

Flood Risk Assessment

WEST STREET, WORSBOROUGH

HOOBER HOMES

05/12/2023



FLOOD RISK ASSESSMENT
WEST STREET, WORSBOROUGH
FOR
HOOBER HOMES



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05 December 2023

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FOR
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EXECUTIVE SUMMARY

The project comprises the proposed development of a 1.5-hectare brownfield site for residential use.

The Environment Agency's Flood Map for Planning shows the site to lie within Flood Zone 1. The site is not at significant risk of flooding from any source. In accordance with current Planning Practice Guidance 'Flood Risk and Coastal Change', sequential testing is not required.

There is a low to high risk surface water flow route recorded along the southern boundary and a low risk flow route along the central portion of the site originating from highway exceedance flows north-east and north-west of the site. At the point where the two flow routes meet at the site low point there is an area at low to high risk of surface water ponding which overflows into the River Dove south of the site.

The entire site is recorded to lie outside of the maximum extent of flooding from reservoirs, even when there is flooding from rivers.

Ground levels will be altered to raise depressions in the south-east to match the rest of the site. The raising of levels and presence of surface water drainage features will remove any surface water ponding and will lower the modelled flood depth.

The surface water flow routes within the site should be maintained or diverted through the site. The existing culvert/surface water drain within the site should also be maintained.

Surface water disposal is considered in accordance with the drainage hierarchy in Building Regulations Part H 2015 and Planning Practice Guidance 'Reducing the causes and impacts of flooding', paragraph 80.

Infiltration type SuDS such as soakaways will not be possible due to the expected presence of impermeable ground conditions (siltstone and mudstone) and steep topography.

Surface water disposal will be via gravity to the existing 300 mm x 300 mm culvert/surface water drain within the southern portion of the site, ultimately discharging to the River Dove. Discharge to watercourse is subject to approval from the LLFA.

As stipulated by the LLFA, surface water discharge will be restricted to the historic brownfield rate allowance of 10 l/s/ha equating to 15 l/s.

Attenuation storage will be provided for rainfall events up to the return period of 1 in 100 year plus 40% climate change. The total estimated storage volume is 425 m³, subject to detailed design.

Source Control SuDS such as rain gardens (bio-retention areas) may be suitable to provide water treatment and attenuation.

Foul effluent will discharge via gravity to the 450 mm public foul sewer south of the Trans Pennine Trail, south of the site.

Both the surface and foul water drainage systems may be offered for adoption to a NAV.

1.0 THE DEVELOPMENT AND NATIONAL PLANNING POLICY

1.1 Introduction

This Flood Risk Assessment has been prepared in accordance with current National Planning Policy Framework¹ and Planning Practice Guidance 'Flood Risk and Coastal Change'² on the instruction of Hooper Homes. Any other parties using the information in this report do so at their own risk, unless previously approved in writing. This report outlines a general drainage strategy only for the proposed development.

The project comprises the development of a 1.5-hectare brownfield site for residential use.

1.2 Site location and description

The site is located within Worsborough in Barnsley and is centred on coordinates 435890E, 403650N (Appendix 1).

The site is bounded by West Street (B6100) to the north, residential dwellings to the west, commercial/light-industrial units to the east and the Trans Pennine Trail and wood to the south.

The site currently comprises a vacant plot of land. A portacabin, substation and electricity supply area surrounded by fencing in the north of the site and one partly demolished building is present in the south-east.

The site falls from approximately 60.33 mAOD in the north-east and approximately 57.69 mAOD in the north to approximately 52.97 mAOD in the south-east at average gradients of 1 in 14 and 1 in 23 respectively (Appendix 2).

Proposals are for the development of 51 household properties with access from West Street to the north (Appendix 3).

¹ <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

² <https://www.gov.uk/guidance/flood-risk-and-coastal-change>

1.3 Environment Agency - Flood Map for Planning

The Environment Agency's Flood Map for Planning (Figure 1 and Appendix 4) shows that the site lies within Flood Zone 1 (low risk); land having a less than 1 in 1,000 annual probability of flooding from rivers or sea.



Figure 1: Environment Agency's Flood Map for Planning

1.4 Barnsley Metropolitan District Council Strategic Flood Risk Assessment

The Barnsley Metropolitan Borough Council's Strategic Flood Risk Assessment flood map is based on the Environment Agency flood map and records the site to be within Flood Zone 1 (Appendix 5).

1.5 National Planning Policy Framework

The National Planning Policy Framework (September 2023) sets out the principles for assessing the suitability of sites for development, in relation to flood risk, as part of the planning process.

1.5.1 Sequential Test

Initially a Sequential Test is applied to the allocation of land suitable for development. The test is required for any development proposed in Flood Zone 2 or 3 (and occasionally also in Flood Zone 1 where there are flood risks present which are not identified on the Environment Agency's Flood Maps for Planning).

The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites, appropriate for the proposed development, in areas with a lower probability of flooding.

The site lies within Flood Zone 1 and this report confirms that the site is not at significant risk of potential flooding from any source, therefore the sequential test is not required.

1.5.2 Climate change

An issue emphasised in the Planning Policy Guidance is the requirement to take account of potential climate change effects. New development is generally accepted as having a 100 year design life for flood risk purposes. Climate change allowances for peak rainfall intensity³ are to be selected based on the assigned values for the relevant Management Catchment and epoch suited to the design life of the development. For the Don and Rother Management Catchment, the Upper End Allowance of 40 % should be used to assess storage requirements.

³ <https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall>

2.0 FLOOD RISK

2.1 Potential sources of flooding

The Environment Agency and Strategic Flood Risk Assessment maps are intended for general guidance on flood risk and it is also necessary to consider other, more detailed, sources in relation to local factors.

2.1.1 Fluvial and tidal

The nearest watercourse is the River Dove (main river) located approximately 83 m south of the site. This watercourse is not tidally influenced, therefore flood risk from this source is assessed as negligible. It is also noted that there is a 300mm x 300mm culvert/ surface water drain connection from the southern portion of the site to the River Dove.

2.1.2 Surface water

The Environment Agency surface water flood risk map (Figure 2 and Appendix 4) shows the majority of the northern portion of the site is at very low risk of surface water flooding. Very low risk corresponds to the unshaded areas of the map. There are two surface water flow routes that traverse the site and eventually discharge south into the River Dove. There is a low to high risk surface water flow route recorded along the southern portion of the site, originating from offsite highway exceedance flows from the north west, flowing in a south-easterly orientation. There is also a low to medium risk surface water flow route, originating from offsite highway exceedance flows to the north east, passing through the site in a southern orientation. There is an area of low to high risk surface water ponding in the south eastern portion of the site, corresponding with a localised low point and where the two overland flow routes converge before flowing south into the River Dove.

Very low risk refers to land having less than a 1 in 1,000 annual exceedance probability of flooding (0.1% AEP). Low risk refers to land having between a 1 in 1,000 and 1 in 100 annual exceedance probability of flooding (0.1% - 1% AEP). Medium risk refers to land having between a 1 in 100 and 1 in 30 annual exceedance probability of flooding (1% - 3.33% AEP). High risk refers to land having a greater than 1 in 30 annual exceedance probability of flooding (>3.33% AEP).

Surface water flood depths for extreme rainfall events between the 1 in 100 and 1 in 1000 year return period generally range between from 300-900 mm, with the flow route entering and existing the site from the north and south respectively only at risk of depths between 0-300 mm. Surface water ponding depths in the south-eastern corner of the site have the potential to be greater than 900 mm. An overlay of the surface water flood depth map onto the topographic survey shows that the maximum surface water flood depth in the south-east is approximately 1.1 m (Appendix 9).

The Environment Agency surface water modelling does not take into consideration the presence of the existing culvert within the site that connects to the River Dove, which currently allows surface water to discharge from the site. Therefore, the surface water ponding shown on the Environment Agency flood map is not representative of actual conditions.

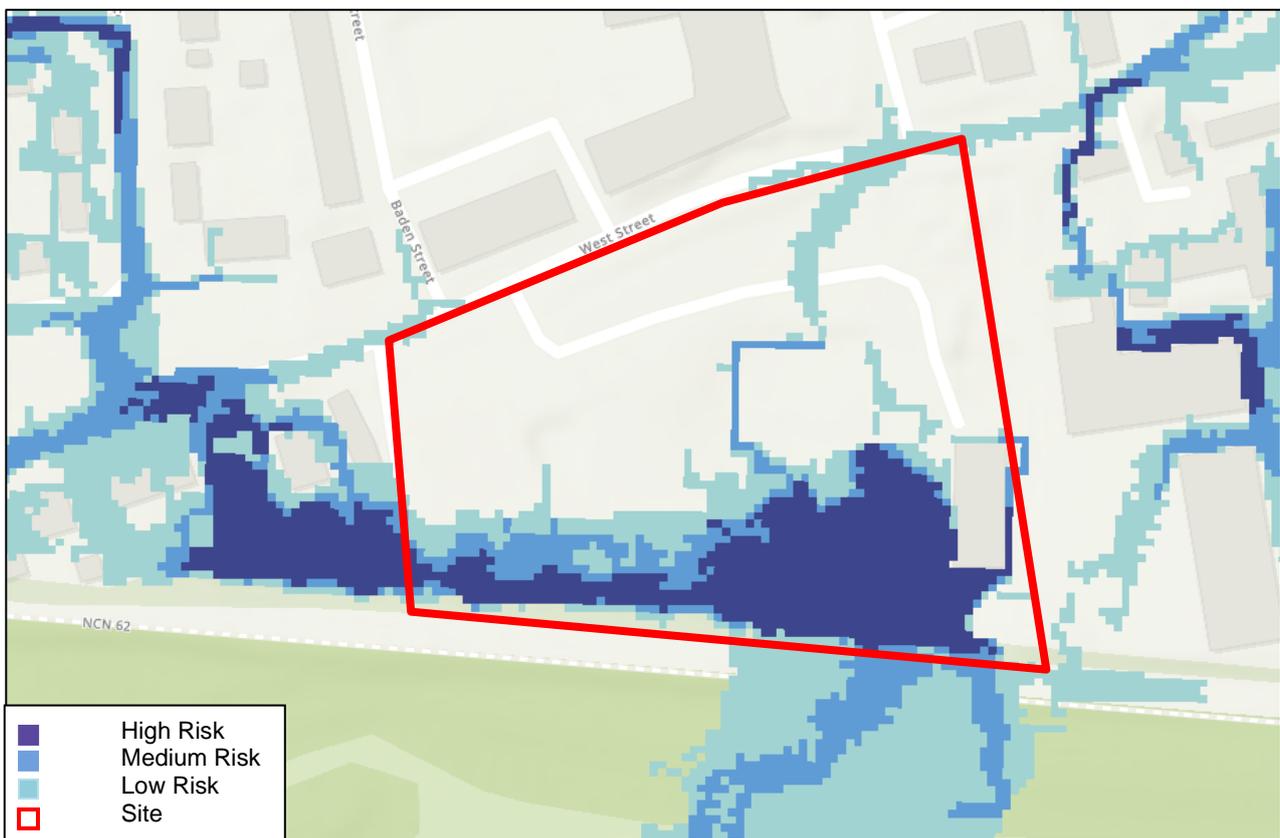


Figure 2: Environment Agency – Risk of surface water flooding map

2.1.3 Reservoir

The Environment Agency reservoir flood risk map (Figure 3 and Appendix 4) shows the whole site to lie outside of the maximum extent of flooding from reservoirs, even when there is flooding from rivers.



Figure 3: Environment Agency – Risk of reservoir flooding map

2.1.4 Groundwater

Groundwater is a potential flood risk to areas which are low lying and on permeable ground or, occasionally, to areas of higher ground in the vicinity of springs. There is no public record of any flood risk to the site associated with groundwater.

2.1.5 Sewerage

The surrounding public sewer network is owned and maintained by Yorkshire Water. There is no public record of any flood risk to the site associated with these sewers.

2.2 Historic Flooding

DEFRA online mapping records the site to be outside the historical flood outline (Appendix 6).

2.3 Residual flood risk

The site is not at risk of fluvial flooding or reservoir flooding.

There is a low to high risk surface water flow route recorded along the southern boundary and a low risk flow route along the central portion of the site originating from highway exceedance flows north-east and north-west of the site. At the point where the two flow routes meet at the site low point there is an area at low to high risk of surface water ponding. The Environment Agency surface water modelling does not take into consideration the presence of the existing culvert within the site that connects to the River Dove, which currently allows surface water to discharge from the site. Therefore, the surface water ponding shown on the Environment Agency flood map is not representative of actual conditions.

These risks are not a development constraint and will be managed on the site within the surface water drainage strategy and by the mitigation measures in Section 2.4.

2.4 Flood Mitigation Measures

The ground levels on the site will be altered to raise depressions in the south-east and match the rest of the site. The raising of levels and presence of surface water drainage features will remove any surface water ponding and will lower the modelled flood depth.

Onsite surface water flow routes should be maintained or diverted through the site. The existing culvert/ surface water drain within the site boundary, connecting to the River Dove, should also be maintained.

3.0 DRAINAGE STRATEGY

3.1 Existing drainage

Yorkshire Water sewer records (Appendix 7) show a 225 mm public surface water sewer and a 300 mm public foul water sewer in West Street north of the site. There are two parallel public combined sewers (450 mm and 750 mm) located south of the Trans Pennine Trail, to the south of the site. There is also a 225 mm public surface water sewer recorded to the west of the site passing through a private garden before outfalling into the River Dove.

A CCTV survey has been conducted by EDS (Appendix 8). Multiple 100 mm, 150 mm and 225 mm surface water drains are recorded in the central and eastern portion of the site which ultimately connect to a 300 mm x 300 mm culvert/surface water drain within the southern portion of the site, ultimately discharging to the River Dove. Displaced joints, sedimentation and root ingress were recorded within the existing drains.

3.2 Yorkshire Water consultation

Pre-planning advice has been received from Yorkshire Water (Appendix 7); letter reference Z004470 dated 13th September 2023. The main points of the advice are summarised below.

Foul water:

- Development should take place with separate systems for foul and surface water drainage.
- Foul water domestic waste can discharge to the 450 mm public combined sewer to the south of the site.

Surface water:

- Following the surface water disposal hierarchy, surface water should look to drain either to soakaway or watercourse in the first instance.
- It is understood the River Dove is located to the south of the site. This appears to be the obvious place for surface water disposal.

- If other methods of surface water disposal are not viable, and subject to providing satisfactory evidence as to why they have been discounted, surface water discharge to the public sewer will be restricted to the brownfield rate with 30% betterment.
- Yorkshire Water requires to see existing and proposed; drainage layouts, impermeable areas, calculations and discharge rates

3.3 Barnsley Metropolitan Borough Council consultation

A request for maximum allowable surface water discharge to the River Dove via the existing culvert was sent to Barnsley Metropolitan Borough Council (2nd November 2023).

A response received on 21st November states that the LLFA usually use the greenfield rate of 5 l/s/ha. Following further correspondence with the LLFA to establish an appropriate surface water discharge rate, given the historic brownfield nature of the site, an additional response was received on 30th November stating that the LLFA will allow an equivalent historic brownfield rate allowance of 10 l/s/ha on this occasion (Appendix 5).

3.4 Ground conditions

The British Geological Survey maps record bedrock geology in the south-western and north-eastern portion of the site as mudstone, siltstone and sandstone of the Pennine middle Coal Measures Formation. Bedrock geology for the remainder of the site (central and eastern) is recorded as sandstone of the Kent's Rock Formation. There are no online records of the superficial deposits.

A historical borehole log (Ref: SE30SE136) located approximately 50 m north of the site recorded 1m topsoil and 5m sandstone with mudstone, overlying layers of solid and broken ground. Groundwater was encountered at 5.1 m below ground level.

3.5 Brownfield calculations

Based on the 0.76 ha impermeable area of site in June 2019 (Appendix 9), a brownfield runoff rate with 30% betterment equates to:

$$\begin{aligned} Q &= 2.78 \times 50\text{mm/hr} \times 0.76 \text{ ha} = 105.64 \text{ l/s} \\ &= 0.7 \times 105.64 \text{ l/s} = \mathbf{73.95 \text{ l/s}} \end{aligned}$$

Based on the historic brownfield rate allowance stipulated by the LLFA of 10 l/s/ha, the brownfield rate acceptable to the LLFA equates to 15 l/s (1.5 ha x 10 l/s/ha).

3.6 Drainage hierarchy

Surface water disposal should be in accordance with the drainage hierarchy in Building Regulations Part H⁴ and Planning Practice Guidance 'Reducing the causes and impacts of flooding', paragraph 80 reference ID 7-080-20150323. Disposal via SuDS methods should be considered as the first option. Disposal to the public sewer should be considered only when SuDS methods and disposal to the watercourse are shown to be unsuitable.

3.6.1 Sustainable Drainage Systems (SuDS)

SuDS methods include water infiltration systems such as soakaways, basins and filter strips, together with swales, pervious pavements, detention basins, ponds and other wetland solutions. The various methods are considered in detail in The SuDS Manual (CIRIA C753).

Infiltration type SuDS such as soakaways will not be possible due to the expected presence of impermeable ground conditions (siltstone and mudstone) and steep topography.

Source control SuDS features such rain gardens (bio-retention areas) may be suitable to incorporate into the site to provide water quality treatment and attenuation. Other SuDS methods may be applicable and their use is summarised in the appended SuDS checklist (Appendix 9).

3.6.2 Watercourse

The nearest watercourse is the River Dove (main river) located approximately 83 m south of the site. It is also noted that there is a culvert/drain connection from the southern portion of the site to the River Dove. Discharge to the Rive Dove may be viable utilising this existing connection subject to confirmation from the LLFA.

⁴https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/442889/BR_PDF_AD_H_2015.pdf

3.6.3 Public sewer

There is a 225 mm public surface water sewer recoded to the west of the site passing through a private garden before discharging into the River Dove. Discharge to the sewer is subject to approval from Yorkshire Water and will require a request for a new connection.

3.7 Proposals for surface water disposal

The final disposal strategy for surface water run-off requires detailed consideration and approval during the design phase of the project. The final design will need the approval of the relevant statutory bodies but will broadly follow these principles:

- Surface water disposal will be via gravity to the existing 300 mm x 300 mm culvert/surface water drain within the southern portion of the site, ultimately discharging to the River Dove. Discharge to watercourse is subject to approval from the LLFA.
- As stipulated by the LLFA, surface water discharge will be restricted to the historic brownfield rate allowance of 10 l/s/ha equating to 15 l/s.
- Attenuation storage will be provided for rainfall events up to the return period of 1 in 100 year plus 40% climate change. The total estimated storage volume 425 m³, subject to detailed design. Attenuation calculations are provided in Appendix 9.
- Source Control SuDS such as rain gardens (bio-retention areas) may be suitable to provide water treatment and attenuation.
- The surface water drainage system may be offered for adoption to a NAV (new appointments and variations).

3.8 Proposals for foul disposal

Foul effluent will discharge via gravity to the 450 mm public foul sewer south of the Trans Pennine Trail, south of the site.

The foul drainage system may be offered for adoption to a NAV.

3.9 Residual flood risk

There is a potential flood risk to site occupiers and to others from surface water runoff as a result of developing the site. The residual risk can be managed by the general flood mitigation measures outlined in Section 3.10.

3.10 Mitigation measures

The proposed surface water drainage system is designed to current best practice and to the standards laid out in the publication 'Design and Construction Guidance for foul and surface water sewers' and Building Regulations Part H 2015.

In the event of surface water exceedance during extreme rainfall events the site is laid out so that surface water runoff is directed away from houses, including those on neighbouring streets.

4.0 CONCLUSIONS

1. The site is within Flood Zone 1 and is not at risk of fluvial flooding or reservoir flooding.
2. There is a low to high risk surface water flow route recorded along the southern boundary and a low risk flow route along the central portion of the site originating from highway exceedance flows north-east and north-west of the site. At the point where the two flow routes meet at the site low point there is an area at low to high risk of surface water ponding which overflows into the River Dove south of the site.
3. Ground levels will be altered to raise depressions in the south-east to match the rest of the site. The raising of levels and presence of surface water drainage features will remove any surface water ponding and will lower the modelled flood depth.
4. The surface water flow routes within the site should be maintained or diverted through the site. The existing culvert/surface water drain within the site should also be maintained.
5. Infiltration type SuDS such as soakaways will not be possible due to the expected presence of impermeable ground conditions (siltstone and mudstone) and steep topography.
6. Surface water disposal will be via gravity to the existing 300 mm x 300 mm culvert/surface water drain within the southern portion of the site, ultimately discharging to the River Dove. Discharge to watercourse is subject to approval from the LLFA.
7. As stipulated by the LLFA, surface water discharge will be restricted to the historic brownfield rate allowance of 10 l/s/ha equating to 15 l/s.
8. Attenuation storage will be provided for rainfall events up to the return period of 1 in 100 year plus 40% climate change. The total estimated storage volume is 425 m³, subject to detailed design.
9. Source Control SuDS such as rain gardens (bio-retention areas) may be suitable to provide water treatment and attenuation.
10. Foul effluent will discharge via gravity to the 450 mm public foul sewer south of the Trans Pennine Trill, south of the site.
11. Both the surface and foul water drainage systems may be offered for adoption to a NAV.
12. The level of risk and safeguards available are considered appropriate to this class of development.

APPENDICES

APPENDIX 1



APPENDIX 2

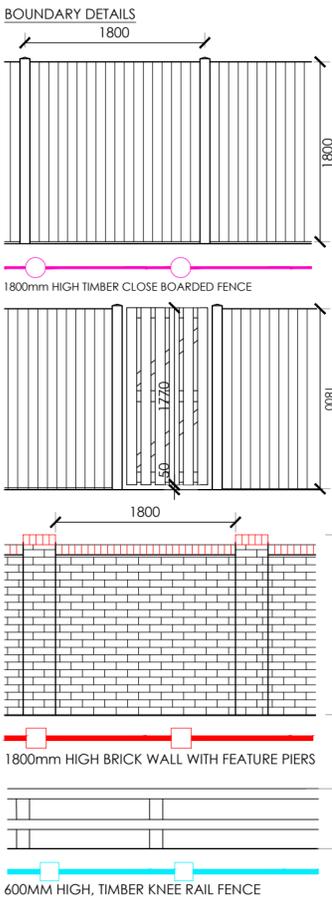
APPENDIX 3

WEST STREET, WORSBROUGH, BARNLSLEY

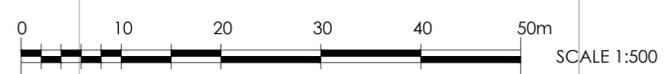
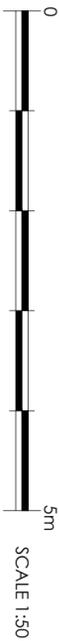
NOTES
 ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THE BUILDING REGULATIONS AND THE REQUIREMENTS OF THE LOCAL AUTHORITY.

THIS DRAWING IS BASED ON SURVEY DRAWING NO. HH/WS/101, PREPARED BY MS LAND & CONSTRUCTION LTD INFORMATION / DRAINAGE SURVEY DRAWING NO. LIC222-13P. IT IS SUBJECT TO CORRECTION OF BOUNDARIES / RIGHTS OF WAY / EASEMENTS AND CONSULTATION WITH THE LOCAL AUTHORITY, DESIGN TEAM AND PUBLIC UTILITIES, ETC.

- GENERAL KEY**
- ▲ PEDESTRIAN & VEHICULAR ENTRANCES
 - GATE
 - ★ AFFORDABLE
 - 8 BIN STORE
 - SITE BOUNDARY
 - EXISTING TREES / SHRUBS / HEDGES TO BE REMOVED - REFERENCE ARBORICULTURISTS DRAWINGS.
 - EXISTING TREES / SHRUBS / HEDGES TO BE RETAINED - REFERENCE ARBORICULTURISTS DRAWINGS.
 - ROOT PROTECTION ZONES - REFERENCE ARBORICULTURISTS DRAWINGS.
- BOUNDARY TREATMENTS**
- 1800mm HIGH BRICK WALL WITH FEATURE PIERS
 - 1800mm HIGH TIMBER CLOSE BOARDED FENCE
 - 600mm HIGH, TIMBER KNEE RAIL FENCE
 - RETAINING WALL TO S.E DETAILS
- GROUND TREATMENTS**
- TARMAC TO ESTATE ROADS, PAVEMENTS / FOOTPATH, PRIVATE DRIVES AND DRIVE - UNLESS OTHERWISE STATED
 - BRINDLE SETS TO MEWS COURTS / ACCESSWAYS AND DRIVES - UNLESS OTHERWISE STATED
 - TURFED AREAS
 - PAVING SLABS TO PATHS & PATIOS
 - LOW LEVEL SHRUBS REFERENCE LANDSCAPE ARCHITECTS DRAWINGS FOR SPECS.



PLOTS 01, 02, 20, 35, 36, 37, 38, 41, 42, 44 & 47, THE LOCKING MECHANISM SHOULD BE OPERABLE FROM BOTH SIDES OF THE GATE TO ENSURE THE AREA IS LEFT SECURE AT ALL TIMES.



A PLOTS 5 & 4 ALTERED TO SUIT WESTERN BOUNDARY AS CLIENT INSTRUCTIONS. JC 05-09-23

REV DESCRIPTION BY CHKD DATE

LOROC ARCHITECTS

25A PARK SQUARE WEST, LEEDS, LS1 2PW
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 W: www.loroc.co.uk

3RD FLOOR, 86 - 90 PAUL STREET, LONDON, EC2A 4NE
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CLIENT: HOOBER HOMES

PROJECT: WEST STREET, WORSBROUGH, BARNLSLEY

TITLE: PROPOSED SITE PLAN LAYOUT

DRAWING NO. 1724-101 REVISION A
 SCALE 1:500 @ A2 DATE AUG '23
 DRAWN BY BC CHECKED BY JC

- PURPOSE OF ISSUE
- PLANNING
 - BUILDING REGS
 - TENDER
 - COMMENT
 - INFORMATION
 - CONSTRUCTION

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APPENDIX 4

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
435876/403657

Created
6 Nov 2023 12:20

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

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 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>

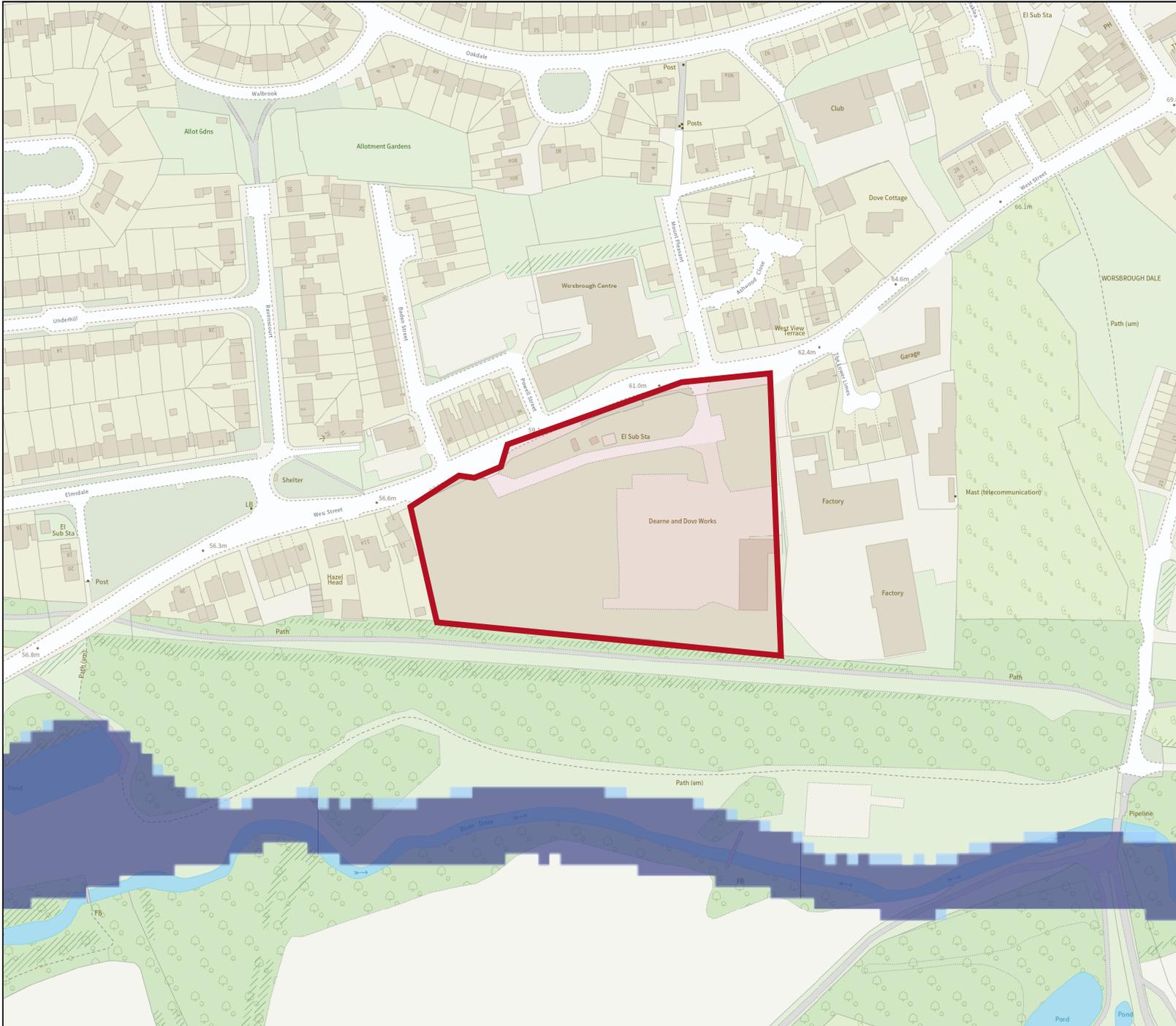
Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
435876/403657

Scale
1:2500

Created
6 Nov 2023 12:20



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



Extent of flooding

S70 5NU



Extent of flooding from rivers or the sea

- High
- Medium
- Low
- Very low

Extent of flooding



S70 5NU



Extent of flooding from surface water

- High
- Medium
- Low
- Very low

Low risk: depth

S70 5NU



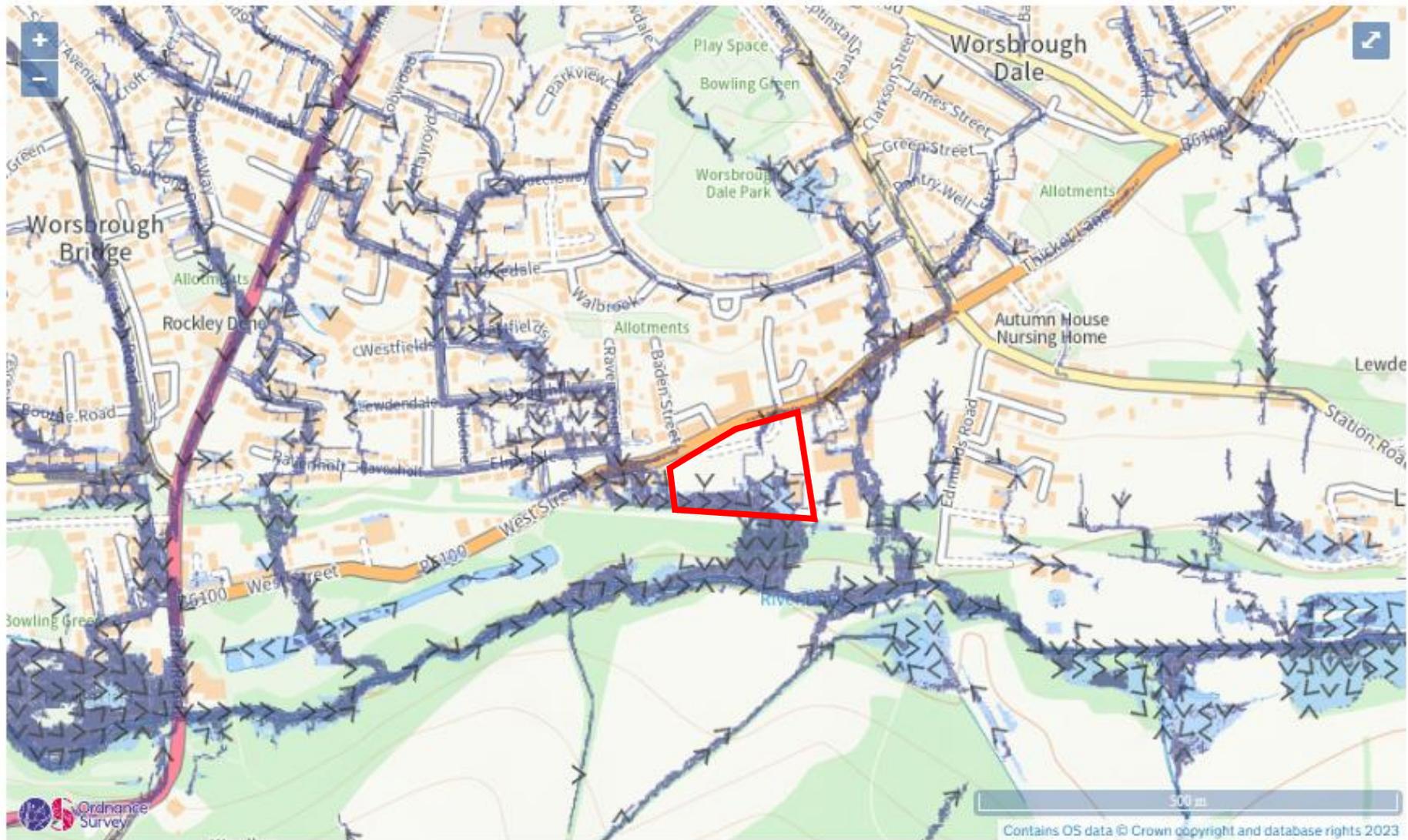
Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

- Over 900mm
- 300 to 900mm
- Below 300mm

Low risk: velocity

S70 5NU



Surface water flood risk: water velocity in a low risk scenario

Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow

Extent of flooding

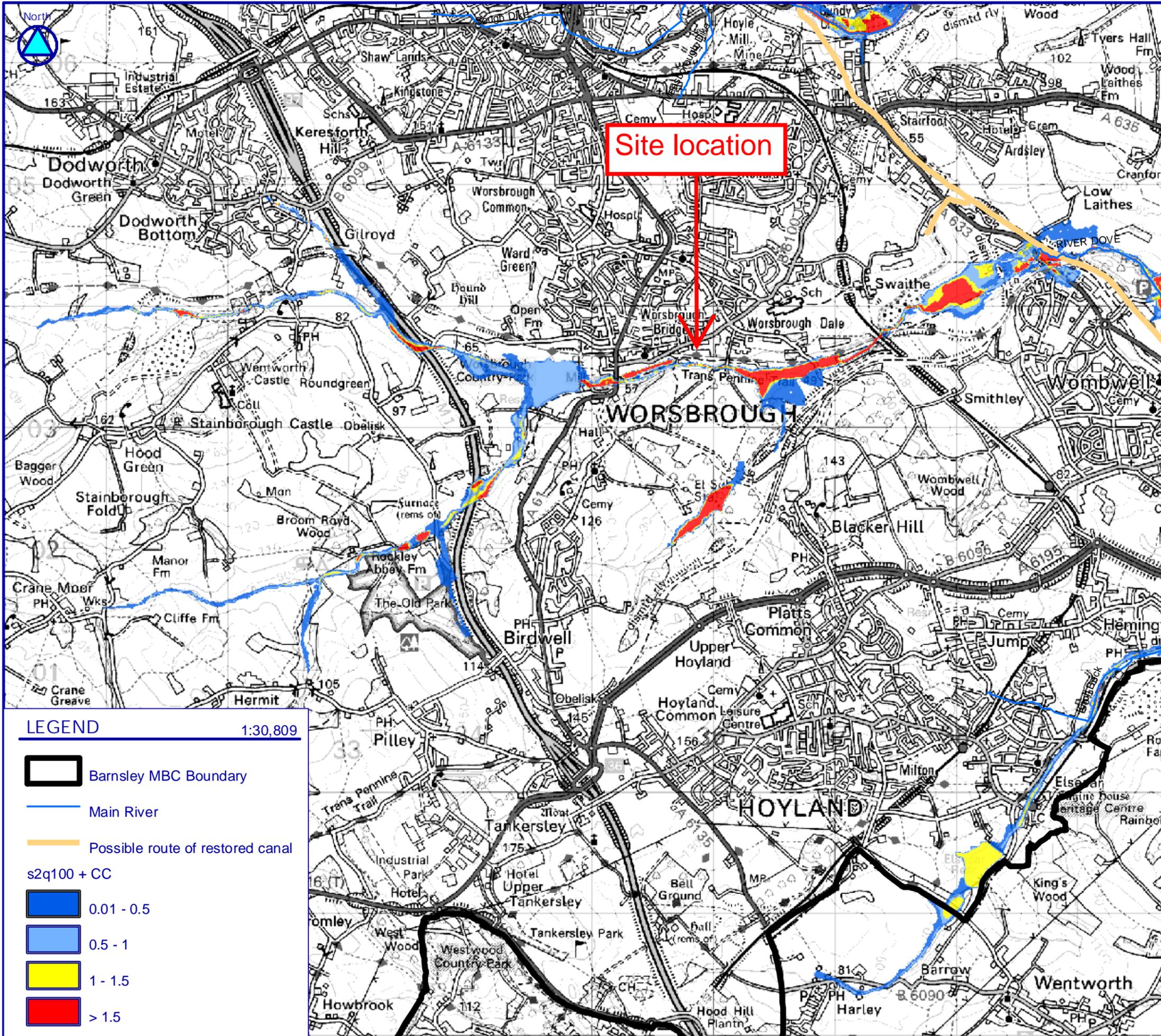
S70 5NU



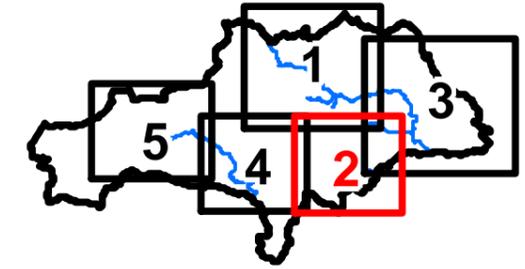
Maximum extent of flooding from reservoirs:

- when river levels are normal
- ▨ when there is also flooding from rivers

APPENDIX 5



KEYPLAN



Note:
This map shows the potential scale of flood inundation for a range of severe overtopping flood events and different standards of flood defence. They do not include the impact of a breach or failure of these defences.

Typical range of defence standards for the River Don and Deane is to protect up to a 1 in 30year (3%) return period.

s2 = 1 in 2year Standard of Defence
q100 = 1 in 100year or 1% probability flood event.
Climate Change scenario represents 20% increase of flood flow.

This map should be considered in support of the Environment Agency Flood Zone Maps to aid the Sequential and Exception Tests. It should not be considered in isolation without reference to the other SFRA Flood Risk Maps.

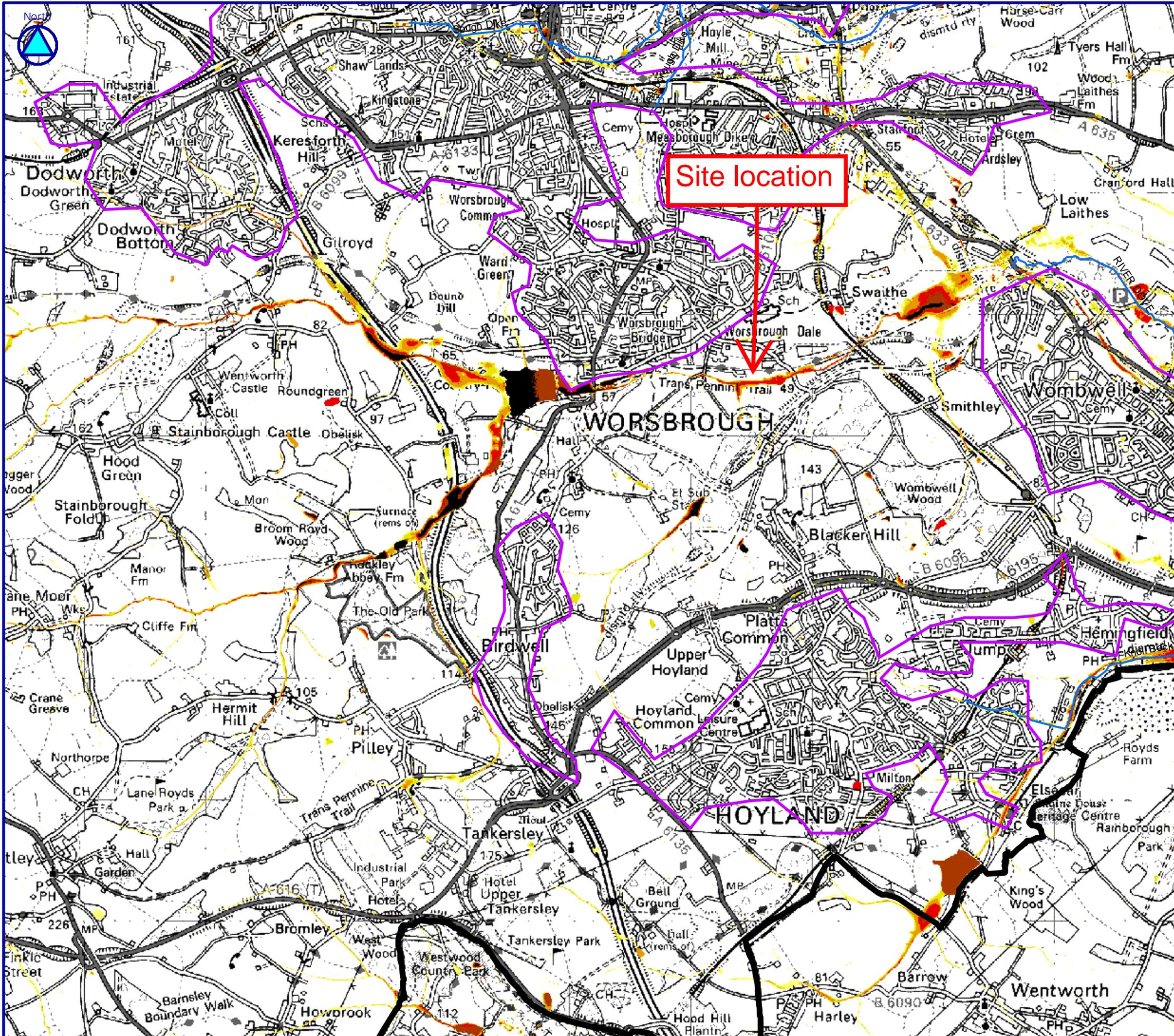
Please see the Section 6 of the SFRA for further details.

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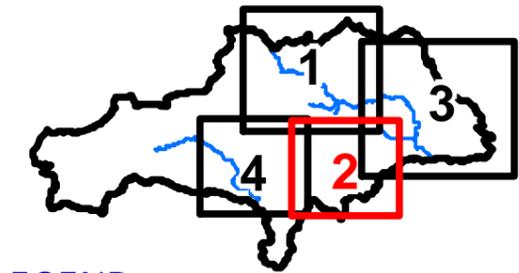


MAP H - 2

s2q100 + Climate Change

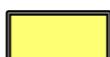


KEYPLAN



LEGEND

1:30,809

-  Barnsley MBC Boundary
-  Urban Areas
-  Main River
- Surface Water Flooding
- Flood Depth (m)
-  0.15 - 0.3
-  0.3 - 0.5
-  0.5 - 1
-  1 - 1.5
-  1 - 2
-  > 2

Note:
Please see Section 5.8 of the SFRA
for further details.

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MAP C - 2

PLUVIAL FLOODING CAUSED BY
100YEAR RAINSTORM

Jessica Stevenson-Steels

From: Grayson , Ian (SENIOR ENGINEER - ASSETS) <iangrayson@barnsley.gov.uk>
Sent: 30 November 2023 15:34
To: Chris Hodge
Subject: RE: 48404 RE: Land off West Street, Worsbrough

Hello Chris

Whilst I understand your issues, unfortunately we cannot allow discharge rates as high as you are requesting without further proof of flow rates from the previous development. However, on this occasion to try to help we are willing to allow an equivalent of the historic brownfield rate allowance of 10 l/s/ha. Please be aware this is a one-off decision and in no way sets a precedent for what BMBC will allow for future developments.

Thanks

From: Chris Hodge <chris.hodge@eastwoodce.com>
Sent: 30 November 2023 10:32
To: Grayson , Ian (SENIOR ENGINEER - ASSETS) <iangrayson@barnsley.gov.uk>
Cc: Jessica Stevenson-Steels <jessica.stevenson-steels@eastwoodce.com>; Taylor Holden <taylor.holden@hooberhomes.co.uk>
Subject: RE: 48404 RE: Land off West Street, Worsbrough

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Morning Ian,

Would you be available for a chat through this one. At 5 l/s/ha we are really struggling to get attenuation to work (also trying to avoid too larger pipes beneath highways). Given the site is brownfield, might there be some compromise to get the total rate nearer 15-20 l/s.

Greenfield works out about 7.5 l/s and the existing slab/building present contributes another 7 l/s or so - previously I would imagine the site to be discharging 70-100 l/s.

There is already a fair flow of water passing through the site in this culvert/drain.

Regards
Chris Hodge
Technical Director

Direct dial 01142554554
www.eastwoodce.com



Eastwood Consulting Engineers is a trading name of Eastwood and Partners (Consulting Engineers) Limited
Registered Office: St Andrew's House, 23 Kingfield Road, Sheffield, S11 9AS
Company No: 1835021, VAT Registration No: 738 2114 44

Web: www.eastwoodce.com
Tel: 0114 255 4554

From: Grayson , Ian (SENIOR ENGINEER - ASSETS) <iangrayson@barnsley.gov.uk>
Sent: 21 November 2023 12:54
To: Chris Hodge <chris.hodge@eastwoodce.com>
Subject: RE: 48404 RE: Land off West Street, Worsbrough

Hello Chris

We usually use greenfield rates (5 litres(l) second(s) / hectare (Ha).

Thanks

From: Chris Hodge <chris.hodge@eastwoodce.com>
Sent: 02 November 2023 12:22
To: Atkins , Wayne (SENIOR ENGINEER) <WayneAtkins@barnsley.gov.uk>
Cc: Grayson , Ian (SENIOR ENGINEER - ASSETS) <iangrayson@barnsley.gov.uk>; HighwayDrainage <HighwayDrainage@barnsley.gov.uk>; Keith Emmett <keith.emmett@eastwoodce.com>; Jessica Stevenson-Steels <jessica.stevenson-steels@eastwoodce.com>
Subject: 48404 RE: Land off West Street, Worsbrough

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Afternoon All,

We are currently looking to work up feasibility designs for the above-mentioned scheme and wondered if anyone was available to talk through the proposed strategy and likely requirements. We are keen to agree discharge rates for the site based on connection to the 'culvert' that flows into the River Dove.

There have been numerous surveys carried out and attach the latest – the primary flow appears to come from the east and almost seems to be taking ground water flows of some form which we will make allowance to intercept and re-route.

The site was obviously previously developed with a likely high flow from site – unfortunately we have not got a pre-demo survey proving all drained areas and there is just a slab that remains in situ. We obviously would like to limit the amount of attenuation required to also limit large structures/tanks which may cause an issue to highway adoptions.

If we could have a chat through this to agree a sensible way forward so we can progress designs it would be appreciated.

Regards
Chris Hodge
Technical Director

Direct dial 01142554554
www.eastwoodce.com

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Tel: 0114 255 4554

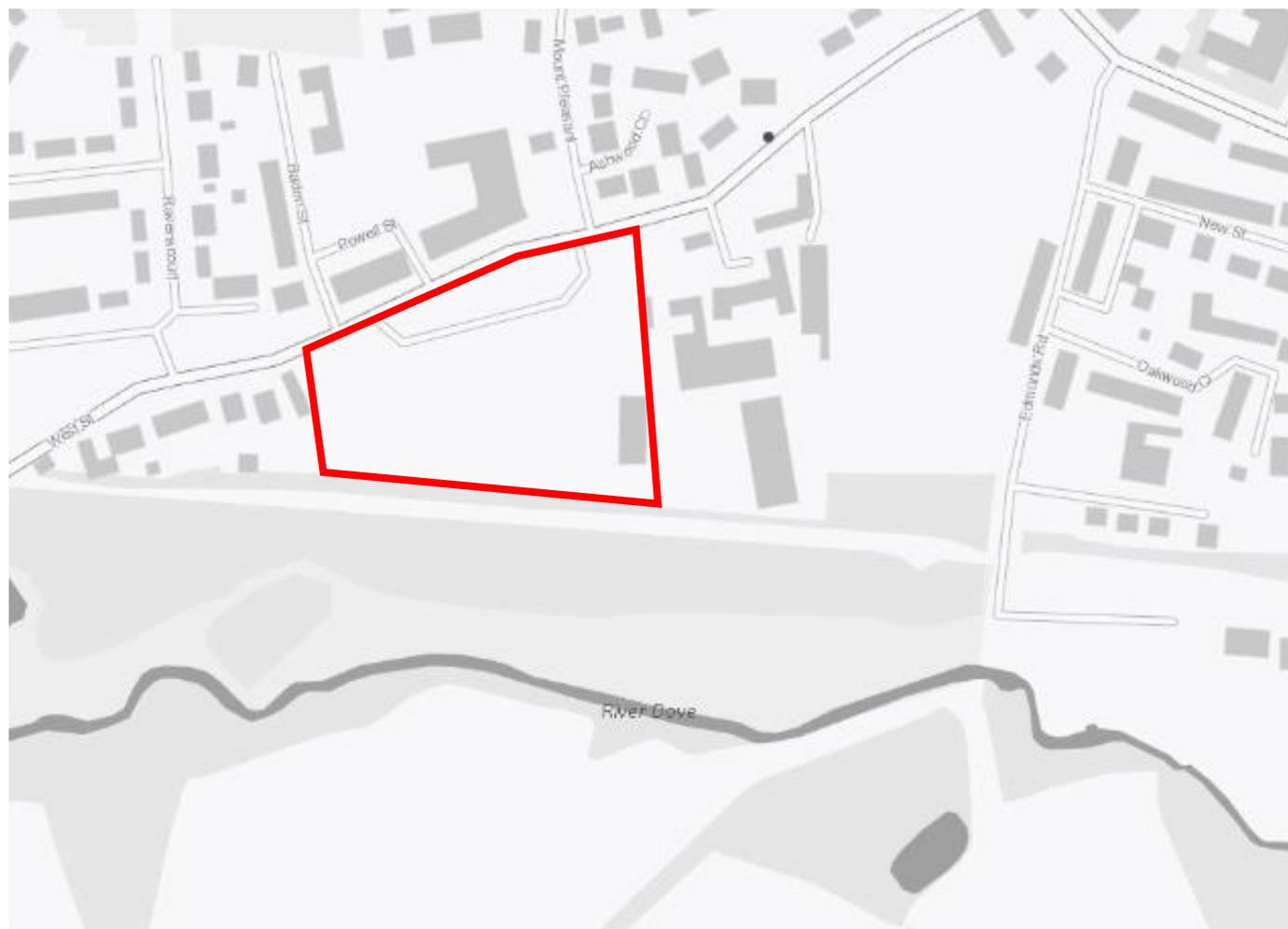
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APPENDIX 6

DEFRA: Historic flood map



Layer List

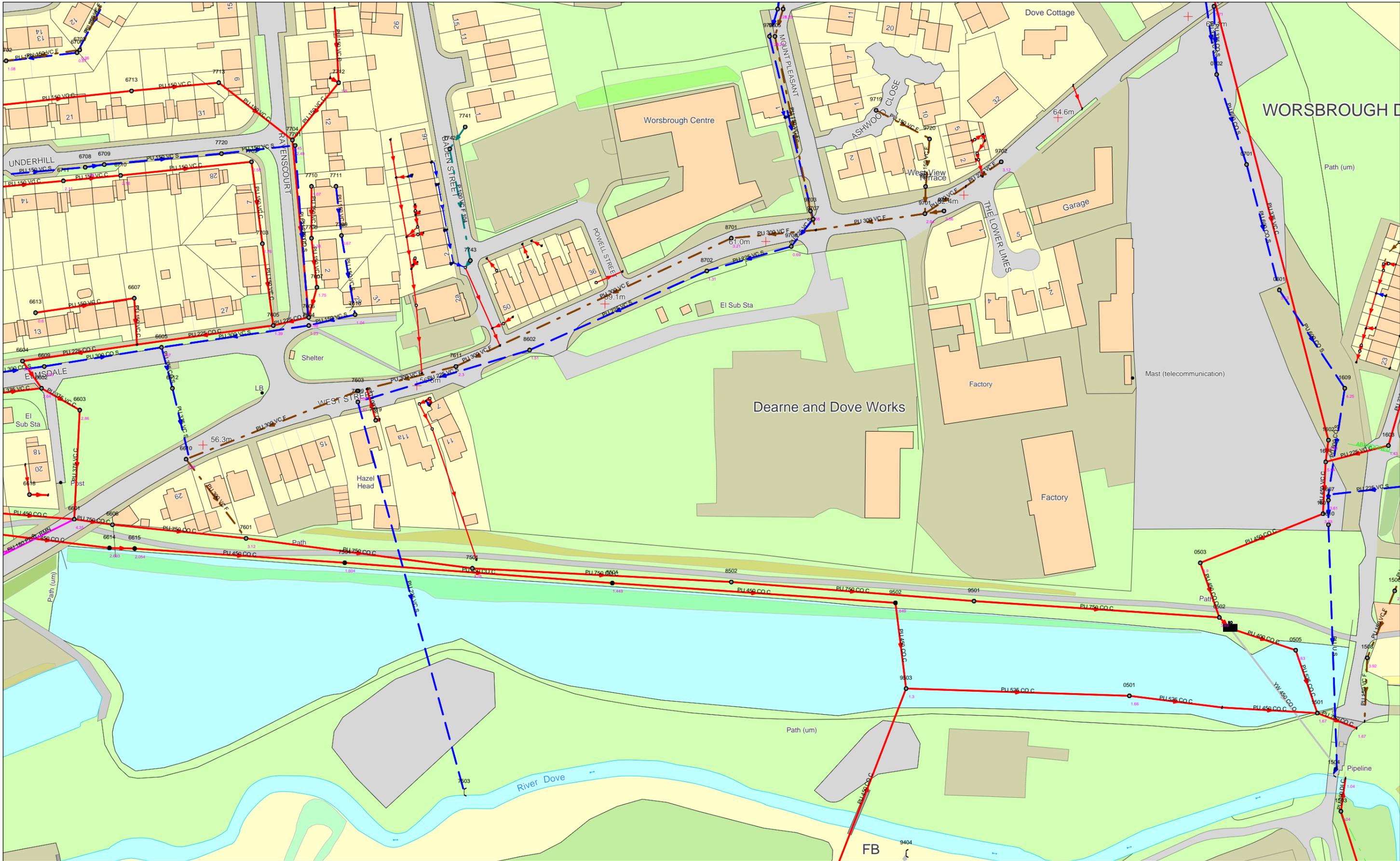
Operational layers

HistoricFloodMap

Historic_Flood_Map



APPENDIX 7



UPN: Undefined
 Originator: G Mullaney, ,

435714 : 403543



Map Name : SE3503SE
 Yorkshire Water,
 PO Box 500,
 Halifax Road,
 Bradford BD6 2LZ
 Contact Name :
 G Mullaney
 Contact Tel :

Title
 Notes
 (Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432

Partial Key
 Foul Sewer = F
 Combined Sewer = C
 Surface Water Sewer = SW
 Trade Sewer = TD
 Partially Separate = PS
 Date Req : 13/09/2023, 11:14:55
 Source : Sewer Network Enquiry

This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
 Date Gen : 13/09/2023, 11:15:22



YorkshireWater

Eastwood Consulting Engineers
St Andrews House
23 Kingfield Road
Sheffield
S11 9AS
jessica.stevenson-steels@eastwoodce.com

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax:

Email:
technical.sewerage@yorkshirewater.co.uk

Your Ref:
Our Ref: Z004470

For telephone enquiries ring:
George Mullaney on 0345 120 8482

13th September 2023

Dear Ms Stevenson-Steels,

West Street, Barnsley, S70 5NU - Pre-planning Enquiry V240540

Thank you for your recent enquiry. Our charge of £187.00 plus VAT will be added to your account with us, reference EPL039. You will receive an invoice for your account in due course.

Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records. The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste can discharge to the 450 mm diameter public combined sewer recorded to the south of the site.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2010. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.





Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

It is understood that a watercourse (River Dove) is located to the south of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details.

If other methods of surface water disposal are not viable and subject to providing satisfactory evidence as to why they have been discounted, curtilage surface water discharges to the public sewer will be restricted to the level of run-off - i.e. same rate of discharge - to that from the existing use of the site less a 30% reduction in the existing discharge. Any discharge of surface water from the site should discharge to similar points of connection to that of the existing use of the site. You will need to demonstrate positive drainage, based on a 1 in 1 year storm, to the public sewer to Yorkshire Water by means of investigation and calculation carried out at your expense.

To do this, Yorkshire Water requires to see existing and proposed drainage layouts with pipe sizes, gradients, gullies, downpipes and connection points, measured impermeable areas of the present and proposed use of the site, along with the calculations that show the existing and proposed discharge rate from the site to the public sewer.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply online or obtain an application form from our website (www.yorkshirewater.com/developers/sewerage/sewerage-connections/) or by telephoning 0345 120 84 82.

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network or interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for Code for Adoption under Section 104 of the Water Industry



YorkshireWater

Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the Code for Adoption, pursuant to an agreement under Section 104 of the Water Industry Act 1991. We are happy to offer pre-development technical advice on any prospective sites that you would like to put forward for adoption, prior to submission of your adoption application.

An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Sewer Adoption, Diversion and Requisition (telephone 0345 120 84 82) or email technical.sewerage@yorkshirewater.co.uk or visit - <https://www.yorkshirewater.com/developers/sewerage/sewer-adoptions/> for further information.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

George Mullaney
Development Services Technician

APPENDIX 8



DRAINAGE INVESTIGATION REPORT

CLIENT HOOBER HOMES LTD.

SITE Land off West Street
Worsbrough

DATE 27/09/2023 JOB No. 8425

- **Comprehensive Site Surveys**
- **Drainage Rehabilitation**
- **Pipeline and Ancillary Installation**
- **Maintenance Programme
Appraisal & implementation**

LIBERTY STEEL MILLS, SHEFFIELD RD, S60 1BN
Telephone 0845 2300 939
email: cctv@eds.uk.net www.eds.uk.net

environmental
drainage solutions ltd

GENERAL SITE PHOTOS

JOB No.	8425	SHEET 1 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES		SITE	OFF WEST STREET WORSBROUGH

GP1	
REMARKS	EDS3
GP2	
REMARKS	EDS3

GENERAL SITE PHOTOS

JOB No.	8425	SHEET 2 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES		SITE	OFF WEST STREET WORSBROUGH

GP3	
REMARKS	EDS3
GP4	
REMARKS	300MM WIDE CHANNEL RUNNING LENGTH OF CONCRETE SLAB.

GENERAL SITE PHOTOS

JOB No.	8425	SHEET	3 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES			SITE	OFF WEST STREET WORSBROUGH

GP5	
REMARKS	STANDING WATER ADJACENT TO CONCRETE SLAB
GP6	
REMARKS	STANDING WATER ADJACENT TO CONCRETE SLAB

GENERAL SITE PHOTOS

JOB No.	8425	SHEET 4 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES		SITE	OFF WEST STREET WORSBROUGH

GP7	
REMARKS	OUTFALL PRIOR TO DIGGING OUT
GP8	
REMARKS	OUTFALL LOCATION PRIOR TO DIGGING OUT

GENERAL SITE PHOTOS

JOB No.	8425	SHEET 5 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES		SITE	OFF WEST STREET WORSBROUGH

GP9	
REMARKS	RIVER DOVE U/S OF FOUL PIPE BRIDGE
GP10	
REMARKS	RIVER DOVE U/S OF FOUL PIPE BRIDGE

GENERAL SITE PHOTOS

JOB No.	8425	SHEET	6 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES			SITE	OFF WEST STREET WORSBROUGH

GP11	
REMARKS	OUTFALL TO RIVER DOVE D/S OF EDS3, POSITIVE DYE TEST.
GP12	
REMARKS	FOUL PIPE BRIDGE OVER RIVER DOVE

GENERAL SITE PHOTOS

JOB No.	8425	SHEET 7 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES		SITE	OFF WEST STREET WORSBROUGH

GP13	
REMARKS	OUTFALL
GP14	
REMARKS	VIEW U/S OF OUTFALL

GENERAL SITE PHOTOS

JOB No.	8425	SHEET 8 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES		SITE	OFF WEST STREET WORSBROUGH

GP15	
REMARKS	OUTFALL
GP16	
REMARKS	OUTFALL LOCATION

GENERAL SITE PHOTOS

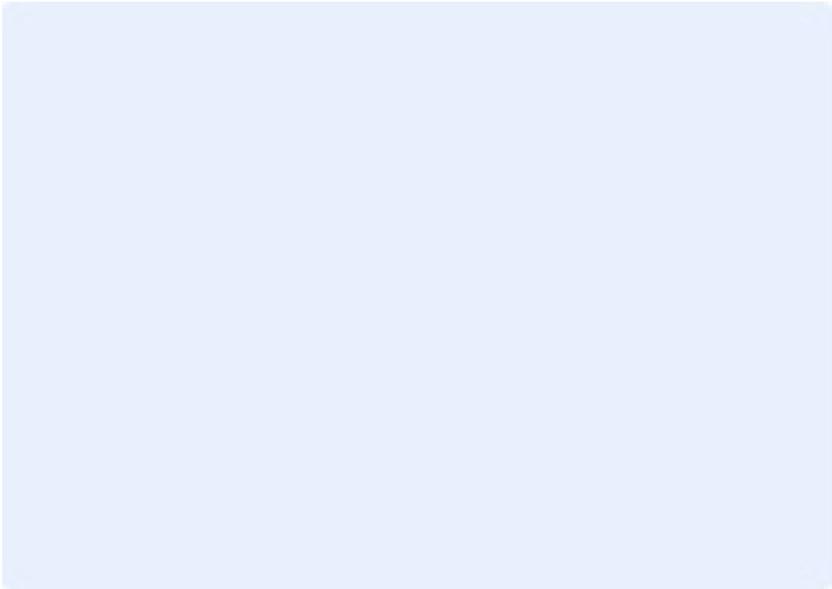
JOB No.	8425	SHEET 9 OF 10	DATE	27/09/23
CLIENT	HOOBER HOMES		SITE	OFF WEST STREET WORSBROUGH

GP17	
REMARKS	FMH1
GP18	
REMARKS	FMH2

GENERAL SITE PHOTOS

JOB No. 8425 **SHEET** 10 OF 10 **DATE** 27/09/23

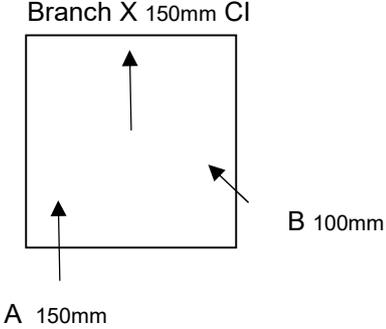
CLIENT HOOBER HOMES **SITE** OFF WEST STREET
WORSBROUGH

GP19	
REMARKS	FMH3
GP20	
REMARKS	

MANHOLE RECORD CARD

JOB No. 8245 **SHEET 1 OF 5** **DATE** 27/09/23

CLIENT HOOBER HOMES **SITE** OFF WEST STREET WORSBROUGH

NODE REF	EDS1	
SURVEY DATE		
NODE TYPE	MH	
STATUS	PR	
FUNCTION	SW	
INVERT (M)	1.6M	
CONSTRUCTION	BR	

REMARKS (Photos etc)
 BR A 0.74M TO INVERT
 BR B 0.5M TO INVERT

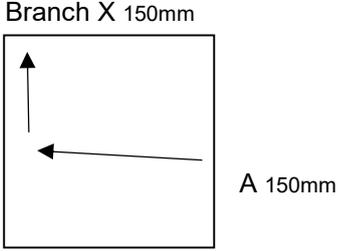


MH – MANHOLE, PPIC – POLYPROPYLENE INSPECTION CHAMBER, PU – PUBLIC, PR – PRIVATE, F – FOUL, SW – SURFACE WATER, C – COMBINED, BR – BRICK, PCC – PRE-CAST CONCRETE,

MANHOLE RECORD CARD

JOB No. 8245 **SHEET 2 OF 5** **DATE** 27/09/23

CLIENT HOOBER HOMES **SITE** OFF WEST STREET WORSBROUGH

NODE REF	EDS2	
SURVEY DATE		
NODE TYPE	MH	
STATUS	PR	
FUNCTION	SW	
INVERT (M)	1.33M	
CONSTRUCTION	BR/PCC	

REMARKS
(Photos etc)

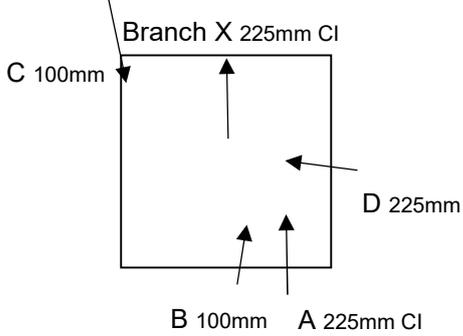


MH – MANHOLE, PPIC – POLYPROPYLENE INSPECTION CHAMBER, PU – PUBLIC, PR – PRIVATE, F – FOUL, SW – SURFACE WATER, C – COMBINED, BR – BRICK, PCC – PRE-CAST CONCRETE,

MANHOLE RECORD CARD

JOB No. 8245 **SHEET** 3 OF 5 **DATE** 27/09/23

CLIENT HOOBER HOMES **SITE** OFF WEST STREET WORSBROUGH

NODE REF	EDS3	
SURVEY DATE		
NODE TYPE	MH	
STATUS	PR	
FUNCTION	SW	
INVERT (M)	2.9M	
CONSTRUCTION	BR	

REMARKS (Photos etc)
 CHAMBER ABOVE GROUND LEVEL, 3.35M TO BASE.
 BR C THROUGH HOLE IN MH WALL (DETAIL PHOTO) RIBBED PIPE WITH RESTRICTION INTO CHAMBER

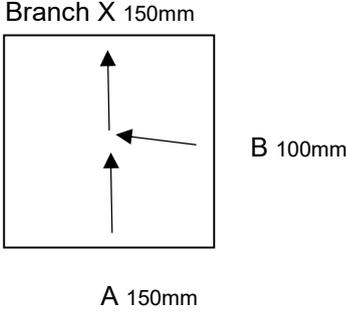


MH – MANHOLE, PPIC – POLYPROPYLENE INSPECTION CHAMBER, PU – PUBLIC, PR – PRIVATE, F – FOUL, SW – SURFACE WATER, C – COMBINED, BR – BRICK, PCC – PRE-CAST CONCRETE,

MANHOLE RECORD CARD

JOB No. 8245 **SHEET** 4 OF 5 **DATE** 27/09/23

CLIENT HOOBER HOMES **SITE** OFF WEST STREET WORSBROUGH

NODE REF	EDS4	
SURVEY DATE		
NODE TYPE	MH	
STATUS	PR	
FUNCTION	SW	
INVERT (M)	0.7M	
CONSTRUCTION	BR	

REMARKS
(Photos etc) SLOWLY FLOWING WATER IN CHAMBER, WATER SAMPLE TAKEN FROM EDS4 29/9/23 08:30.

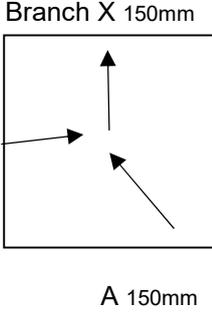


MH – MANHOLE, PPIC – POLYPROPYLENE INSPECTION CHAMBER, PU – PUBLIC, PR – PRIVATE, F – FOUL, SW – SURFACE WATER, C – COMBINED, BR – BRICK, PCC – PRE-CAST CONCRETE,

MANHOLE RECORD CARD

JOB No. 8245 **SHEET 5 OF 5** **DATE** 27/09/23

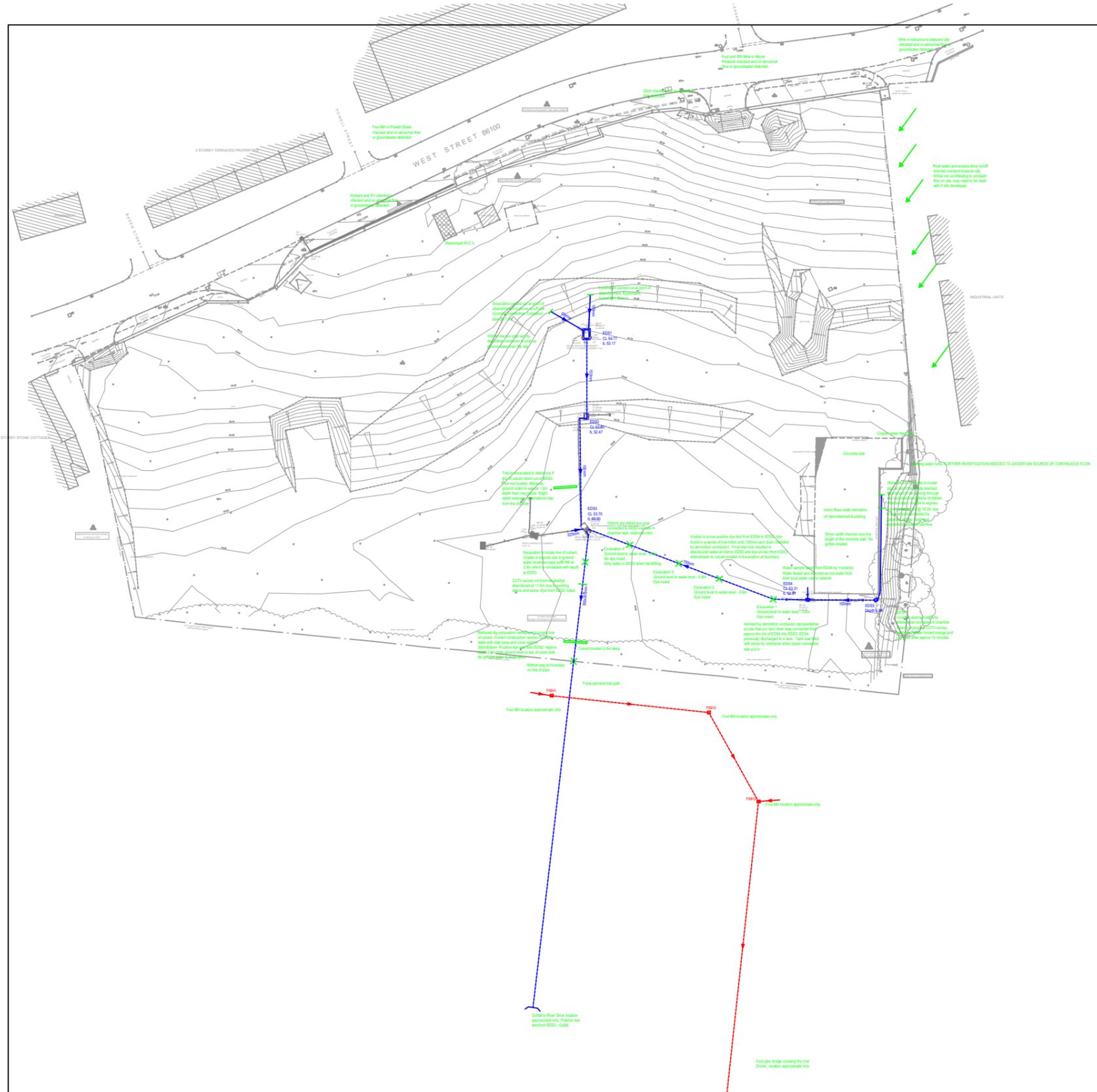
CLIENT HOOBER HOMES **SITE** OFF WEST STREET WORSBROUGH

NODE REF	EDS5	
SURVEY DATE		
NODE TYPE	MH	
STATUS	PR	
FUNCTION	SW	
INVERT (M)	0.94M	
CONSTRUCTION	BR	

REMARKS
(Photos etc)



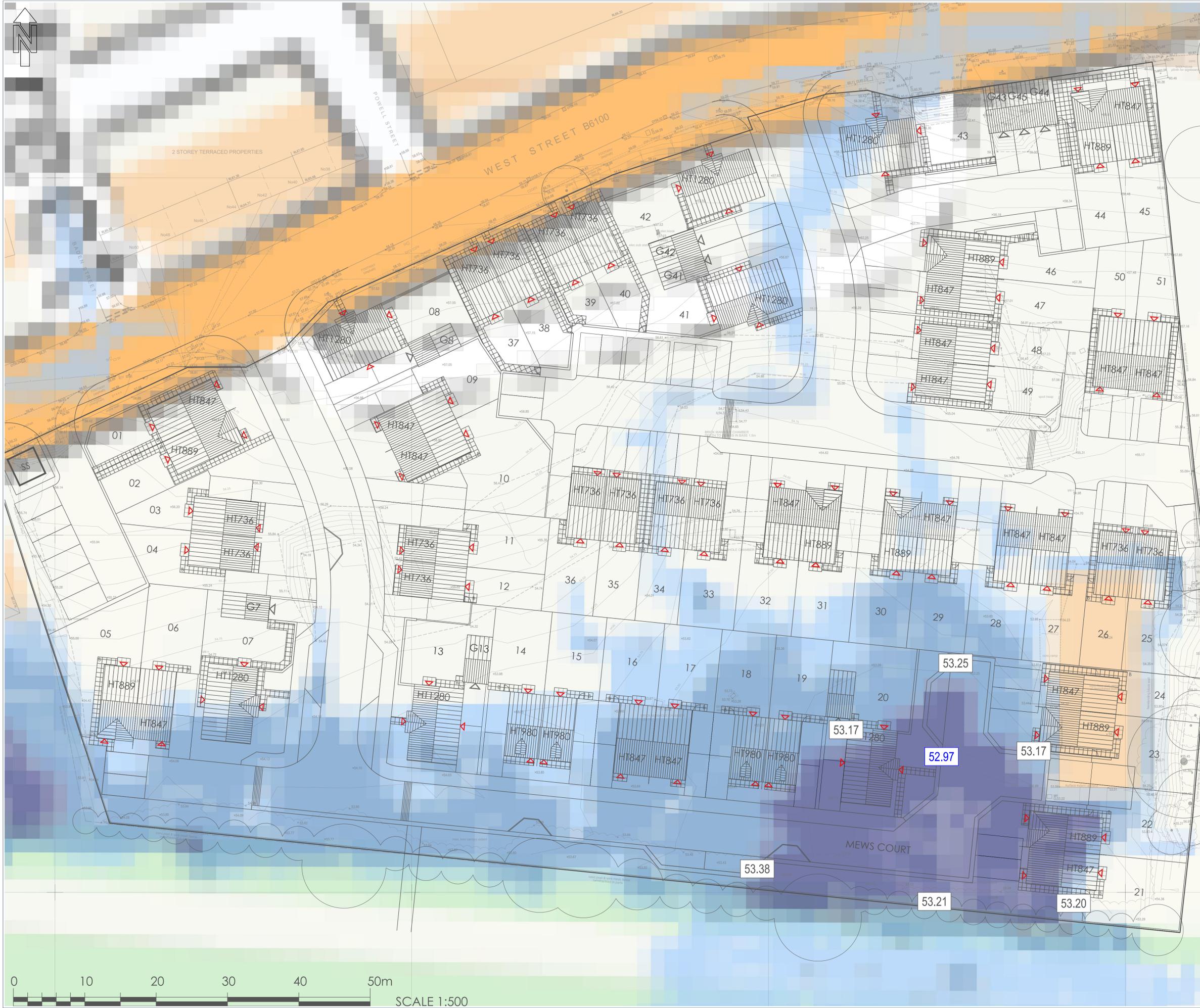
MH – MANHOLE, PPIC – POLYPROPYLENE INSPECTION CHAMBER, PU – PUBLIC, PR – PRIVATE, F – FOUL, SW – SURFACE WATER, C – COMBINED, BR – BRICK, PCC – PRE-CAST CONCRETE,



NOTES:
 Manhole locations and cover levels from topographical survey supplied. Otherwise, locations approximate.
 Where sewer/drain lines are shown dashed, connectivity established by flow, dye or sound testing. In these cases, connectivity is notional only as buried chambers or pipe defects may exist that may produce inaccurate findings. We always recommend CCTV surveys be completed wherever possible.
 Where survey undertaken due to suspected subsidence, then drawing and report to be read in conjunction with separate subsidence notes.
 During investigation works, demolition contractor operative was on site, providing useful information regarding temporary drainage installed to facilitate demolition operations.

 Liberty Steels Mills Sheffield Rd Rotherham S60 1BN Tel 0845 2300 939 Fax 0845 2300 949 email ops@eds.uk.net Web www.eds.uk.net	Client	Title	Drawn	Checked	LEGEND Foul Drain/Sewer Surface Water Drain/Sewer Watercourse/culvert Combined Drain/Sewer Manhole (Colour denotes use) Gully (Colour denotes use) Rainwater Pipe / Gully Soil Vent Pipe EDS1 G RWP RWG SVP
	HOOBER HOMES LTD	LAND OFF WEST STREET WORSBROUGH	KB	GEC	
	Date	27/09/23	Scale	NTS	
		Drawing No.	EDS/EAC/8425/01		

APPENDIX 9



High Risk
Medium Risk
Low Risk

XX.XX Elevation on the 900 mm surface water flood depth boundary

XX.XX Minimum elevation within the >900 mm surface water flood depth boundary

P01	First issue.	KBE	CH	02.11.2023
REV	DESCRIPTION	SIG	CHK	DATE

HOOPER HOMES

WEST STREET, WORSBROUGH,
BARNSELY

SURFACE WATER FLOOD OVERLAY

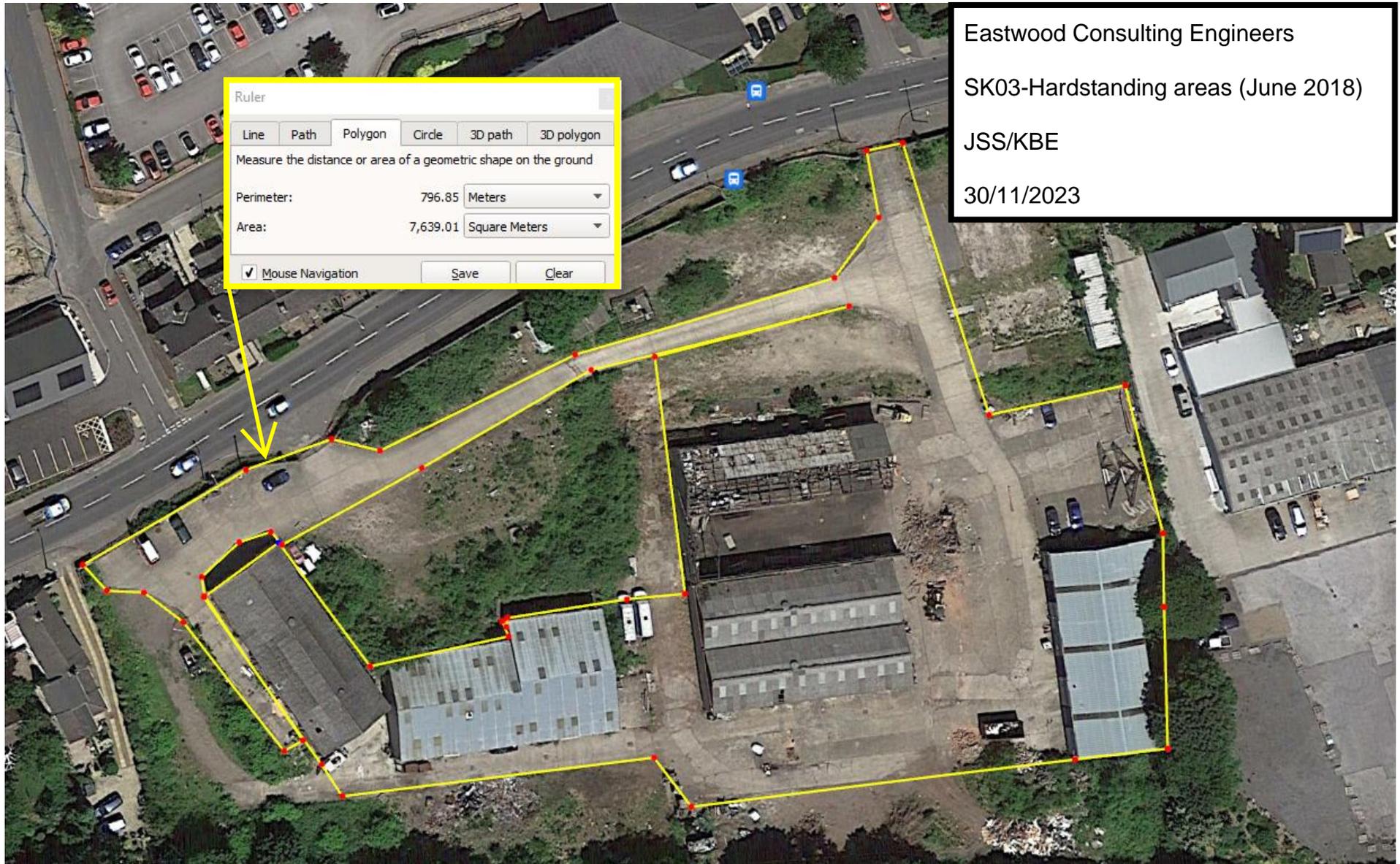
Eastwood
CONSULTING ENGINEERS

St Andrew's House
23 Kingfield Road
Sheffield, S11 9AS

T: 0114 255 4554
E: mail@eastwoodce.com
eastwoodce.com

ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
48404	1:500	S0	Initial

DRAWING NUMBER				REV
48404 - ECE - XX - XX - DR - C - 0004	P01	Project	Originator	Zone
		Level	Type	Role
				Number



Eastwood Consulting Engineers

SK03-Hardstanding areas (June 2018)

JSS/KBE

30/11/2023

Location, Town
SuDS Checklist

SUDS Type	SUDS Technique	Description	Suitable	Comments
Source Control	Green roof	Vegetated roof that reduces runoff volume and rate	No	Expected planning requirement for traditional pitched roofs to match neighbouring housing.
	Rain garden/ bio retention area	Small depressions in the ground that can act as infiltration points.	Possible	Potential areas of rain gardens to be developed.
	Rainwater harvesting/rainwater butts	Rainwater is stored and re-used	Possible	Individual water butts can be used for garden watering.
	Permeable paving	Paving which allows inflow of rainwater into underlying construction/soil	No	Expected presence of impermeable ground (siltstone and mudstone). Type C permeable paving will also be unviable due to the steep topography.
Infiltration	Soakaway	Pit or trench which stores and disposes of water to the ground	No	Expected presence of impermeable ground (siltstone and mudstone).
	Filter Drain	Trench which conveys and/or disposes of water to the ground.	No	
	Infiltration Basin	Shallow basin which stores and disposes of water to the ground	No	Expected presence of impermeable ground (siltstone and mudstone) and lack of suitable open space.
Conveyance	Swale	Shallow vegetated depression which conducts and retains water	No	Difficulties of adoption and lack of space.
Detention	Subsurface storage	Traditional underground pipes, tank storage, or modular systems	Yes	Area available on the site for an attenuation tank/crates.
	Detention Basin	Normally dry but may have small permanent water pools at the inlet and outlet. They can function as POS	No	Poor infiltration rate due to clay and deep impermeable bedrock resulting in residual water and siltation in the basin. Inefficient use of POS.

Location, Town
SuDS Checklist

	Pond	Permanent body of water	No	Lack of suitable public open space.
	Wetland	Permanent body of shallow water or marsh	No	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 02.11.23.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.362	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for 02.11.23.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.586	4-8	0.172

Total Area Contributing (ha) = 0.758

Total Pipe Volume (m³) = 158.194

Network Design Table for 02.11.23.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	10.889	0.716	15.2	0.053	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	23.857	1.479	16.1	0.071	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	23.259	0.582	40.0	0.161	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	31.862	2.139	14.9	0.071	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	23.860	0.596	40.0	0.056	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	30.907	0.103	300.1	0.069	0.00	0.0	0.600	o	1500	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	63.12	5.05	57.689	0.053	0.0	0.0	0.0	3.37	134.1	9.1
1.001	62.51	5.18	56.973	0.124	0.0	0.0	0.0	3.27	130.2	21.0
1.002	61.74	5.33	55.419	0.285	0.0	0.0	0.0	2.49	176.3	47.7
1.003	61.12	5.46	54.837	0.356	0.0	0.0	0.0	4.09	289.4	58.9
1.004	60.37	5.62	52.698	0.412	0.0	0.0	0.0	2.49	176.2	67.4
1.005	59.43	5.83	50.902	0.481	0.0	0.0	0.0	2.47	4366.7	77.4

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Network Design Table for 02.11.23.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	12.595	0.576	21.9	0.152	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	41.086	2.629	15.6	0.061	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	52.664	0.176	299.2	0.064	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.006	4.461	0.030	148.7	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	9.952	0.066	150.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	63.02	5.07	55.380	0.152	0.0	0.0	0.0	2.81	111.7	25.9
2.001	61.99	5.28	54.804	0.213	0.0	0.0	0.0	3.33	132.3	35.8
2.002	60.30	5.64	50.900	0.277	0.0	0.0	0.0	2.47	4372.9	45.2
1.006	63.17	5.04	50.724	0.000	20.0	0.0	0.0	1.66	264.8	20.0
1.007	62.51	5.17	50.694	0.000	20.0	0.0	0.0	1.28	90.3	20.0

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Manhole Schedules for 02.11.23.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
1	59.039	1.350	Open Manhole	1200	1.000	57.689	225				
2	58.323	1.350	Open Manhole	1200	1.001	56.973	225	1.000	56.973	225	
3	56.844	1.425	Open Manhole	1200	1.002	55.419	300	1.001	55.494	225	
4	56.262	1.425	Open Manhole	1500	1.003	54.837	300	1.002	54.837	300	
5	54.123	1.425	Open Manhole	1200	1.004	52.698	300	1.003	52.698	300	
6	53.527	2.625	Open Manhole	2400	1.005	50.902	1500	1.004	52.102	300	
7	56.805	1.425	Open Manhole	1200	2.000	55.380	225				
8	56.229	1.425	Open Manhole	1200	2.001	54.804	225	2.000	54.804	225	
9	54.288	3.388	Open Manhole	2400	2.002	50.900	1500	2.001	52.175	225	
10	53.761	3.037	Open Manhole	2400	1.006	50.724	450	1.005	50.799	1500	1125
								2.002	50.724	1500	
11	53.600	2.906	Open Manhole	2400	1.007	50.694	300	1.006	50.694	450	
12	54.180	3.552	Open Manhole	0		OUTFALL		1.007	50.628	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	435904.147	403697.472	435904.147	403697.472	Required	
2	435908.412	403687.454	435908.412	403687.454	Required	
3	435906.562	403663.668	435906.562	403663.668	Required	
4	435929.701	403661.312	435929.701	403661.312	Required	
5	435926.513	403629.611	435926.513	403629.611	Required	
6	435924.073	403605.876	435924.073	403605.876	Required	
7	435835.710	403666.848	435835.710	403666.848	Required	
8	435841.016	403655.426	435841.016	403655.426	Required	



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Manhole Schedules for 02.11.23.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
9	435840.932	403614.340	435840.932	403614.340	Required	
10	435893.325	403609.006	435893.325	403609.006	Required	
11	435892.805	403604.575	435892.805	403604.575	Required	
12	435891.644	403594.691			No Entry	

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PIPELINE SCHEDULES for 02.11.23.SWS

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	59.039	57.689	1.125	Open Manhole	1200
1.001	o	225	2	58.323	56.973	1.125	Open Manhole	1200
1.002	o	300	3	56.844	55.419	1.125	Open Manhole	1200
1.003	o	300	4	56.262	54.837	1.125	Open Manhole	1500
1.004	o	300	5	54.123	52.698	1.125	Open Manhole	1200
1.005	o	1500	6	53.527	50.902	1.125	Open Manhole	2400
2.000	o	225	7	56.805	55.380	1.200	Open Manhole	1200
2.001	o	225	8	56.229	54.804	1.200	Open Manhole	1200
2.002	o	1500	9	54.288	50.900	1.888	Open Manhole	2400
1.006	o	450	10	53.761	50.724	2.587	Open Manhole	2400
1.007	o	300	11	53.600	50.694	2.606	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	10.889	15.2	2	58.323	56.973	1.125	Open Manhole	1200
1.001	23.857	16.1	3	56.844	55.494	1.125	Open Manhole	1200
1.002	23.259	40.0	4	56.262	54.837	1.125	Open Manhole	1500
1.003	31.862	14.9	5	54.123	52.698	1.125	Open Manhole	1200
1.004	23.860	40.0	6	53.527	52.102	1.125	Open Manhole	2400
1.005	30.907	300.1	10	53.761	50.799	1.462	Open Manhole	2400
2.000	12.595	21.9	8	56.229	54.804	1.200	Open Manhole	1200
2.001	41.086	15.6	9	54.288	52.175	1.888	Open Manhole	2400
2.002	52.664	299.2	10	53.761	50.724	1.537	Open Manhole	2400
1.006	4.461	148.7	11	53.600	50.694	2.456	Open Manhole	2400
1.007	9.952	150.8	12	54.180	50.628	3.252	Open Manhole	0

Free Flowing Outfall Details for 02.11.23.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.007	12	54.180	50.628	0.000	0	0

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Simulation Criteria for 02.11.23.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.362		

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Online Controls for 02.11.23.SWS

Hydro-Brake® Optimum Manhole: 11, DS/PN: 1.007, Volume (m³): 13.5

Unit Reference	MD-SHE-0160-1500-2000-1500
Design Head (m)	2.000
Design Flow (l/s)	15.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	160
Invert Level (m)	50.694
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.0
Flush-Flo™	0.582	15.0
Kick-Flo®	1.216	11.9
Mean Flow over Head Range	-	13.1

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

Depth (m)	Flow (l/s)						
0.100	5.7	1.200	12.1	3.000	18.2	7.000	27.3
0.200	12.5	1.400	12.7	3.500	19.6	7.500	28.2
0.300	13.9	1.600	13.5	4.000	20.9	8.000	29.1
0.400	14.6	1.800	14.3	4.500	22.1	8.500	30.0
0.500	14.9	2.000	15.0	5.000	23.2	9.000	30.8
0.600	15.0	2.200	15.7	5.500	24.3	9.500	31.6
0.800	14.7	2.400	16.4	6.000	25.3		
1.000	13.9	2.600	17.0	6.500	26.3		

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Storage Structures for 02.11.23.SWS

Tank or Pond Manhole: 9, DS/PN: 2.002

Invert Level (m) 52.750

Depth (m)	Area (m ²)						
0.000	220.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	220.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	220.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	220.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	220.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	220.0	2.400	0.0	3.800	0.0		
1.200	0.0	2.600	0.0	4.000	0.0		

Summary of Critical Results by Maximum Level (Rank 1) for 02.11.23.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.370
Region England and Wales Cv (Summer) 1.000
M5-60 (mm) 19.000 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 100
Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Summer	100	+40%				
1.001	2	15 Summer	100	+40%	100/15 Summer			
1.002	3	15 Summer	100	+40%	100/15 Summer			
1.003	4	15 Summer	100	+40%	100/15 Summer			
1.004	5	30 Summer	100	+40%	100/15 Summer	100/15 Summer		
1.005	6	120 Summer	100	+40%	100/15 Summer	100/60 Summer		
2.000	7	15 Summer	100	+40%	100/15 Summer			
2.001	8	15 Summer	100	+40%	100/15 Summer			
2.002	9	240 Winter	100	+40%	100/15 Summer			
1.006	10	240 Summer	100	+40%	100/15 Summer			
1.007	11	60 Winter	100	+40%	100/15 Summer	100/30 Winter		

PN	US/MH Name	Water Surcharged			Flooded		Half Drain Pipe		Status
		Level (m)	Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Time (mins)	Flow (l/s)	
1.000	1	57.780	-0.134	0.000	0.34		38.5		OK
1.001	2	57.397	0.199	0.000	0.75		90.1		SURCHARGED
1.002	3	56.685	0.966	0.000	1.24		193.4		FLOOD RISK

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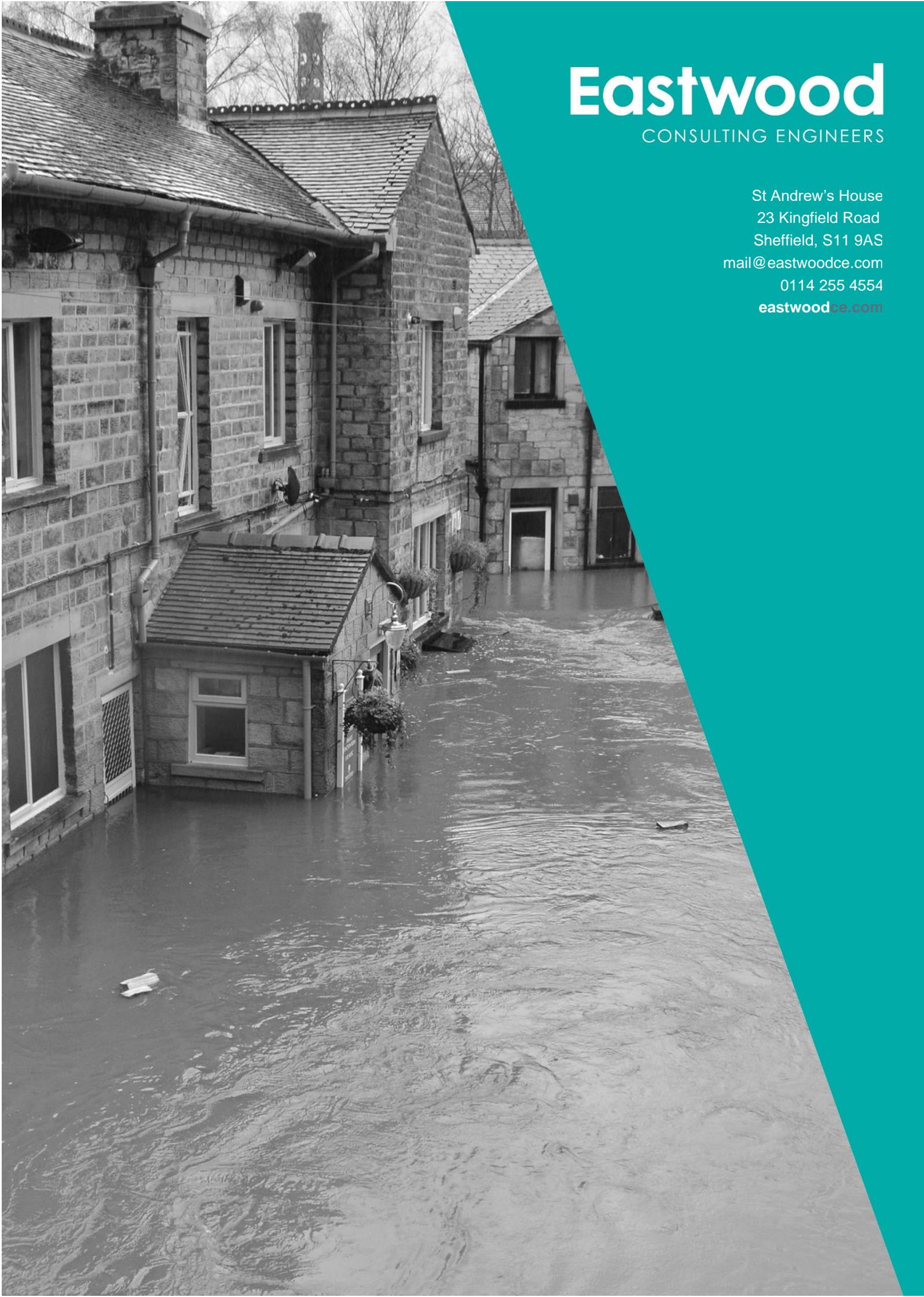
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Summary of Critical Results by Maximum Level (Rank 1) for 02.11.23.SWS

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status
		Level (m)	Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Time (mins)	Flow (l/s)	
1.003	4 55.830	0.693	0.000	0.89			233.9	SURCHARGED
1.004	5 54.123	1.125	0.297	1.61			251.4	FLOOD
1.005	6 53.548	1.146	21.743	0.06			154.0	FLOOD
2.000	7 56.181	0.576	0.000	1.05			101.1	SURCHARGED
2.001	8 55.552	0.523	0.000	1.09			136.5	SURCHARGED
2.002	9 53.550	1.150	0.000	0.01			33.5	SURCHARGED
1.006	10 53.639	2.465	0.000	0.34			48.6	FLOOD RISK
1.007	11 53.601	2.607	0.928	0.27			17.4	FLOOD

PN	US/MH Name	Level Exceeded
1.000	1	
1.001	2	
1.002	3	
1.003	4	
1.004	5	2
1.005	6	6
2.000	7	
2.001	8	
2.002	9	
1.006	10	
1.007	11	4



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