
- 2.3.8 GeoIndex has a record of a borehole and well-constructed close to the north of the site (Ref. SE10NW2). The well was located at Messers Vickamen and Sons Ltd and was constructed in 1887. The construction is unclear but was probably a 7ft (2.1m) diameter well with a 0.5m diameter borehole in the base. Details of the strata are not available to the base of the well (5.8m), below this the borehole penetrated hard grit to 7m bgl, hard ganister to 27.8m bgl and shale to 29.5m bgl. The rest water level was indicated as 5.5m bgl.
- 2.3.9 This is consistent with the geological map indicating that the sandstone of the Huddersfield White Rock probably extends to up to 7m bgl in the north (may be slightly deeper as the site is a slightly higher elevation). This thins and peters out to the south where the mudstones and siltstones of the Marsden Formation crop out.

2.4 Proposed Development

- 2.4.1 The final layout of the site has to be confirmed. Currently, the development is progressing on the assumption that the built area of the units will be 2000m² and the associated hardstanding areas 1550m².

3 ASSESSMENT OF FLOOD RISK TO THE DEVELOPMENT SITE

3.1 Introduction

3.1.1 Data publically available from the EA website has been used to assess the flood risk at the site (Appendix E). Site specific flooding information has also been supplied by the EA and is also included in Appendix E. This is supplemented with information from other publically available sources as listed in Section 1.2.2.

3.2 From Fluvial Flooding

3.2.1 The proposed site is almost entirely within Flood Zone (FZ) 1. FZ2 and 3 is located immediately to the east of the site and impinges into a small area of the southern part of the site. The proposed development is within FZ1.

3.2.2 Flood defences are located along the western bank of the River Holme adjacent, upstream and downstream of the site. These are all privately owned and the defence standard is not given for any of the structures. The condition of all the assets has been assessed by the EA as '3' (fair) and this is considered the minimum acceptable standard for critical assets.

3.2.3 FZ3 is often split into FZ3a and FZ3b defined as a 1 in 100 year or greater fluvial event and the functional floodplain respectively. SFRAs often provide maps or the criteria used to delineate these two zones. The Kirklees SFRA designates the FZ3 to the east as FZ3a.

3.2.4 The EA have provided information about historical flooding close to the site (Appendix E). This shows there are no records of the site flooding in the past including the December 2015 floods (only draft extents available at the time of reporting). Anecdotal evidence from the site owner also indicates that the site has not flooded in the past 70 years or so.

3.2.5 The EA have provided flood data including modelled flood heights at points upstream and downstream of the site. Both defended and undefended scenarios have been modelled. A map showing the node locations and all the data is included in Appendix E, the pertinent data is produced below:

Table 3.1 Modelled flood levels (m aOD) and flows (m³/s)

	Flood return period (years)											
	10	25	50	75	100	1000	10	25	50	75	100	1000
Location	Max Stage (m aOD)						Max Flow (m ³ /s)					
9599	124.98	125.26	125.38	125.44	125.47	126.64	46.95	57.83	67.62	73.26	76.60	96.5
9496	124.42	124.68	124.92	125.03	125.10	125.65	46.95	57.79	67.61	73.22	76.57	96.5
9392	123.94	124.15	124.36	124.47	124.53	124.76	46.95	57.79	67.60	73.22	76.55	96.5

Note: Undefended modelled levels, except 1 in 100 year event.

Undefended and defended scenarios levels and flows very similar

3.2.6 From available data, there is clearly no risk of the development flooding during a 1 in 100 year flood event, as the predicted flood level is at least c. 1.8m below the site level. This includes the small area shown to be in FZ2 on the EA map.

3.3 From Surface Water Flooding

3.3.1 Maps produced by EA data show the predicted extent of surface water flooding near the site (Appendix E). The maps show a low risk of surface water flooding across the site, according to this source, however, this is likely to reflect the former site topography. There does not appear to be any surface

water flow routes across the site. The risk of surface water flooding at the site is therefore considered low to minimal in its current configuration.

3.4 From Sewers and Drains Flooding

- 3.4.1 The SFRA report contains maps showing incidents of sewer flooding from the DG5 Register. None are located close to the site. The risk from sewer flooding is therefore considered minimal.

3.5 From Groundwater Flooding

- 3.5.1 The SFRA report contains maps showing the EA Areas Susceptible to Groundwater Flooding. This assigns each 1km² into one of four categories where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. The site lies in an area where between 25% and 50% of the 1km² square is at risk of groundwater emergence.
- 3.5.2 Groundwater level data is sparse in the vicinity of the site however the groundwater levels measured in the borehole to the north showed groundwater at c. 5.5m bgl. Data to determine the elevation of the groundwater table at this location is not available but this indicates that the groundwater is probably at a similar level to the river level, c. 123m aOD, and there is therefore probably a degree of hydraulic continuity between the two. Considering the depth to groundwater, ground water flooding of the site is not considered a risk.

3.6 From Infrastructure Flooding

- 3.6.1 Studying the risk of flooding from reservoirs map on the Environment Agency website, there is a risk of flooding to the development site from reservoir failure (Appendix E). The reservoirs that could affect the site are Brownhill, Holmestyes, Digley, Yateholme, Bilberry, Riding Wood and Ramsden. The depth of flooding is estimated as over 2 m and speed of floodwater over 2 m/s. The EA state:

Reservoir flooding is extremely unlikely to happen.....However, in the unlikely event that a reservoir dam failed, a large volume of water would escape at once and flooding could happen with little or no warning. If you live or work in an area that could be affected, you should plan in advance what you would do in an emergency.

4 ASSESSMENT OF FLOOD RISK AS A RESULT OF THE DEVELOPMENT SITE

4.1 From Fluvial Flooding

- 4.1.1 The proposed development is for commercial units and falls within FZ1. Compared to the current situation, the development will not have a detrimental impact on flood risk compared to the existing and former situation.

4.2 From Surface Water (Pluvial) Flooding

- 4.2.1 Currently, the site is indicated as at low risk from surface water flooding. However, the elevation of the site has recently been raised and the site is currently virtually flat. It is assumed that there is no positive surface drainage system present across the majority of the site and precipitation falling on the site infiltrates into the ground. As the site is relatively flat, the potential for surface water to run-off to neighbouring land or the river will be limited.
- 4.2.2 An improved drainage principle will be adopted for the new development which should improve the site drainage and limit the potential for off-site run-off. Compared to the current situation, the development will not have a detrimental impact on the surface water flood risk compared to the existing and former situation.

4.3 From Groundwater Flooding

- 4.3.1 The foundation design has to be determined but groundwater is probably at a depth greater than conventional foundations. Should foundations extend to this depth, these will probably be in the form of piles. Should groundwater be shallower, it should be able to flow around the buildings and through the wide intervening areas. It is therefore considered that it is highly unlikely that construction below ground level will have any significant effect on current groundwater movement.

5 CLIMATE CHANGE

- 5.1.1 Climate change is foreseen to have an impact on river and sea levels going into the future. This increase in predicted water levels along with foreseen increases in peak rainfall intensity are required to be assessed during the planning stages of development. In order to make an assessment, the guidelines within EA document 'Flood Risk Assessments: Climate Change Allowances, February 2016', are an appropriate precautionary response to the uncertainty of climate change. The increase in rainfall within the guidance should be used within any future surface water drainage design for the 1 in 100 year plus climate change range of events.
- 5.1.2 The EA have provided predicted flood levels for flood events but these do not include climate change. The revised climate change allowances (February 2016) for the Humber Basin district indicate that an increase of 10% / 15% / 20% in river flow should be added for predictions covering the 2020s, 2050s & 2080s respectively for developments considered as 'less vulnerable' according to Table 2 in the NPPF guidance.
- 5.1.3 The 1 in 100 year plus climate change flood level has been calculated as follows:
-  Collate the flow and flood level data into graphical format (Appendix F);
 -  Calculate the increase in river flow assuming a 15% increase above the 1 in 100 year flow rate;
 -  Assess the flood levels associated with this flow, using the graph.
- 5.1.4 The predicted 1 in 100 year plus climate change levels upstream and downstream of the site are 124.65m to 126.15m aOD. These levels are below the site elevation which is therefore predicted not to flood during a 1 in 100 year plus climate change flood event.

6 SEQUENTIAL AND EXCEPTION TEST APPROACH

- 6.1.1 The National Planning Policy Framework (NPPF) and the Planning Practice Guidance to it provides guidance for local planning authorities in effectively applying Planning Policy in relation to flood risk.
- 6.1.2 The sequential test is a means to ensure that a sequential approach is taken to steer new developments to areas with the lowest probability of flooding. The aim of the sequential test is to guide development into areas within Flood Zone 1. Where there are no reasonably available areas within Flood Zone 1, the Local Authority take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the exception test if required. If there are no reasonably available sites within zones 1 or 2 then available sites in Flood Zone 3 are considered, taking into account the flood risk vulnerability of land uses and applying the exception test if required.
- 6.1.3 This particular development lies within FZ1 as classified in Table 1 of the Planning Practice Guidance to the NPPF. The sequential test is therefore passed and an exception test is not required.

7 MITIGATION MEASURES

- 7.1.1 The site has been shown to be located in FZ1 and it has been demonstrated in the foregoing sections that the predicted peak river levels for a 1 in 100 year plus climate change event is between 124.65m and 126.15m aOD and should not inundate the site. The SFRA User Guide indicates that floor levels should be raised 600mm above the 1 in 100 year plus climate change flood level. Adding this to the predicted flood level, the site elevation is still above the resultant flood level. Mitigation measures are therefore not required.

7.2 Emergency Exit

- 7.2.1 The EA is responsible for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea. As part of their responsibilities, the EA provide lead flood warnings in some areas at risk of fluvial and tidal flooding. In the areas where flood warnings are provided, the EA aim to provide a lead flood warning time of up to 2 hours. This time is invaluable in implementing a flood response/evacuation plan and ensuring that people who live in areas at risk of flooding are suitably prepared.
- 7.2.2 This site lies partially within an EA flood-warning area as described below in Table 7.1. The whole of the site lies in the area that could be inundated during an infrastructure failure and this is the area considered for the evacuation plan below.

Table 7.1: EA Flood Warning Area Details

Name	Location	Flood line Information
River Holme at Holmebridge, Upperthong and Holmfirth	Holmbridge including Hinchliffe Mill and Water Street. Holmfirth including Victoria Mills, Lower Mill Lane and Hollowgate. Thongsbridge including Miry Lane	Call Floodline on 0345 988 1188 select option 1 and enter 137504 to get information

- 7.2.3 Owners of the site can sign up to this flood warning service for free using the details provided above.
- 7.2.4 During a fluvial flooding event, vehicles should exit left or right from the site onto Huddersfield Road. They should remain on this road or turn to the west away from the River Holme. Dry pedestrian egress should be along a similar route.
- 7.2.5 In the unlikely event of a flood resulting from infrastructure failure, safe vehicular access to and from the site will be limited to the time taken between the warning and the onset of floodwaters. During these period, vehicles should exit right from the site onto Huddersfield Road and then remain on this road to the north of Thongsbridge and / or turn to the west away from the River Holme. Vehicles should not drive into Honley to the north which will be in the area at risk of flooding. Pedestrians should follow a similar route.
- 7.2.6 Once flood waters have arrived at the site, safe vehicular egress will not be possible. Safe pedestrian refuge could be provided by the upper floors of the buildings, should these be multi storey. If this is not appropriate, a pedestrian access route from the site to the part of Huddersfield Road to the north west of the site could be provided, as this area is predicted to remain above the flood level. It should be noted that Huddersfield Road to the south west and by the junction with Miry Lane are predicted to be within the flood zone and should not be used by pedestrians in this instance.

8 DRAINAGE STRATEGY

8.1 Existing Site Runoff

8.1.1 Information about public sewer locations have been provided by the client. A public sewer is located in Miry Lane to the north of the site (it is not known if this is a foul or combined sewer). Public sewers are also located in Huddersfield Road to the west; there is one branch to the north west of the site flowing to the north which terminates close to the north west corner of the site and a second branch flowing to the south which commences c. 50m to the south of the site entrance.

8.1.2 A foul sewer has been laid within the site which connects with the sewer in Miry Lane. Considering the fall of the land, this is assumed to be gravity flow.

Surface water

8.1.3 The site is currently undeveloped with no positive site wide surface water drainage.

Foul water

8.1.4 The site is currently undeveloped and not generating any foul water.

8.2 Drainage Options

8.2.1 Any rainwater that falls on the proposed buildings or impermeable areas cannot infiltrate into the ground and therefore these areas need to be artificially drained in order to prevent problems of localised flooding and/or exacerbate existing issues. The units are to be built on areas that are currently permeable and therefore will increase surface water runoff rates.

8.2.2 Requirement H3 of the Building Regulations states that when assessing disposal methods for rainwater from roofs and paved areas, a hierarchical approach should be followed. The hierarchy of disposal methods as described in the Building Regulations Approved Document H states that if discharge to soakaways or other infiltration system is not feasible then discharge to a watercourse should be investigated. If neither of these options are viable then discharge to a surface water sewer (with balancing), or finally combined sewer (with balancing) could be used.

Sustainable Drainage System (SuDS)

8.2.3 Draining via SuDS (e.g. soakaways, storage tanks, permeable paving, etc.) reduces the impact of urbanisation on watercourse flows, ensures the protection and enhancement of water quality and utilising infiltration encourages recharge of groundwater in a manner which mimics nature. Table 8.1 lists the forms of sustainable drainage that will be considered when establishing which solutions may be best suited to the site.

Table 8.1: Evaluation of sustainable drainage options

Component	Recommendation
Swales	Swales are used to convey and/or store runoff, as well as infiltrate water into the ground.
Infiltration structures – ponds, basins, soakaways, etc.	Infiltration devices are used to store surface runoff and infiltrate water into the ground. The use of infiltration devices is dependent upon a suitably free draining sub-soil. Site Investigation needs to be carried out to determine if good drainage characteristics are present.
Pervious surfaces	The use of pervious surfaces could be suitable for the site and testing should be done to confirm or dismiss this.

Infiltration

- 8.2.4 Site investigation works have not been undertaken at the site recently. An investigation undertaken in 2005 found 0.5m to 0.8m of soft silt overlying organic clay with sandstone bedrock beneath. Since this investigation, the dam area has been infilled, and these deposits will be overlain by several metres of Made Ground.
- 8.2.5 Permeability testing has not been carried out. However previous site works have noted the presence of lower permeability materials which would limit the suitability of infiltration systems. Furthermore, Made Ground, particularly when newly laid, may contain contaminants that could be mobilised into groundwater. For these two reasons, this option is not considered feasible.

Discharge to a watercourse

- 8.2.6 The River Holme is located 25m to the east separated from the site by land in the same ownership as the current site. Two culverts already exist to the river, discharging to the east of the site and 260m to the north. Subject to further assessment, it may be feasible to discharge to the River Holme either via a new outfall or through one of the existing culverts. This is therefore the preferred option for the disposal of surface water from the site.

Discharge to public sewers

- 8.2.7 Discharge routes to surface water are feasible subject to further investigation. Therefore, this option is not considered further.

8.3 Proposed Site Runoff

Surface water drainage

- 8.3.1 Initial assessments indicate three possible options for disposal of surface water:
1. Indirect discharge to watercourse (River Holme) via the dam overflow culvert in the north east of the site. Further investigation is required to determine the size and condition of the culvert. Agreement will also be required with the EA.
 2. Indirect discharge to watercourse (River Holme) via the turbine culvert in the north of the site. Further investigation is required to determine the size and condition of the culvert. Some renovation of the culvert may also be required, particularly to remove silt. The site owner is understood to be permitted to discharge into this culvert although the culvert flows beneath third property land. The legality and issues associated with using the culvert will also require further investigation. Agreement for the discharge into the river will also be required with the EA.
 3. Direct discharge to the River Holme via a new sewer across land to the east. Agreement will be required with the EA.

- 8.3.2 Irrespective of the final discharge point, surface water discharge from the site will need to be restricted to the Greenfield runoff rate. The Greenfield runoff rate for the site has been calculated as 4.5 l/s based on a site area of 0.9 ha.
- 8.3.3 For the proposed development, assuming all roof and car park areas are drained to a surface water system, the volume of attenuation has been calculated as 109m³ for a 1 in 30 year event and 239m³ for a 1 in 100 year plus climate change (40%) event. These attenuation volumes could be accommodated either below ground within a storage tank or within the culvert system (for option 2) subject to suitable engineering of the culvert to limit flow rates. Refer to Appendix G for the calculations.
- 8.3.4 All surface water from return periods should be retained within the surface water system. For 1 in 100 year plus climate change events, surface water should be dealt with within the site either below ground or above ground in areas which can withstand volumes of water without detrimental effects, i.e. car park areas.
- 8.3.5 Surface water from the car parking areas should be routed through an oil separator prior to discharge from site.
- Foul water drainage
- 8.3.6 Sewers are known to exist in Miry Lane to the north or Huddersfield Road to the west. Subject to confirmation of their size and location from Yorkshire Water, these could be used for the discharge of foul water. A foul water sewer has already been laid in the site and connected to the sewer in Miry Lane, and this would be the preferred disposal route as a gravity sewer can be used. Alternatively, a connection with the sewers in Huddersfield Road could be sought but these would probably need to be pumped and / or cross third party land. Consent will be required from Yorkshire Water to discharge foul water flows from the development into the public sewer network.

9 CONCLUSIONS AND RECOMMENDATION

-  A Flood Risk Assessment which reviews all aspects of flood risk to the site and proposes a strategy for the discharge of surface water runoff in a manner which will not increase the risk of flooding either on or off site has been produced to accompany the outline planning application.
-  The site is in FZ1 and is above the elevation of the 1 in 100 year plus climate change flood level including 600mm freeboard. Flood mitigation measures are therefore not required.
-  Although the site is currently shown as at low risk of surface water flooding, the site level has recently been raised and development of the site will improve the surface water drainage system resulting in a reduced risk of surface water flooding.
-  The site is not considered at risk of groundwater flooding. The development is unlikely to increase groundwater flooding risks off-site.
-  The site is not at risk of sewer flooding.
-  The site is located in an area which would be affected by infrastructure failure. An emergency evacuation plan has been outlined.
-  Soakaway tests have not been undertaken on the site but it is considered that infiltration systems will not be suitable for the disposal of surface water.
-  The site is located to the west of the River Holme. Two culverts exist from the site to the river and these or a new surface water sewer could be used for the disposal of surface water from the site into the River Holme subject to further surveys and necessary permissions.
-  All surface water infrastructure should be designed in accordance with Sewers for Adoption 7th Edition and should provide adequate storage for the 1 in 30 year storm event. Additional on-site storage should be provided for up to the 1 in 100 year event + 40% climate change allowance, with no risk of flooding to buildings.
-  Foul water drainage from the proposed development should be discharged to a Yorkshire Water sewer. Sewers are located to the south west, north west and north and there is already a gravity sewer connecting the site to the sewer in Miry Road. Subject to agreement with Yorkshire Water, this should be used for the disposal of foul water from the site.
-  The proposed development has an acceptable flood risk within the terms and requirements of the NPPF.
-  The comments stated above are based on information received from other consultees. The flood risk classification of this site has been based on the above observations, and the recommendations stated. This report is intended for the use of the developer of the site in support of their outline planning application for the site only.

Appendix A

Site Location





Appendix B

Culvert Plan



SANDSTONE
TIPPED
HILL

30'

HEAR WATER
TRACKING IN

MORTAR BUILT
STONES

CAR
WASH
MANHOLE

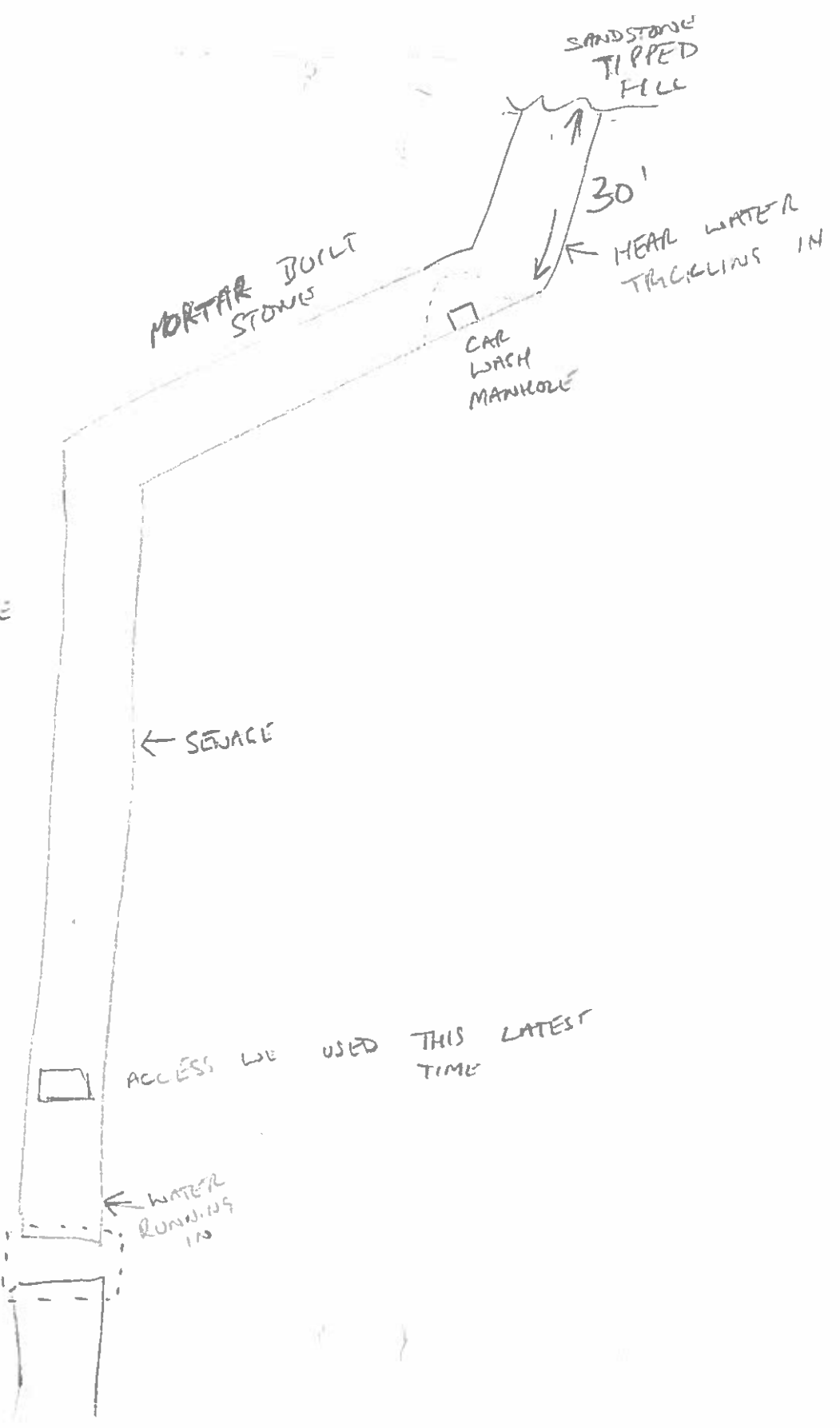
DRY
STONE

← SEWAGE

ACCESS WE USED THIS LATEST
TIME

ACCESS WE USED
FIRST TIME →

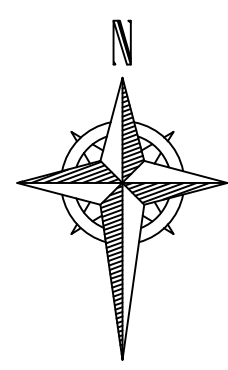
← WATER
RUNNING
IN



Appendix C

Topographic Map





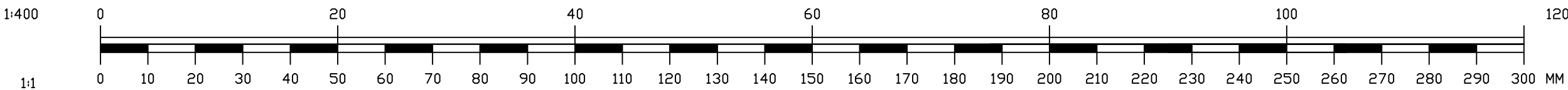
- Notes
1. The survey was carried out on , using Leica TPS 1203/1205 and GPS 1200 instruments.
 2. North relates to OS Grid North.
 3. All co-ordinates relate to OS GB36 Datum at Stn 1. The rest of the site is orientated to OS Grid North but has been surveyed on a flat grid with no scale factor. All heights relate to OSGB 36 datum and have been computed using the DSTN02 Geoid model.
 4. This dwg is an extension of IRALDITHONGS3.21_01, dated 27th June 2016.

LEGEND

- ▲ Survey Station
□ IC - Inspection Cover
□ CA - Cable TV Cover
□ FH - Fire Hydrant
□ SV - Stop Valve
□ GV - Gas Valve
□ PB - Post Box
□ TCB - Call box
□ TC - TCSU Cover
□ PT - Parking Ticket Machine
□ ER - Earthing Rod
□ TB - Traffic Bollard
□ Litter Bin
□ Gully
▷ MH - Manhole Triangular
○ MHC - Manhole Circular
○ PB - Post Box
● GP - Gate Post
● TP - Telephone Pole
● EP - Electricity Pole
● RS - Road Sign
● TL - Traffic Light
● BL - Bollard
● FP - Flag Pole
● LP - Lamp Post
● C - Camera
= Gate
● Tree (Coniferous - girth and spread to scale)
● Tree (Deciduous - girth and spread to scale)
● Tree (Dead/diseased - girth and spread to scale)
+ Spot Level
+ Top of Wall Height
+ Apex Height
+ Eave Height
- Kerb
- - - Drop Kerb
- - - Road Edge (channel)
- - - Track Edge
- - - Change of Surface
— Road Centre Line
— Double Yellow Lines
- Wall
— Fence
— Edge of Hedge
— Vegetation Edge
— Metal Railings
- Building
— Apex Line
— Eave Line
— Parking Bay
- Overhead Power Cable
— Open Channel
— Top of Bank
— Bottom of Bank
— Major Contour Interval - 10m
— Minor Contour Interval - 0.2m



SURVEY STATION SCHEDULE			
STATION	DESCRIPTION	COORDINATES	HEIGHT
1	Survey Station	547700	497700
2	Survey Station	547700	497700
3	Survey Station	547700	497700
4	Survey Station	547700	497700
5	Survey Station	547700	497700
6	Survey Station	547700	497700
7	Survey Station	547700	497700
8	Survey Station	547700	497700
9	Survey Station	547700	497700
10	Survey Station	547700	497700
11	Survey Station	547700	497700
12	Survey Station	547700	497700
13	Survey Station	547700	497700
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16	Survey Station	547700	497700
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98	Survey Station	547700	497700
99	Survey Station	547700	497700
100	Survey Station	547700	497700



client
ALDI STORES LTD / S.MARSDEN

project
HUDDERSFIELD ROAD,
THONGSBIDGE.

scale 1:400@A0 | drawn by GC | checked by RW

date 25TH JULY 2016 | cad file ALDITHONGS.21

title
DETAILED
TOPOGRAPHICAL
SURVEY

drawing number
IR.ALDITHONGS3.21_01

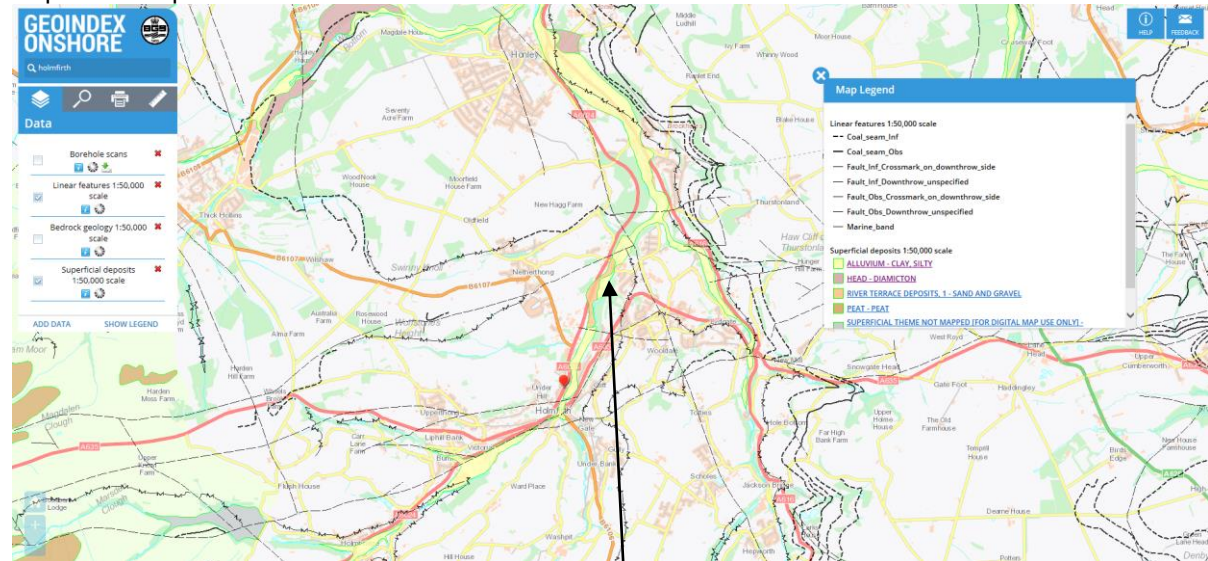
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Appendix D

Geology Map

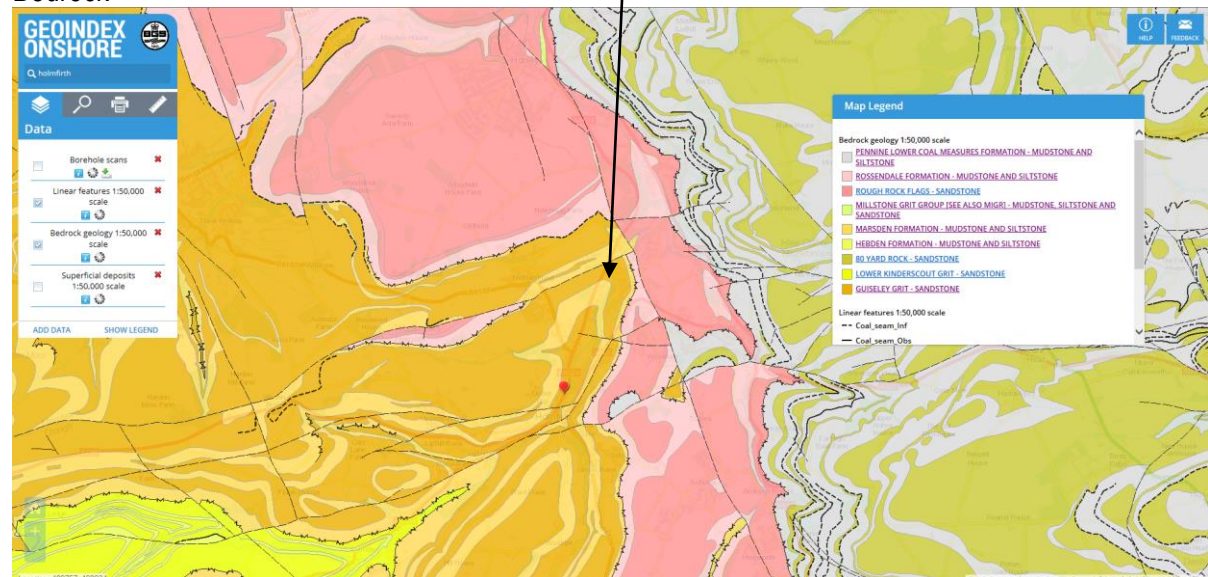


Superficial deposits



Site

Bedrock



Appendix E

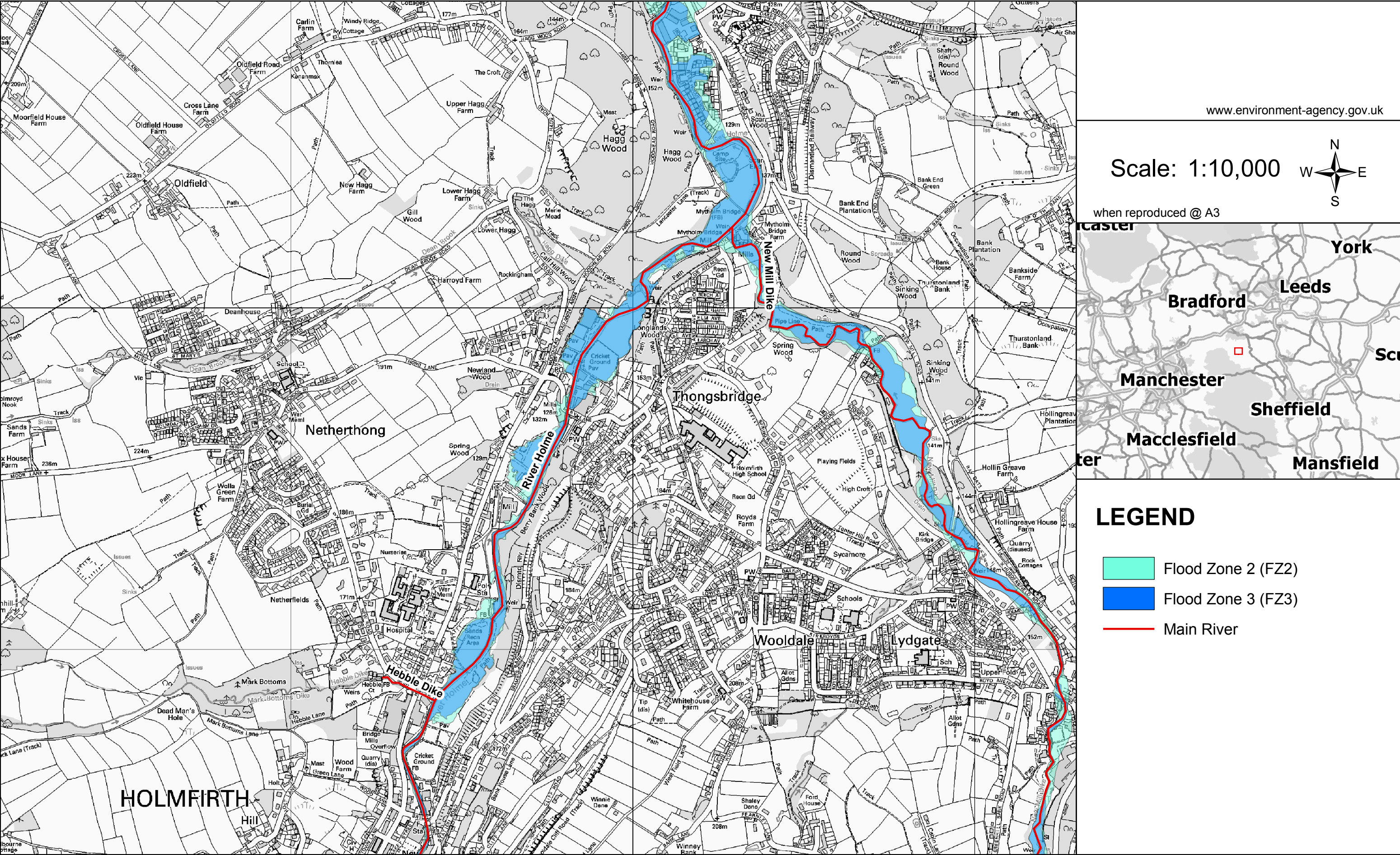
EA Data



Flood Map for Planning for Land off Huddersfield Road, Thongsbridge, HD9 3JQ

Date Created: 13.10.16

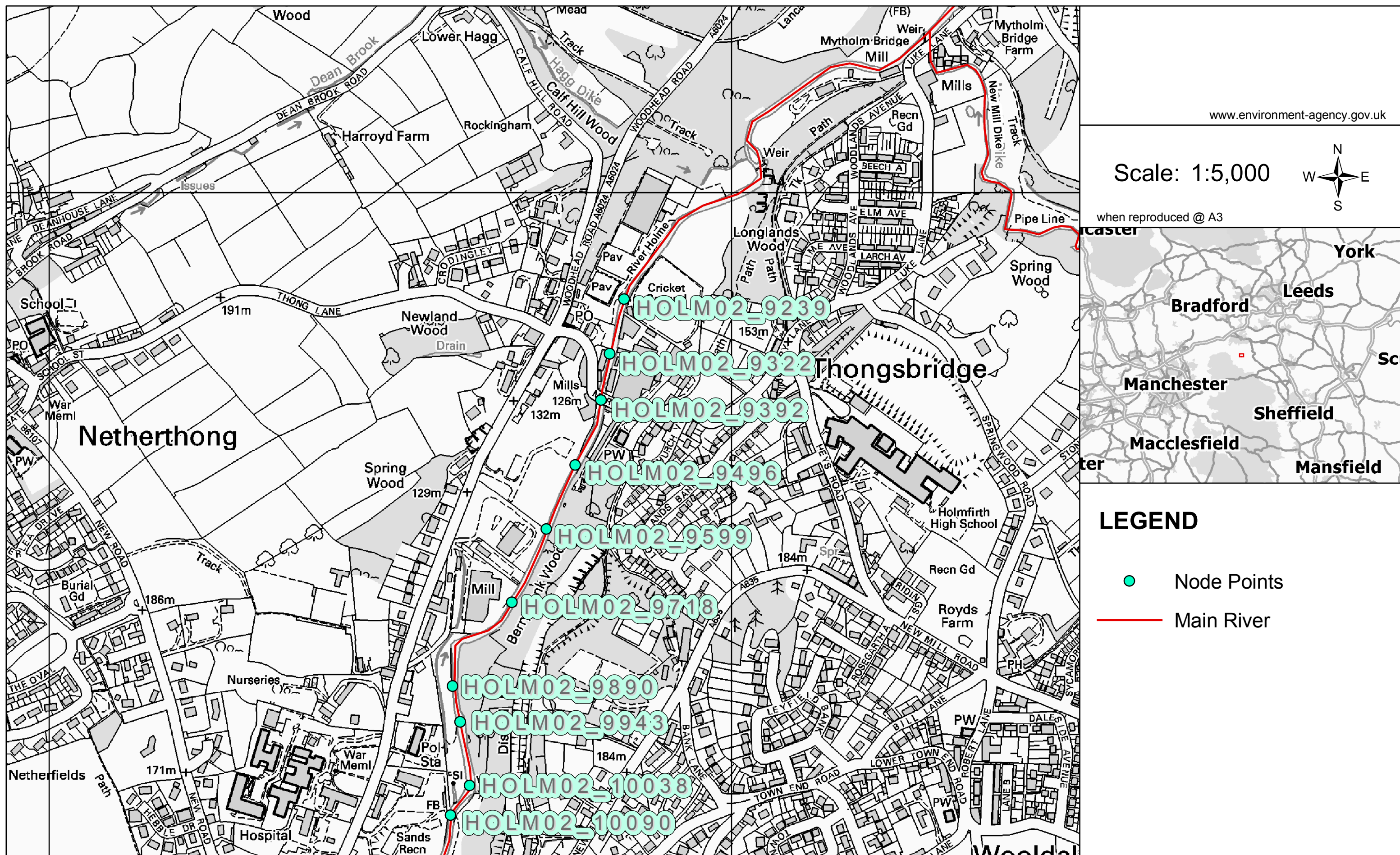
RFI: 25582



Node Point Location Map for Land off Huddersfield Road, Thongsbridge, HD9 3JQ

Date Created: 13.10.16

RFI: 25582



UNCLASSIFIED

Node Point Information - RFI: 25582

Node Point	Maximum Modelled Stage (Maod) AND Flows (m3/s) for the Defended Scenario - 2010 model										2005 Model	
	1 in 10 Year		1 in 25 Year		1 in 50 Year		1 in 75 year		1 in 100 Year		1 in 1000 Year	
	10% annual probability		4% annual probability		2% annual probability		1.33% annual		1% annual probability		0.1% annual probability	
	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow
HOLM02_10038	129.983	46.967	130.168	57.855	130.311	67.649	130.378	73.26	130.415	76.579	130.612	96.5
HOLM02_10090	130.432	46.964	130.784	57.855	131.041	67.645	131.152	73.266	131.216	76.582	131.39	96.5
HOLM02_9239	122.688	46.942	122.866	57.786	122.996	67.59	123.064	73.214	123.097	76.559	123.254	96.5
HOLM02_9322	123.478	46.948	123.663	57.788	123.799	67.595	123.87	73.22	123.909	76.554	124.068	96.5
HOLM02_9392	123.937	46.949	124.148	57.786	124.358	67.599	124.469	73.22	124.533	76.554	124.755	96.5
HOLM02_9496	124.419	46.951	124.682	57.786	124.919	67.607	125.034	73.219	125.099	76.573	125.264	96.5
HOLM02_9599	124.973	46.95	125.258	57.828	125.376	67.624	125.441	73.259	125.471	76.601	125.638	96.5
HOLM02_9718	125.894	46.956	126.09	57.833	126.209	67.644	126.263	73.269	126.273	76.57	126.211	96.5
HOLM02_9890	126.873	46.966	127.112	57.849	127.313	67.65	127.422	73.263	127.514	76.553	127.567	96.5
HOLM02_9943	127.179	46.967	127.383	57.852	127.549	67.651	127.637	73.26	127.695	76.569	127.809	96.5

Node Point	Maximum Modelled Stage (Maod) AND Flows (m3/s) for the Undefined Scenario - 2010 model									
	1 in 10 Year		1 in 25 Year		1 in 50 Year		1 in 75 year		1 in 100 Year	
	10% annual probability		4% annual probability		2% annual probability		1.33% annual		1% annual probability	
	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow
HOLM02_10038	129.981	46.839	130.168	57.839	130.311	67.663	130.379	73.329	130.415	76.566
HOLM02_10090	130.428	46.835	130.784	57.839	131.041	67.667	131.153	73.333	131.216	76.565
HOLM02_9239	122.685	46.817	122.865	57.768	122.997	67.615	123.064	73.27	123.097	76.493
HOLM02_9322	123.476	46.822	123.663	57.773	123.799	67.619	123.87	73.276	123.909	76.513
HOLM02_9392	123.934	46.823	124.147	57.772	124.358	67.617	124.47	73.275	124.532	76.518
HOLM02_9496	124.415	46.825	124.682	57.768	124.919	67.613	125.035	73.27	125.099	76.534
HOLM02_9599	124.97	46.826	125.258	57.813	125.376	67.653	125.442	73.315	125.47	76.553
HOLM02_9718	125.89	46.832	126.089	57.821	126.209	67.665	126.264	73.325	126.271	76.523
HOLM02_9890	126.87	46.84	127.112	57.832	127.314	67.662	127.423	73.314	127.512	76.538
HOLM02_9943	127.176	46.84	127.382	57.837	127.549	67.66	127.637	73.323	127.695	76.557

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Asset Defence Map for Land off Huddersfield Road, Thongsbridge, HD9 3JQ

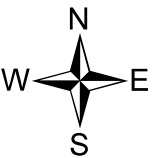
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RFI: 25582

www.environment-agency.gov.uk

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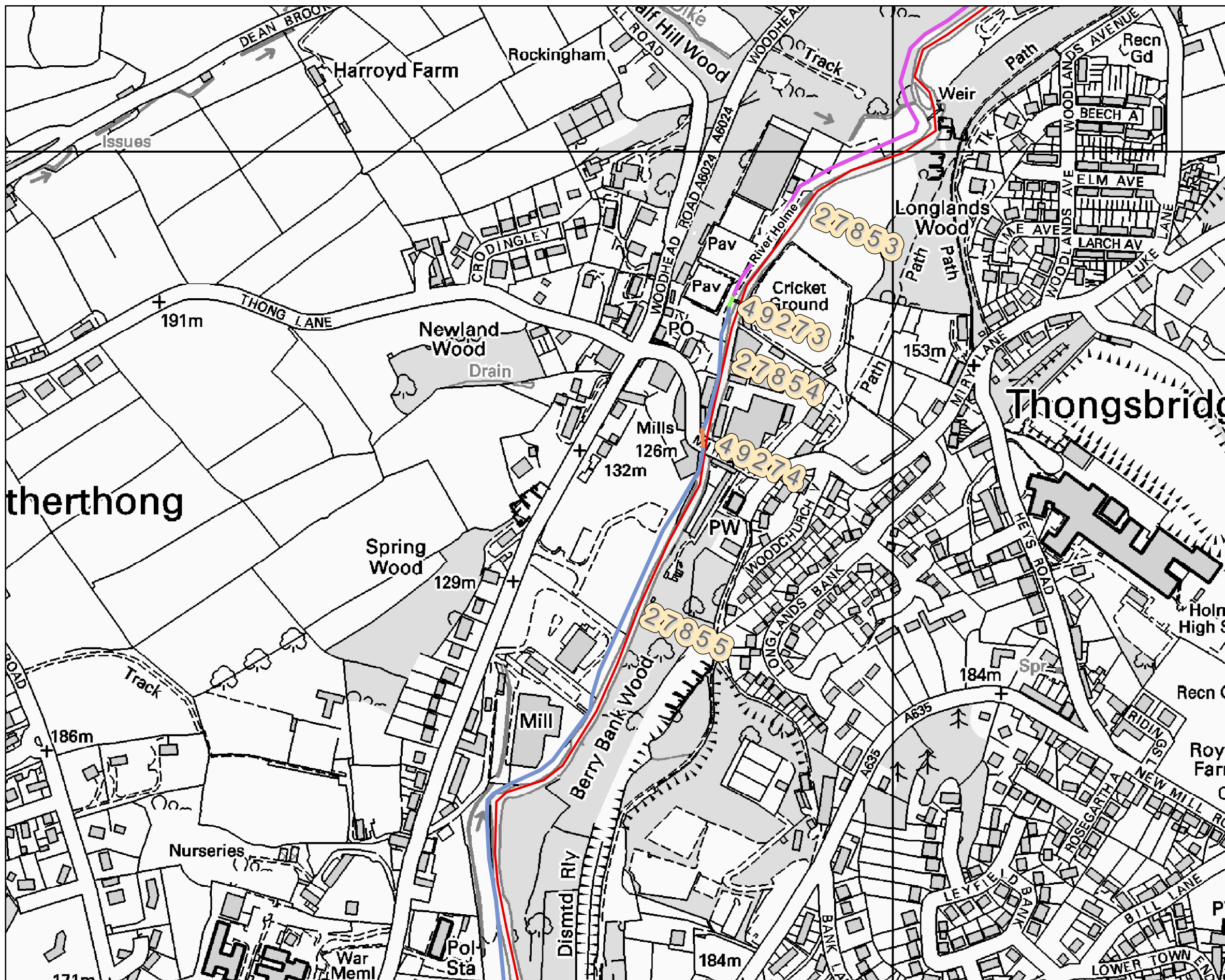
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LEGEND

Defences

- BRIDGE ABUTMENT 10M
- CHANNEL SIDES
- FOOTBRIDGE ABUTMENT 1M
- OPEN CHANNEL
- Main River



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Asset Defence Information - RFI: 25582

Asset ID	Asset Type	Asset Subtype	Maintainer	Description	Actual Condition Rating	Design Standard of Protection (yrs)
27854	Defence	High Ground	Private	CHANNEL SIDES	3	0
49273	Defence	High Ground	Private	FOOTBRIDGE ABUTMENT 1M	2	0
27853	Defence	High Ground	Private	OPEN CHANNEL	3	0
49274	Defence	High Ground	Private	BRIDGE ABUTMENT 10M	2	0
27855	Defence	High Ground	Private	CHANNEL SIDES	3	0

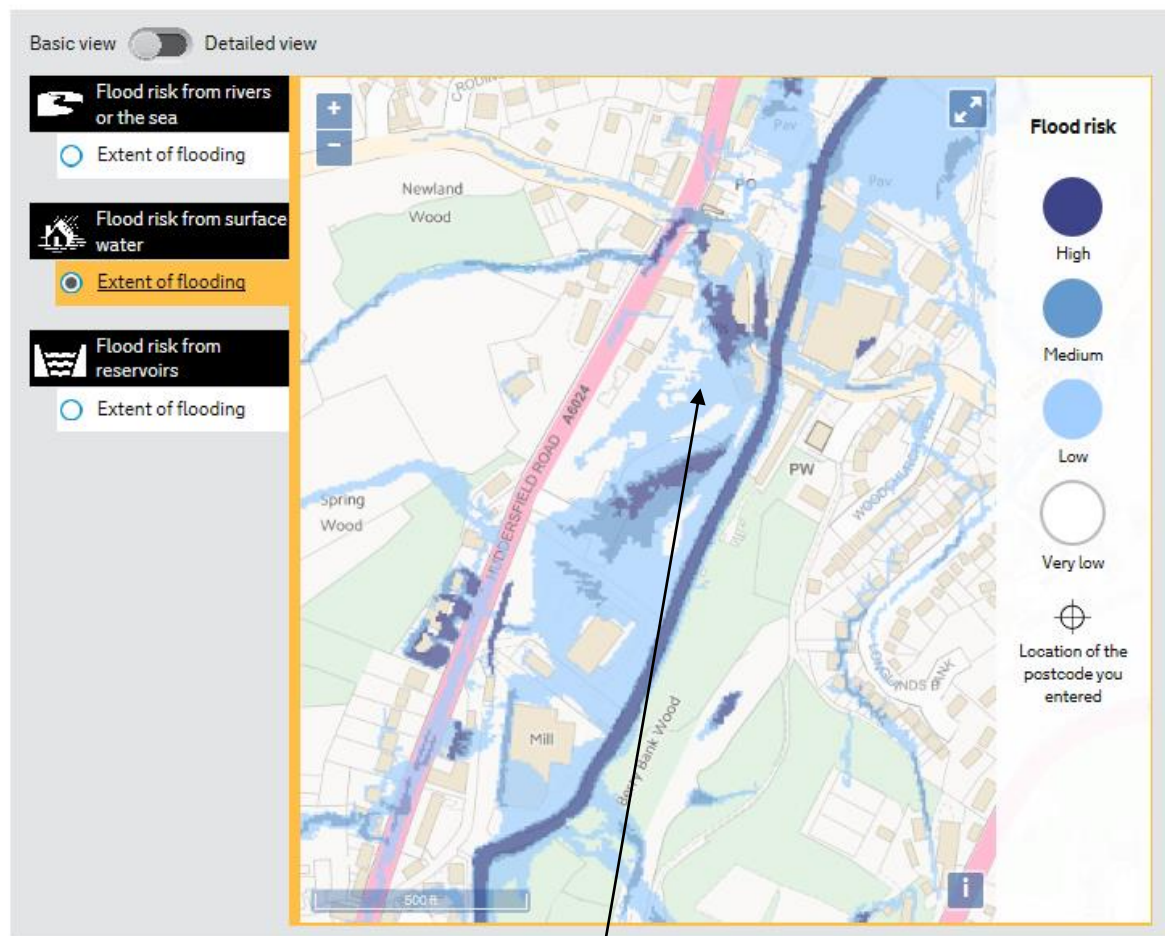
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BETA This is a new service – your [feedback](#) will help us to improve it.

Learn more about this area's flood risk

From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.



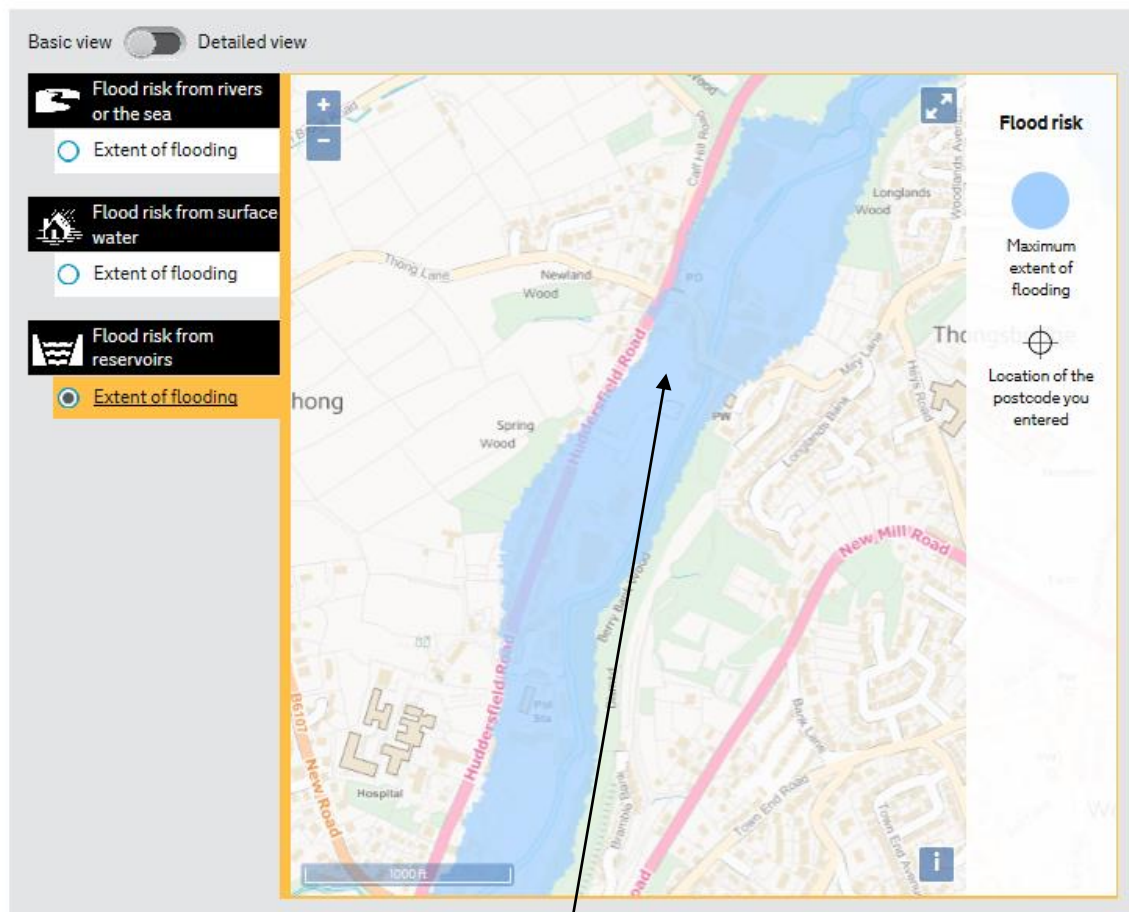
Site

BETA This is a new service – your [feedback](#) will help us to improve it.

Learn more about this area's flood risk

From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.

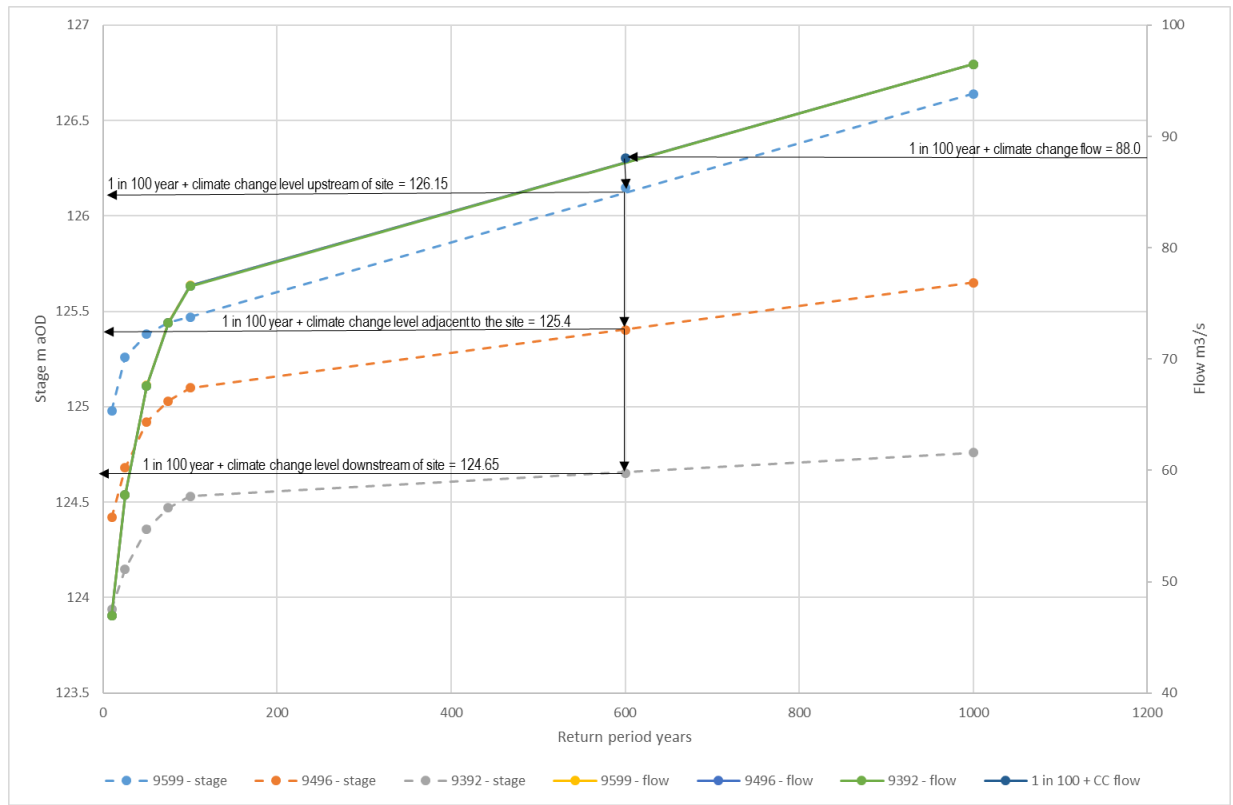


Site

Appendix F

Climate Change Assessment

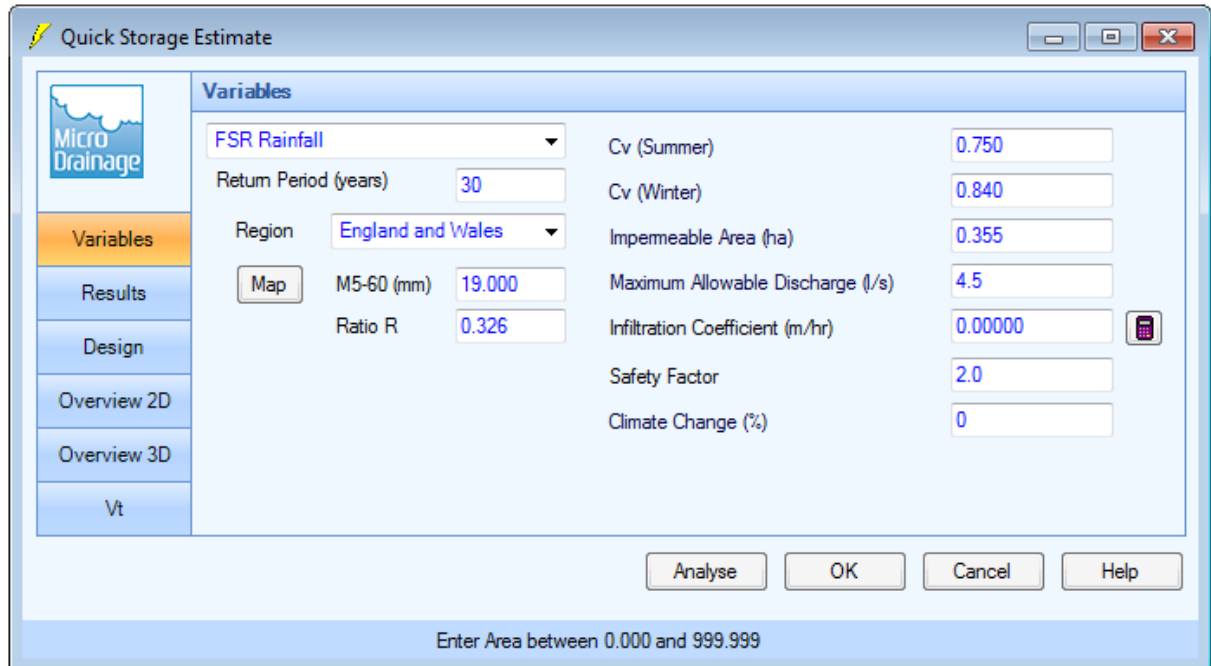




Appendix G

Flood Storage Volumes Calculations





Quick Storage Estimate

Variables

FSR Rainfall ▼ Cv (Summer) 0.750

Return Period (years) 30 Cv (Winter) 0.840

Region England and Wales ▼ Impervious Area (ha) 0.355

Map M5-60 (mm) 19.000 Maximum Allowable Discharge (l/s) 4.5

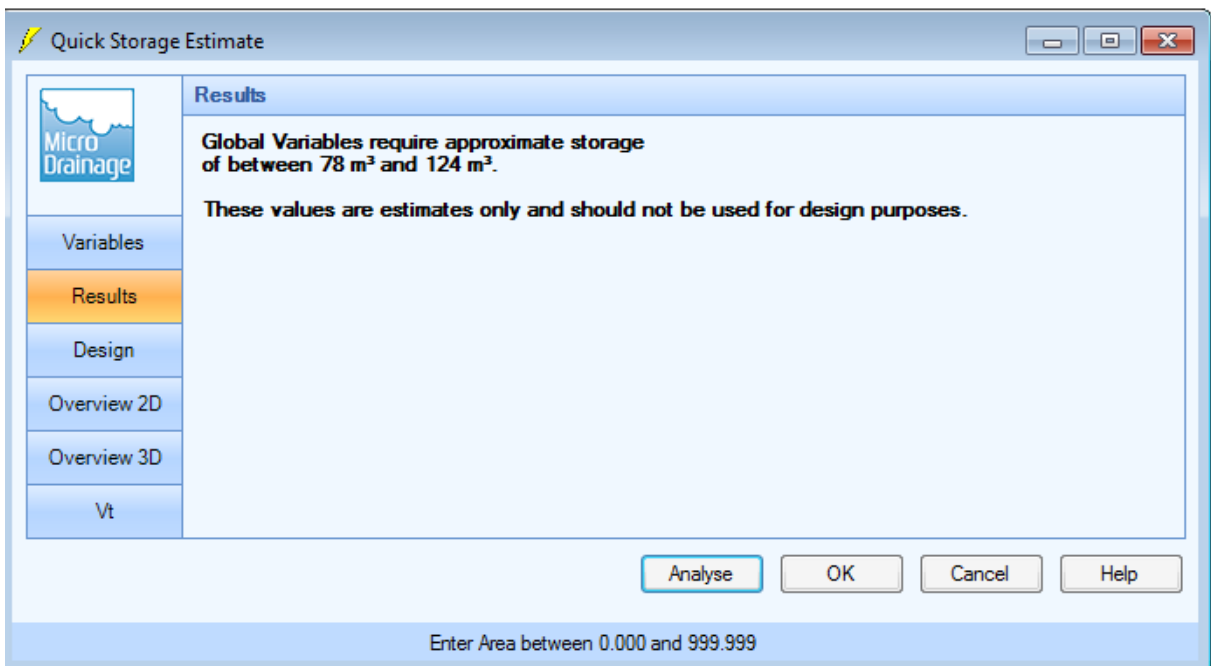
Ratio R 0.326 Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 0

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999



Quick Storage Estimate

Results

Global Variables require approximate storage of between 78 m³ and 124 m³.

These values are estimates only and should not be used for design purposes.

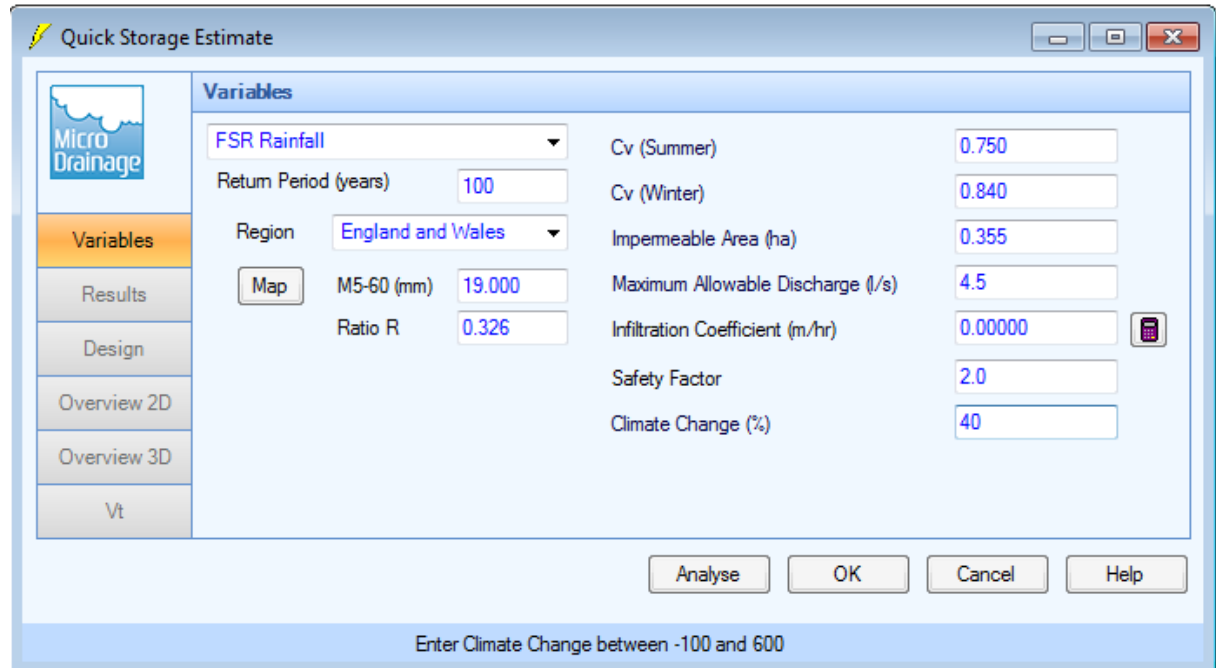
Analyse OK Cancel Help

Enter Area between 0.000 and 999.999

1 in 30 year

Take 2/3 of the difference between the upper and the lower limit and add this to the lower limit to get an approximate storage volume.

Volume for storage = 108.6 m³



Quick Storage Estimate

Variables

FSR Rainfall

Return Period (years) 100

Region England and Wales

Map

M5-60 (mm) 19.000

Ratio R 0.326

Cv (Summer) 0.750

Cv (Winter) 0.840

Impervious Area (ha) 0.355

Maximum Allowable Discharge (l/s) 4.5

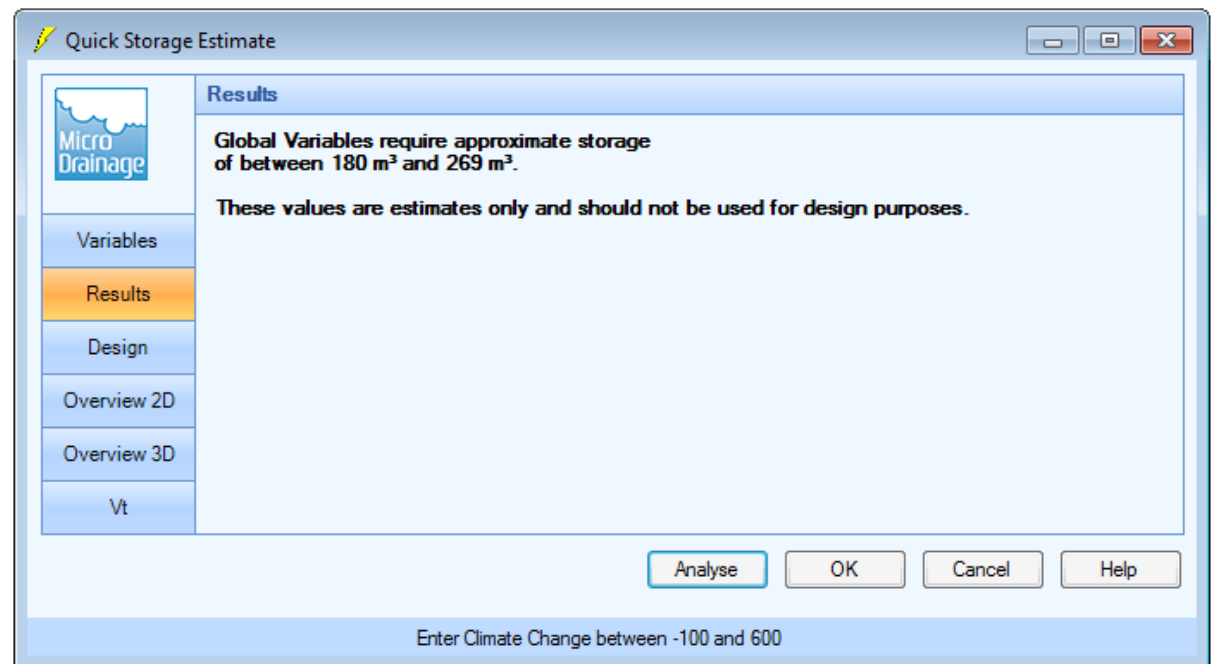
Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 40

Analyse OK Cancel Help

Enter Climate Change between -100 and 600



Quick Storage Estimate

Results

Global Variables require approximate storage of between 180 m³ and 269 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Climate Change between -100 and 600

1 in 100 year plus climate change

Take 2/3 of the difference between the upper and the lower limit and add this to the lower limit to get an approximate storage volume.

Volume for storage = 239.3 m³