Eastwood
CONSULTING ENGINEERS

Flood Risk Assessment

WOODWARD COURT, MIRFIELD

BELLWAY HOMES LTD (YORKSHIRE)

26/11/2025

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FLOOD RISK ASSESSMENT

WOODWARD COURT, MIRFIELD

FOR

BELLWAY HOMES LTD (YORKSHIRE)

49653-ECE-XX-XX-RP-C-0001 **26 November 2025**

FLOOD RISK ASSESSMENT

WOODWARD COURT, MIRFIELD

FOR

BELLWAY HOMES LTD (YORKSHIRE)

Job No.	:	49653
Report Status	:	Issue 3
Document Date	:	26 November 2025
Approved	:	

Chris Hodge

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Issue 1: 15 October 2025
Issue 2: 13 November 2025 *Updated with revised site layout and drainage calculations.*
Issue 3: 26 November 2025 *Proposed SuDS features updated.*

EXECUTIVE SUMMARY

The project comprises the development of a 4.73-hectare greenfield site for residential use.

The site lies within Flood Zone 1 at low risk of flooding from rivers and sea. For both the present day and climate change scenarios (2040-2060s) there is an area with a low risk of surface water ponding on the southern boundary of the site corresponding with a topographic depression. For the climate change scenario (2040-2060s), there is second isolated area noted to be at low risk of surface water ponding also in the southern portion of the site.

The ground levels on site will be altered to raise depressions in the southern portion to match the remaining areas 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. Finished floor levels will also be set 150 mm above external ground levels.

The Kirklees Council SFRA groundwater flood map shows the southern portion of the site to lie in an area with between 25-50% susceptibility to groundwater flooding. The eastern site boundary is recorded to be within an area with a less than 25% susceptibility to groundwater flooding. The Kirklees Council Lead Local Flood Authority pre-application advice notes that a geo-hydrology report should be prepared. Further mitigation measures may therefore be required.

The site lies within Flood Zone 1, with a small area at low risk of surface water ponding. The proposed mitigation measures and site layout will ensure the site is safe for the lifetime of the development, therefore in line with Paragraph 175 of the National Planning Policy and Kirklees Council pre-application advice, a Sequential Test is not required.

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.

Surface water disposal will be via gravity to an infiltration basin in the southern portion of the site, subject to approval from the Lead Local Flood Authority.

In line with the Lithos Geoenvironmental Appraisal (Ref: 1668/1F) and subsequent email correspondence, the development should ensure that no dwelling is built within 10 m of the basin crest due to potential ground stability issues as a result of focussed sustained water flows in shallow mine workings.

The infiltration basin has been sized using the lowest recorded infiltration rate on site of 3.87 x 10^{-5} m/s. The basin has been sized for the 1 in 100 year plus 45% climate change rainfall event. An approximate basin volume of 1,260 m^3 will be required, subject to detailed design.

The proposed infiltration basin will provide water quality treatment and attenuation as well as adding biodiversity and amenity value to the site. The proposed SuDS features are subject to approval by the Lead Local Flood Authority and detailed design.

Foul effluent should discharge via gravity to the 225 mm public combined sewer south of the site in Hepworth Lane. This is subject to formal approval from Yorkshire Water.

Both the surface and foul water drainage systems will be offered for adoption to Yorkshire Water or a NAV (New Appointments and Variations).

1.0 THE DEVELOPMENT

1.1 Introduction

This Flood Risk Assessment has been prepared in accordance with current National Planning Policy Framework[1] and Planning Practice Guidance 'Flood Risk and Coastal Change'[2] on the instruction of Bellway Homes Ltd (Yorkshire). Any other parties using the information in this report do so at their own risk, unless previously approved in writing. This report only outlines a general drainage strategy for the proposed development. Detailing of the drainage strategy should be provided within, and referenced from, the site specific Drainage Assessment Report (Ref: 49653-ECE-XX-XX-RP-C-0002) and associated plans.

The project comprises the development of a 4.73-hectare greenfield site for residential use.

1.2 Site Location and Description

The site is located within Mirfield, and is centred on coordinates 444080, 432740 (Appendix 1).

The site is bounded by residential properties to the south and west, Woodward Court to the north-west, Hepworth Lane to the south, a school and playing fields to the north, with agricultural fields and a building to the east. The site is currently occupied by open ploughed farmland boarded by hedgerows and wooden fences.

The site falls from approximately 98.34 mAOD in the north-east to approximately 84 mAOD in the south at an average gradient of 1 in 24 (Appendix 2).

Proposals are for 75 household properties with access from Woodward Court in the north-west (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 Surface Water

The Environment Agency surface water flood risk maps (Figures 2, 3 and Appendix 4) show the majority of the site to be at a very low risk of surface water flooding for both present day and climate change (2040-2060s) scenarios.

For both the present day and climate change (2040-2060s) scenario, there is a small area with a low (0.1%-1%) risk of flooding on the southern boundary. For the climate change scenario, there is a second isolated area at low risk (0.1%-1%) of flooding in the southern portion of the site.

Figure 2: Environment Agency – Risk of surface water flooding map (present day scenario)

A 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).

Figure 3: Environment Agency – Risk of surface water flooding map (2040-2060s, climate change scenario)

1.5 Kirklees Strategic Flood Risk Assessment

The Kirklees 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). The surface water flood map included in the SFRA shows surface water flooding to cover a larger extent than the Environment Agency maps. The discrepancy is due to the 2016 SFRA mapping predating 2025 Environment Agency mapping.

1.6 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 intensity[3] are to be selected based on the assigned values for the relevant Management Catchment and epoch suited to the design life

[3] https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall

of the development. For the Aire and Calder Management Catchment the Upper End Allowance of 45% should be used to assess storage requirements.

The Environment Agency surface water flood maps (Section 1.4, 2.1.1 and 2.1.2) include a climate change scenario. This is based on the latest UK Climate Projections (UKCP18) from the Met Office using a mid-range allowance (2040-2060s)[4].

[4] https://www.gov.uk/government/publications/flood-risk-maps-for-surface-water-how-to-use-the-map/92c4e96c-c2e0-4545-9c0e-1b410a4a78e9

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 an unnamed watercourse located approximately 300 m east of the northern portion of the site. This is a tributary of Canker Dyke which ultimately discharges to the River Calder (main river) at a point 2.4 km south-east of the site. These watercourses are not tidally influenced and flood risk from these sources is assessed as negligible.

2.1.2 Surface Water (flood origin and depths)

Surface water flooding

The Environment Agency surface water flood risk maps (Appendix 4) and topographic survey (Appendix 2) have been used to determine any surface water flow paths. For both the present day and climate change (2040-2060s) scenarios, there is an area with a low risk of surface water ponding on the southern boundary of the site corresponding with a topographic depression. For the climate change scenario (2040-2060s), there is a second isolated area noted to be at low risk of surface water ponding also in the southern portion of the site associated with a topographic low point.

Surface water flood depths

The Environment Agency surface water flood risk maps (Appendix 4) show the surface water ponding on site for both the present-day and climate change (2040-2060s) scenario to have a very low (<0.1%) risk of depths reaching 0.2 m each year.

The Environment Agency surface water flood depth maps (Appendix 4) show a smaller extent of flooding than the surface water flood extent maps (Figures 2 and 3). This discrepancy has been raised with the Environment Agency (Appendix 4) and their response notes that the unshaded areas on the flood depth maps are at a very low risk of flooding reaching the specified depth. Based on this information, the surface water flood depths maps have been used to assess the risk of surface water flooding on site given that unshaded areas for the lowest flood depth map are at a very low risk of reaching 0.2 m.

2.1.3 Reservoir

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

Figure 4: Environment Agency – Risk of reservoir flooding map (QGIS)

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. The Kirklees Council SFRA groundwater flood map shows the southern portion of the site to lie in an area with between 25-50% susceptibility to groundwater flooding. The eastern site boundary is recorded as having a less than 25% susceptibility to groundwater flooding (Appendix 5). No information is provided for the northern and western portion of the site.

A Geoenvironmental Appraisal was conducted by Lithos (Ref: 1668/1F) in December 2022. No significant groundwater was encountered during excavations but groundwater monitoring was undertaken over a 3 month period and was recorded at a minimum depth of 3.5 m below ground level.

2.1.5 Sewerage

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

2.1.6 Historic Flooding

Environment Agency mapping records the site to be outside the historical flood outline (Figure 5 and Appendix 4).

The Kirklees Council pre-application consultation response (Appendix 5) notes that there are no significant flood incidents recorded on their database, although the Lead Local Flood Authority is aware of water ingress at a property on Hepworth Lane which is believed to be caused by flow from the highway and not this development site.

Figure 5: Environment Agency – Historic flood map (QGIS)

2.2 Residual Flood Risk

For both the present day and climate change (2040-2060s) scenarios, there is an area with a low risk of surface water ponding on the southern boundary of the site corresponding with a topographic depression. For the climate change scenario (2040-2060s), there is a second isolated area noted to be at low risk of surface water ponding associated with a topographic low point also in the southern portion of the site.

The Kirklees Council SFRA groundwater flood map shows the southern portion of the site to lie in an area with between 25-50% susceptibility to groundwater flooding. The eastern boundary is recorded to have a less than 25% susceptibility to groundwater flooding.

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 3.2.

3.0 SEQUENTIAL TESTING AND MITIGATION MEASURES

The National Planning Policy Framework (September 2025) sets out the principles for assessing the suitability of sites for development, in relation to flood risk, as part of the planning process.

3.1 Sequential Test

Initially a Sequential Test is applied to the allocation of land suitable for development. The test is required for any development proposals in areas at risk of flooding, taking into account all sources of flood risk.

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.

Paragraph 175[5] of the National Planning Policy Framework notes that a proportionate approach should be taken for Sequential Testing. If it is demonstrated that the proposed layout, design, and mitigation measures would ensure that occupiers and users would remain safe from current and future surface water flood risk for the lifetime of the development without increasing flood risk elsewhere, then the sequential test need not be applied.

The site lies within Flood Zone 1, with small area at low risk of surface water ponding. The proposed mitigation measures (Section 3.2) and site layout will ensure the site is safe for the lifetime of the development, therefore in line with Paragraph 175 of the National Planning Policy and Kirklees Council pre-application advice (Appendix 5), a Sequential Test is not required.

3.2 Flood Mitigation Measures

The ground levels on the site will be altered to raise depressions in the southern portion of the site to match the remaining areas 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. Finished floor levels will also be set 150 mm above external ground levels.

The Kirklees Council Lead Local Flood Authority pre-application advice notes that a geo-hydrology report should be prepared. Further mitigation measures may therefore be required.

[5] https://www.gov.uk/guidance/flood-risk-and-coastal-change

4.0 DRAINAGE STRATEGY

Detailing of the drainage strategy is provided within a separate site specific Drainage Assessment Report (Ref: 49653-ECE-XX-XX-RP-C-0002) and associated plans. A summary of the proposed drainage strategy is noted below.

4.1 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 an infiltration basin in the southern portion of the site, subject to approval from the Lead Local Flood Authority.
- In line with the Lithos Geoenvironmental Appraisal (Ref: 1668/1F) and subsequent email correspondence, the development should ensure that no dwelling is built within 10 m of the basin crest due to potential ground stability issues as a result of focussed sustained water flows in shallow mine workings.
- The infiltration basin has been sized using the lowest recorded infiltration rate on site of 3.87 x 10^{-5} m/s.
- The basin has been sized for the 1 in 100 year plus 45% climate change rainfall event. An approximate basin volume of 1,260 m^3 will be required, subject to detailed design. Calculations and the drainage layout are provided in Appendix 7.
- The proposed infiltration basin will provide water quality treatment and attenuation as well as adding biodiversity and amenity value to the site. The proposed SuDS features are subject to approval by the Lead Local Flood Authority and detailed design.
- The surface water drainage system will be offered for adoption to Yorkshire Water or a NAV (New Appointments and Variations).

4.2 Proposals for foul water disposal

Foul effluent should discharge via gravity to the 225 mm public combined sewer south of the site in Hepworth Lane. This is subject to formal approval from Yorkshire Water.

The foul water drainage system may be offered for adoption to Yorkshire Water or a NAV (New Appointments and Variations).

4.3 Residual flood risk

There is a potential flood risk to site occupiers and to others from surface water runoff as a result of the development as all surface water will now be channelled within the drainage network rather than be allowed to flow overland. The residual risk of surface water flooding caused by channelling all surface runoff into the drainage network can be managed by the general flood mitigation measures outlined in Section 4.4.

4.4 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 or blockage scenarios, the site is laid out so that surface water runoff is directed away from buildings, including those on neighbouring streets.

5.0 CONCLUSIONS

1. The site lies within Flood Zone 1 at low risk of flooding from rivers and sea. For both the present day and climate change scenarios (2040-2060s) there is an area with a low risk of surface water ponding on the southern boundary of the site corresponding with a topographic depression. For the climate change scenario (2040-2060s), there is second isolated area noted to be at low risk of surface water ponding also in the southern portion of the site.

2. The ground levels on the site will be altered to raise depressions in the southern portion of the site to match the remaining areas 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. Finished floor levels will also be set 150 mm above external ground levels.

3. The Kirklees Council SFRA groundwater flood map shows the southern portion to lie in an area with between 25-50% susceptibility to groundwater flooding. The eastern site boundary is recorded to be within an area with a less than 25% susceptibility to groundwater flooding. The Kirklees Council Lead Local Flood Authority pre-application advice notes that a geo-hydrology report should be prepared. Further mitigation measures may therefore be required.

4. The site lies within Flood Zone 1, with a small area at low risk of surface water ponding. The proposed mitigation measures and site layout will ensure the site is safe for the lifetime of the development, therefore in line with Paragraph 175 of the National Planning Policy and Kirklees Council pre-application advice, a Sequential Test is not required.

5. 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.

6. Surface water disposal will be via gravity to an infiltration basin in the southern portion of the site, subject to approval from the Lead Local Flood Authority.

7. In line with the Lithos Geoenvironmental Appraisal (Ref: 1668/1F) and subsequent email correspondence, the development should ensure that no dwelling is built within 10 m of the basin crest due to potential ground stability issues as a result of focussed sustained water flows in shallow mine workings.

8. The infiltration basin has been sized using the lowest recorded infiltration rate on site of 3.87×10^{-5} m/s.

9. The basin has been sized for the 1 in 100 year plus 45% climate change rainfall event. An approximate basin volume of 1,260 m^3 will be required, subject to detailed design.

10. The proposed infiltration basin will provide water quality treatment and attenuation as well as adding biodiversity and amenity value to the site. The proposed SuDS features are subject to approval by the Lead Local Flood Authority and detailed design.

11. The surface water drainage system will be offered for adoption to Yorkshire Water or a NAV (New Appointments and Variations).

12. Foul effluent should discharge via gravity to the 225 mm public combined sewer south of the site in Hepworth Lane. This is subject to formal approval from Yorkshire Water.

13. Both the surface and foul water drainage systems will be offered for adoption to Yorkshire Water or a NAV (New Appointments and Variations).

14. The level of risk and safeguards available are considered appropriate to this class of development.

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APPENDICES

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APPENDIX 1

Site location plan

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APPENDIX 2

HAYCOCK & TODD
LAND SURVEY CONSULTANTS ARCHITECTURAL SURVEYORS
The Hollies, 43 Church Street, Royston, Barnsley, S71 4QU
T : 01226 709630 F : 01226 709631
E : info@land-surveying.co.uk W : land-surveying.co.uk

SITE SURVEY

WOODWARD COURT
MIRFIELD.

Sheet 1 of 1	Surveyed by SH, DR
Datum	Drawn by SH, DR
GRID: Related to Ordnance Survey using One Point Localisation on Station S1. Orientation at OS Grid North	Date of Survey November 2012
LEVEL: Related to Ordnance Survey by connection to the OS Active Network by G.P.S.	Scale 1/200
	Survey Job No. S7770

LEGEND

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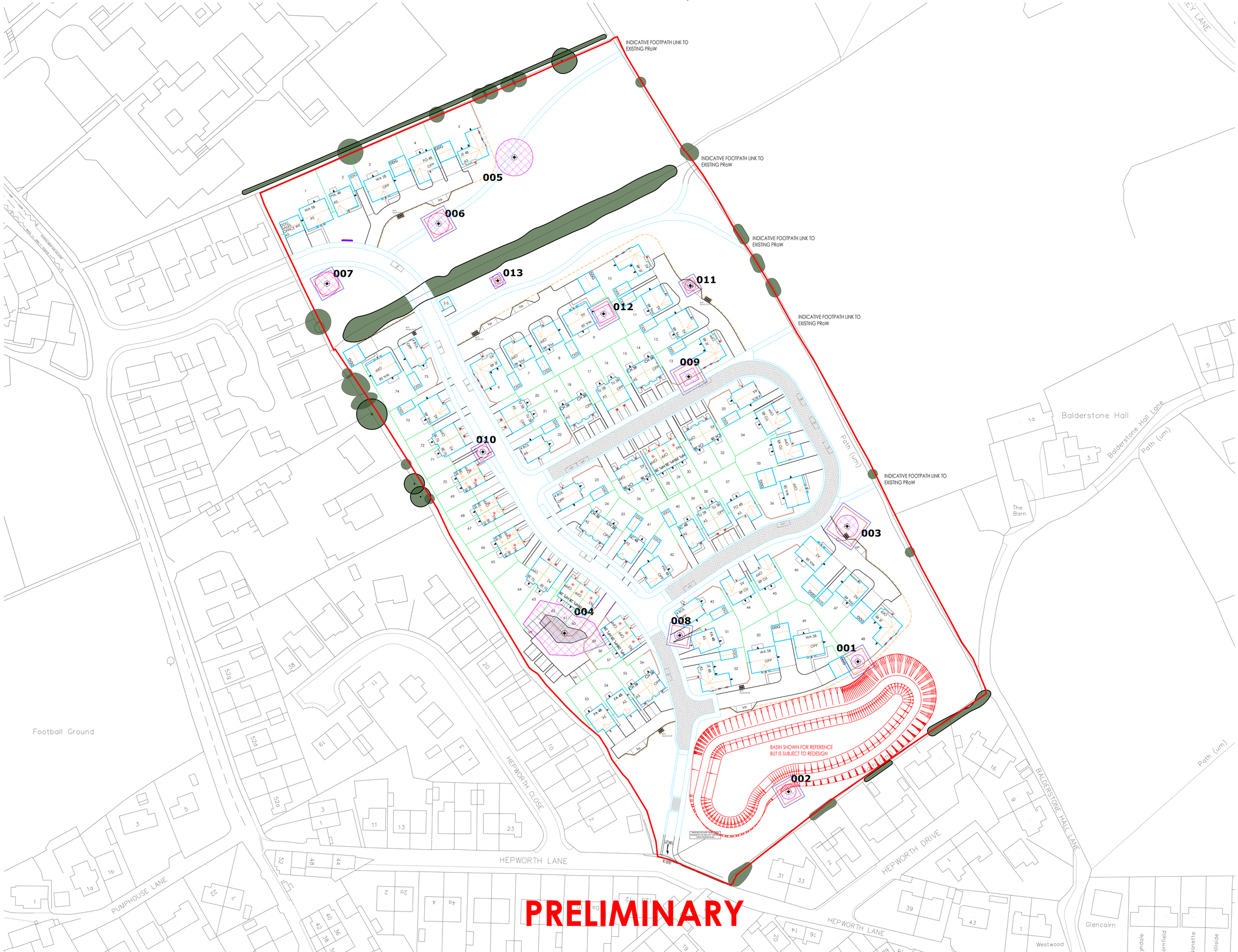
APPENDIX 3

WOODWARD COURT, **MIRFIELD**

Bellway



DRAWING LEGEND:

- RED LINE BOUNDARY
- AFFORDABLE UNITS
- EXISTING TREES/HEDGEROWS TO BE RETAINED
- TREES/HEDGEROWS TO BE REMOVED
- LANDSCAPE - PLEASE REFER TO LANDSCAPE ARCHITECTS DRAWINGS
- VISITOR PARKING BAY
- ON STREET VISITOR PARKING SPACE
- BIN COLLECTION POINTS FOR SHARED DRIVES
- INDICATIVE CONNECTIONS TO PUBLIC RIGHT OF WAY (PRoW)

WOODWARD COURT, MIRFIELD
SCHEDULE OF ACCOMMODATION

House Type	Bed No./Storey	Building Regs	Type	Parking	Sq.ft	No. Units	Total Sq.ft	%
Freesale								
Chandler	3B/2	M4(1)	End	PS	937	12	11244	20%
Turner	3B/2	M4(1)	End	PS	906	10	9060	17%
Farrier	3B/2	M4(1)	Det	PS	1152	3	3456	5%
Scrivener	3B/2	M4(1)	Det	PS	1197	2	2394	3%
Bowyer Lite	4B/2	M4(2)	Det	SG	1336	5	6680	8%
Philosopher Lite	4B/2	M4(2)	Det	SG	1489	8	11912	13%
Forester	4B/2	M4(1)	Det	SG	1502	6	9012	10%
Jeweller	4B/2	M4(1)	Det	SG	1713	6	10278	10%
Watchmaker	5B/2	M4(1)	Det	SG	1880	8	15040	13%
			Freesale Total			**60**	**79,076**	**100%**
Affordable								
Hooper Lite	2B/2	M4(2)	End	PS	776	6	4656	40%
Hooper Lite	2B/2	M4(2)	Mid	PS	776	3	2328	20%
Bailister	3B/2.5	M4(1)	End	PS	1038	6	6228	40%
			Affordable Total			**15**	**13,212**	**100%**
			Affordable Site Percentage					**20%**
				Total		**75**	**92,288**	
Gross Area							**11.70 acres**	**4.73 ha**
Nett Area							**6.55 acres**	**2.65 ha**
Open Space (Exc. Attenuation and BNG habitat zone)							**4.52 acres**	**1.83 ha**
Nett Density	**28**	**dph**		**Nett Coverage**		**14,090**	**sq.ft/acre**	
Single Garage	19		Double Garage		9	Twin Garage	0	
Visitor Parking Bay	9		On Street Visitor Parking		13			

0m 10m 20m 30m 40m 50m

F	Road alignment adjusted infront of plots 37-40. Additional space for soft landscaping in front of plots 26-32. Footpath links shown indicatively to PRoW on eastern boundary.	Nov 25
E	Plot 12 garage pulled forward.	Nov 25
D	Garages to plots 3,5 and 48 moved forward. Plot 5 and 48 moved to accommodate.	Nov 25
C	Garages to plots 5 and 48 moved forward.	Nov 25
B	Layout updated to clients markup.	Oct 25
A	One way junction and road included. Turning head adjacent to plots 42, 50-55 redesigned and plots changed to utilise space gained from amended turning head design.	Oct 25

SITE LAYOUT - 2520-SL-02F

WOODWARD COURT, MIRFIELD

BELLWAY HOMES

SCALE:1:500@A0 - OCTOBER 2025

PRELIMINARY

PARKER PEEL ARCHITECTURAL

e info@parkerpeel.co.uk w www.parkerpeel.co.uk t 01924 921 860

PRELIMINARY

SITE LAYOUT PLAN - 1:500

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APPENDIX 4

Flood map for planning

Your reference	Location (easting/northing)	Created
Unspecified	**420954/421076**	**16 September 2025 15:16**

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

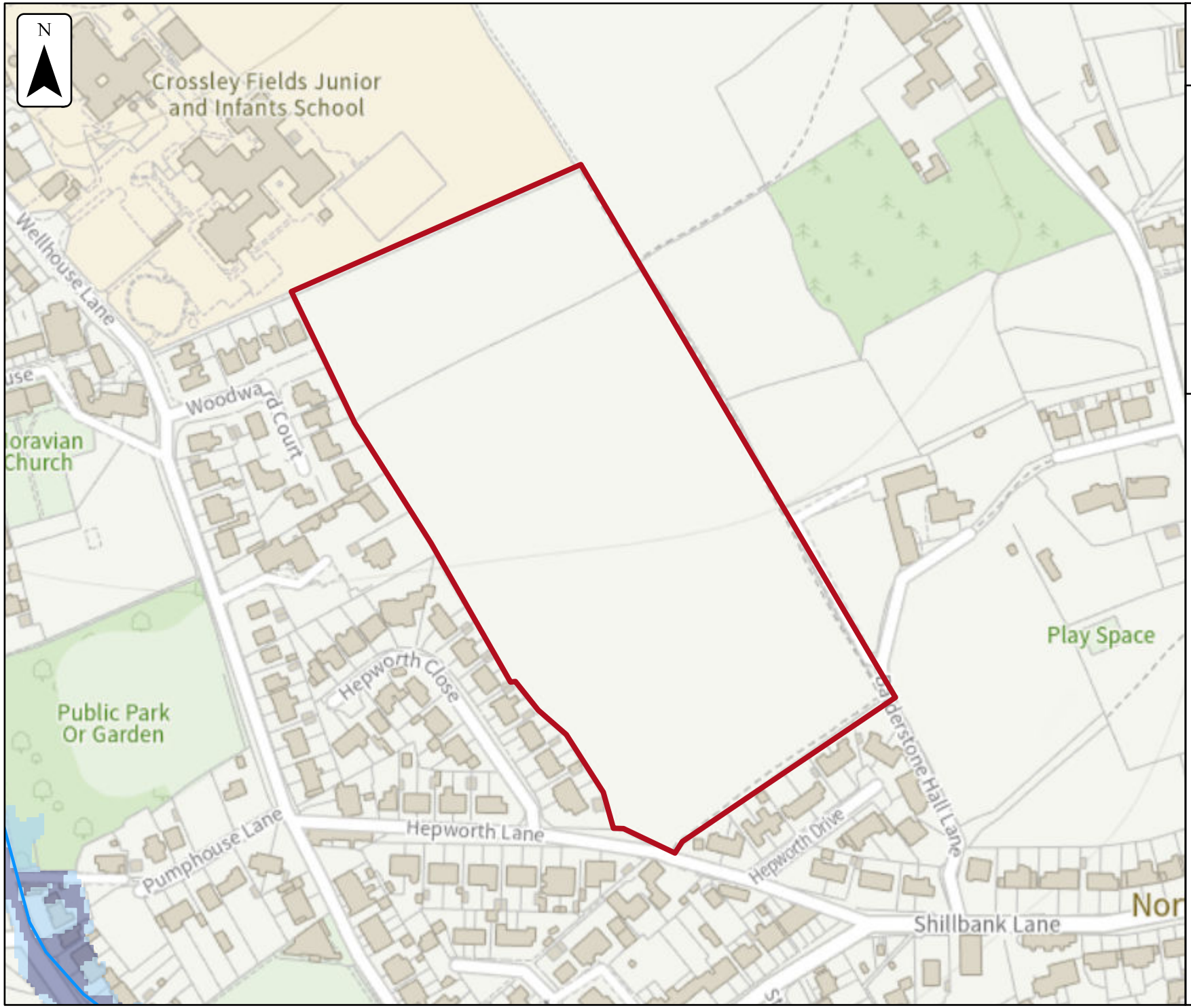
You will need to do a flood risk assessment if your site is **any of the following**:

- 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.



Environment Agency

Flood map for planning

Your reference
Unspecified

Location (easting/northing)
420954/421076

Scale
1:2,500

Created
16 Sep 2025 15:16

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

0 20 40 60 m

Environment Agency – Risk of Surface Water Flooding – Present Day Scenario

Environment Agency – Surface Water Flood Depths up to 20cm – Present Day Scenario

Environment Agency – Surface Water Flood Depths up to 30cm – Present Day Scenario

Environment Agency – Risk of Surface Water Flooding – Climate Change 2040-2060s

Environment Agency – Surface Water Flood Depths up to 20cm – Climate Change 2040-2060s

Environment Agency – Surface Water Flood Depths up to 30cm – Climate Change 2040-2060s

Environment Agency – Risk of Reservoir Flooding

Environment Agency – Historic Flooding

Jessica Stevenson-Steels

From: Enquiries, Unit <enquiries@environment-agency.gov.uk> on behalf of Enquiries, Unit
Sent: 29 May 2025 17:31
To:
Subject: 250529/CLW08 - FW: EA surface water flood maps

Hi Jessica,

The flood risk extents shown for the main Risk of Flooding from Rivers and Sea and Risk of Flooding from Surface Water datasets is the chance that any flooding could occur, regardless of depth.
The depth information for these datasets shows the chance that flooding will reach a given depth (e.g. chance of flooding of 20cm depth or greater).
In any location, the chance of flooding to a given depth decreases as the depth increases.
As an example, a location that has a low chance of flooding to a depth of 10cm would be shown at risk on the extent maps. But it might have a very low chance of deeper flooding to a depth of 20cm and so would not be shown at risk on the 20cm depth maps.

Kind regards

Clare Williamson
Job Title: Customer Service Adviser
Environment Agency: Contact Centre Services - Part of Strategy, Transformation & Assurance (STA)
Phone: 03708 506506
Working hours: Monday – Friday 10.00 – 18.00

From: Jessica Stevenson-Steels
Sent: 27 May 2025 14:08
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Subject: EA surface water flood maps

Good afternoon,

I am currently reviewing surface water flood maps for a site centred on 456605E, 519410N (location plan attached).

It is noted that some areas are highlighted to be at risk of surface water flooding (attachment 1), but are not shown on the flood depth map (attachment 2) despite the lowest depth category being ‘up to 20 cm’, which I would have expected to cover all areas at risk of surface water flooding.

I have noticed this on multiple occasions for different sites, so this discrepancy is not just specific to this one location.

Please can you advise why all areas shown on the surface water flood extents map may not appear on the surface water flood depths map.

Kind regards,

Jessica Stevenson-Steels BSc MCIWEM
Environmental Engineer

Eastwood Consulting Engineers is a trading name of Eastwood and Partners (Consulting Engineers) Limited
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Company No: 1835021, VAT Registration No: 738 2114 44, Web: www.eastwoodce.com Tel: 0114 255 4554

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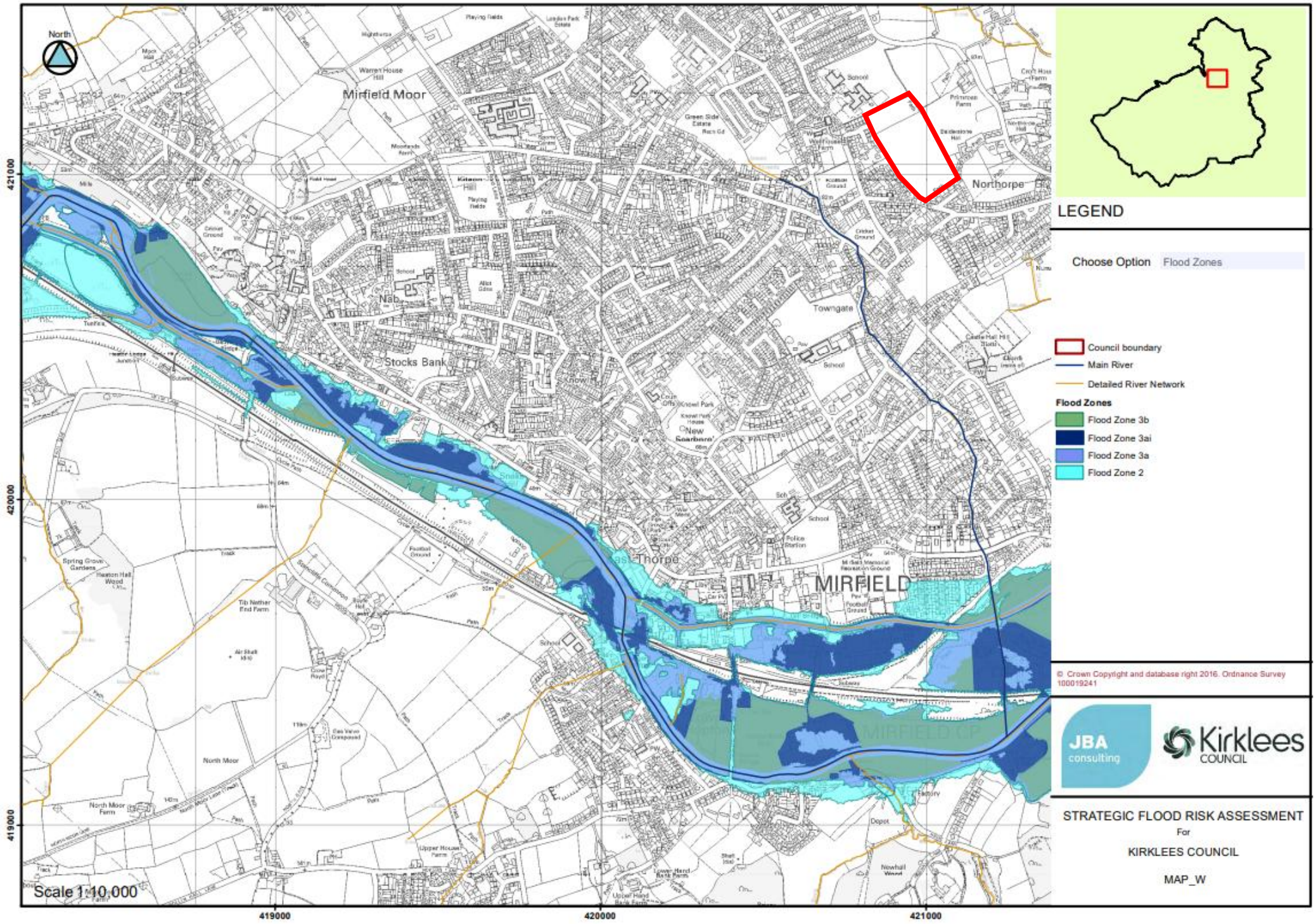
APPENDIX 5



LEGEND

Choose Option: Flood Zones

- Council boundary
- Main River
- Detailed River Network

Flood Zones

- Flood Zone 3b
- Flood Zone 3ai
- Flood Zone 3a
- Flood Zone 2

JBA consulting

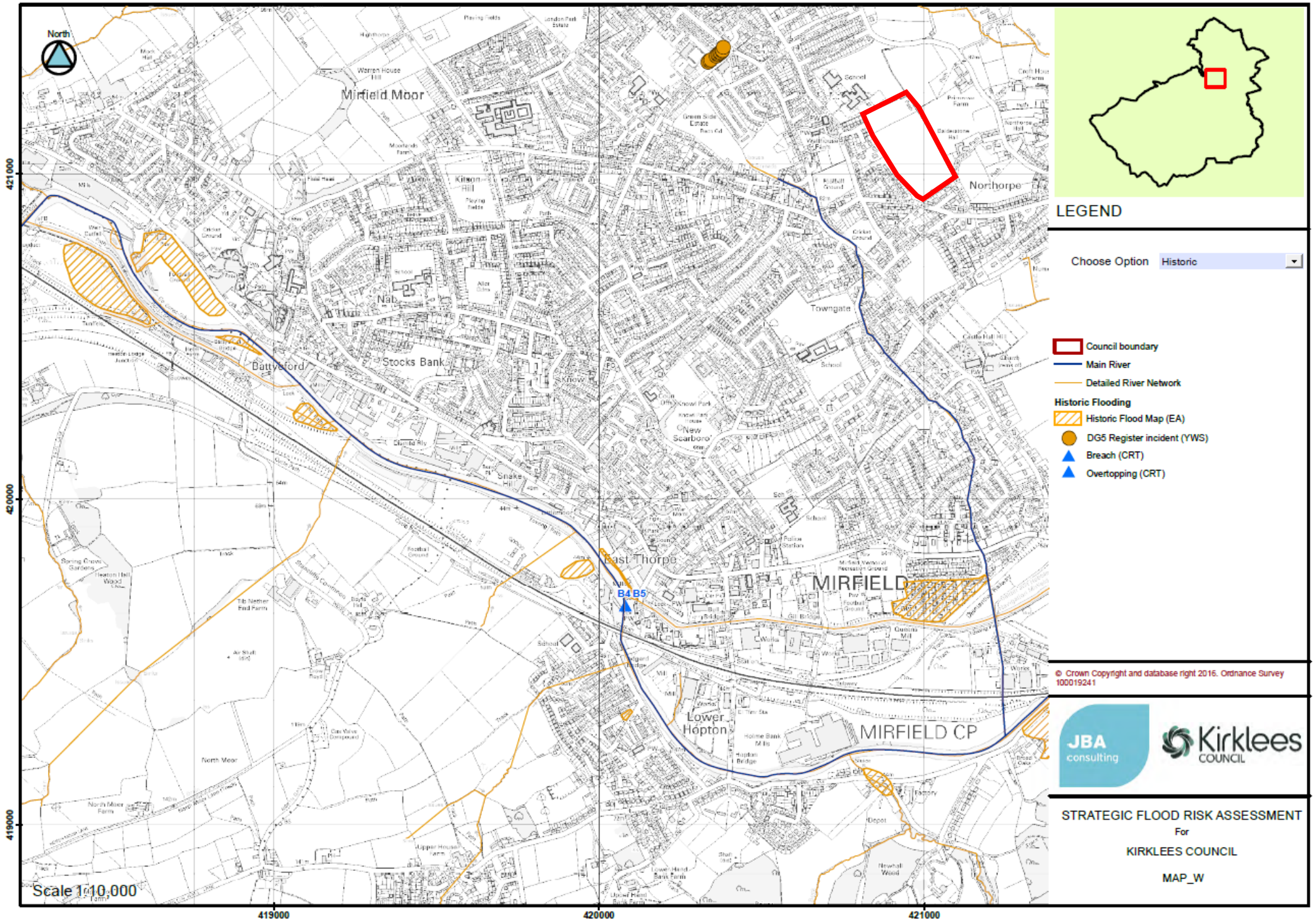
Kirklees COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

KIRKLEES COUNCIL

MAP_W



LEGEND

Choose Option: Historic

- Council boundary
- Main River
- Detailed River Network

Historic Flooding

- Historic Flood Map (EA)
- DG5 Register incident (YWS)
- Breach (CRT)
- Overtopping (CRT)

JBA consulting

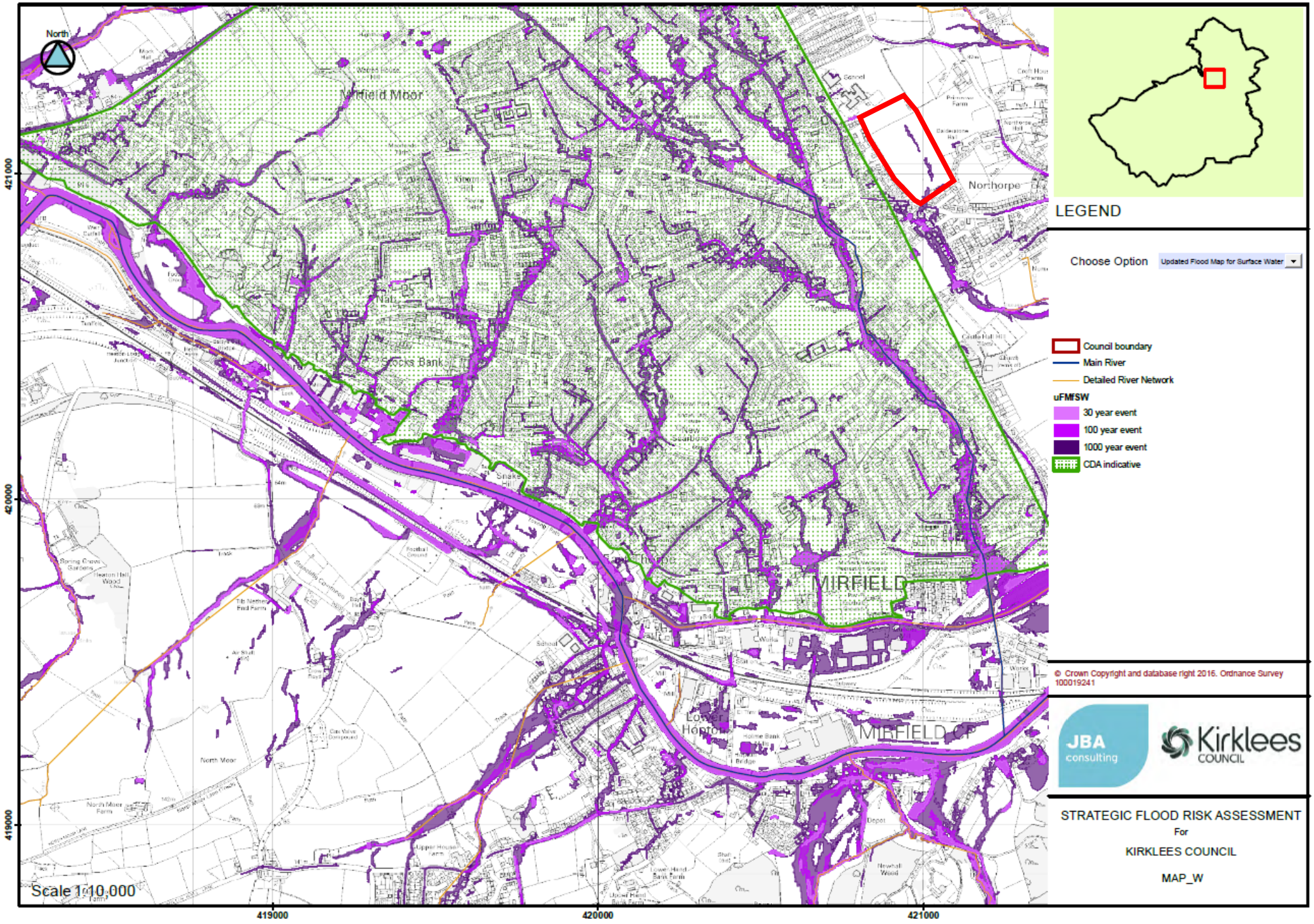
Kirklees COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

KIRKLEES COUNCIL

MAP_W



LEGEND

Choose Option: Updated Flood Map for Surface Water

- Council boundary
- Main River
- Detailed River Network

uFMfSW

- 30 year event
- 100 year event
- 1000 year event
- CDA indicative

JBA consulting

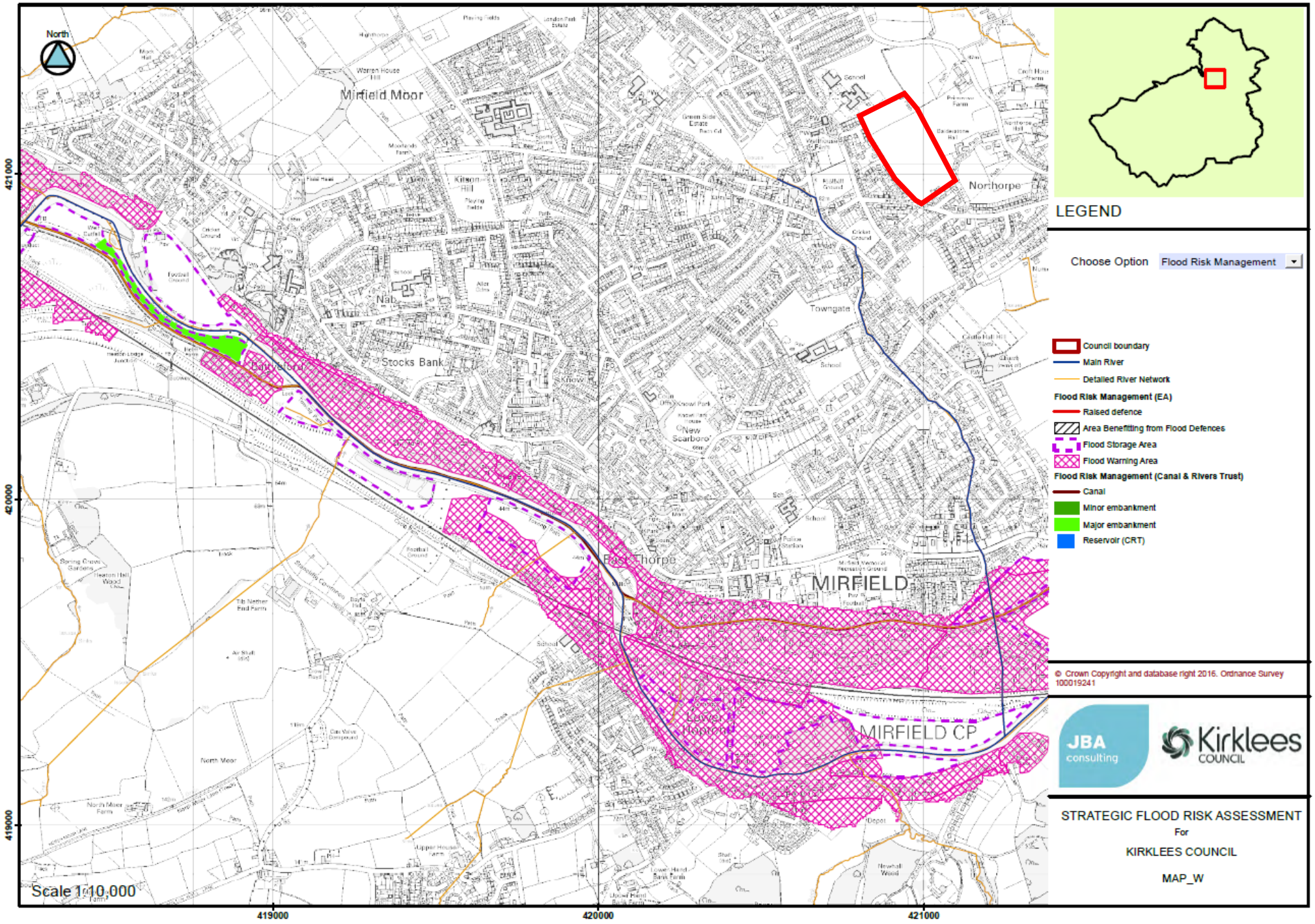
Kirklees COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

KIRKLEES COUNCIL

MAP_W



LEGEND

Choose Option: Flood Risk Management

- Council boundary
- Main River
- Detailed River Network

Flood Risk Management (EA)

- Raised defence
- Area Benefitting from Flood Defences
- Flood Storage Area
- Flood Warning Area

Flood Risk Management (Canal & Rivers Trust)

- Canal
- Minor embankment
- Major embankment
- Reservoir (CRT)

JBA consulting

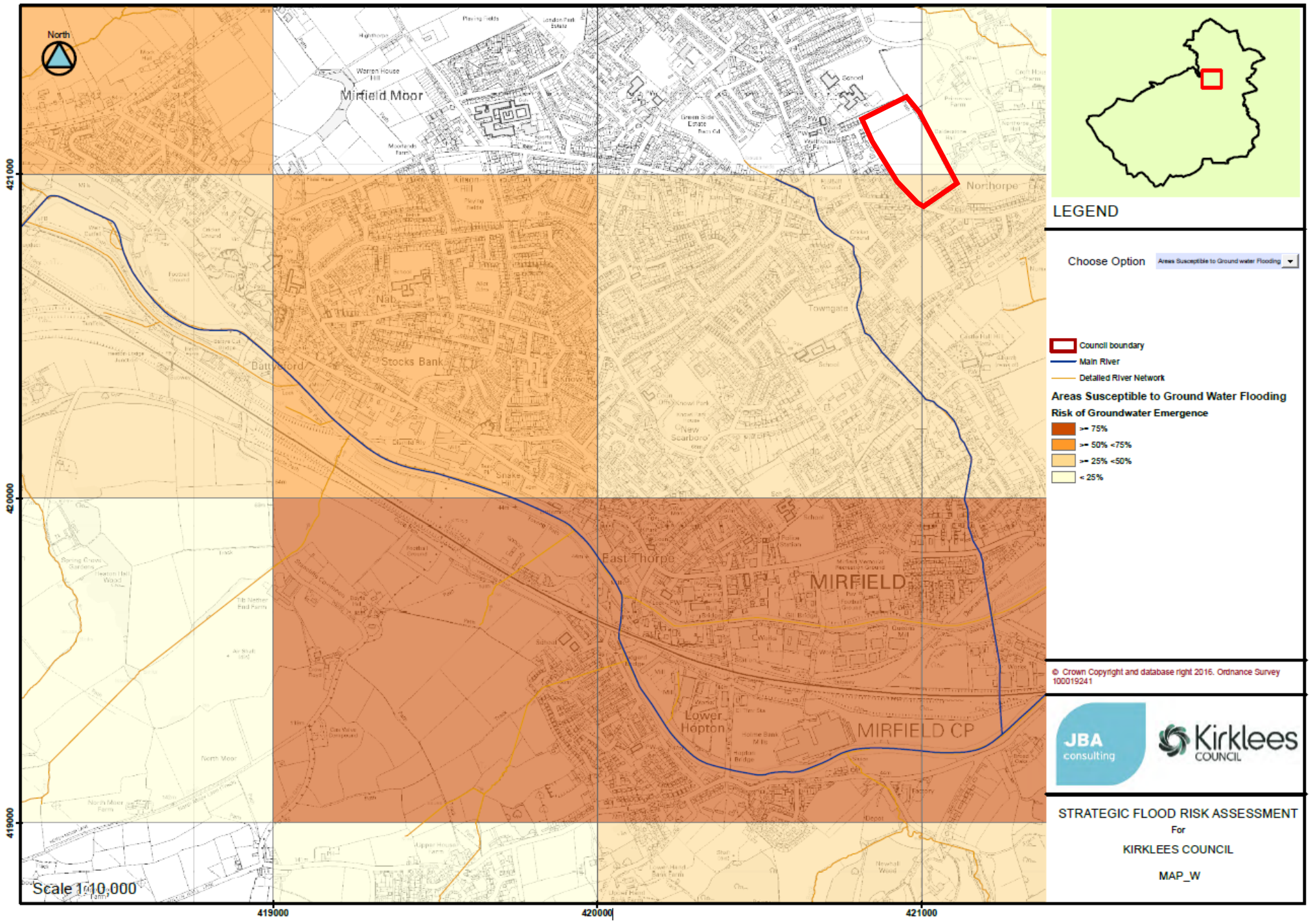
Kirklees COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

KIRKLEES COUNCIL

MAP_W



LEGEND

Choose Option: Areas Susceptible to Ground water Flooding

- Council boundary
- Main River
- Detailed River Network

Areas Susceptible to Ground Water Flooding

Risk of Groundwater Emergence

- >= 75%
- >= 50% <75%
- >= 25% <50%
- < 25%

JBA consulting

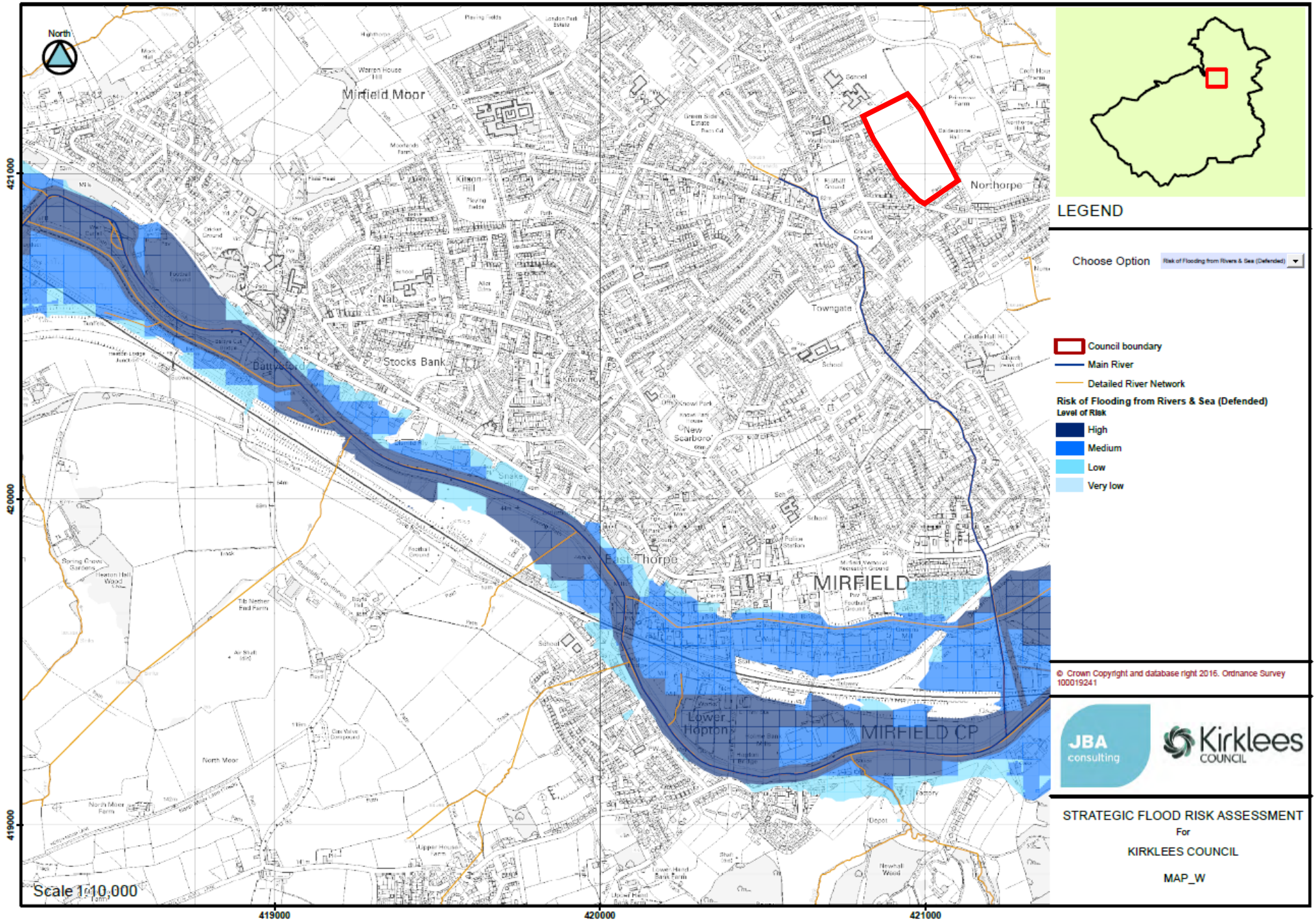
Kirklees COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

KIRKLEES COUNCIL

MAP_W


North
Mirfield Moor
Northorpe
Nab
Stocks Bank
Battyford
Towngate
New Scarboro'
East Thorpe
MIRFIELD
Lower Hopton
MIRFIELD CP
North Moor
421000
420000
419000
Scale 1:10,000
LEGEND
Choose Option
Council boundary
Main River
Detailed River Network
Risk of Flooding from Rivers & Sea (Defended)
Level of Risk
High
Medium
Low
Very low
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JBA consulting
Kirklees COUNCIL
STRATEGIC FLOOD RISK ASSESSMENT
For
KIRKLEES COUNCIL
MAP_W

Kirklees Council
Planning and Development Service
PO Box 1720
Huddersfield

Pre-Application Consultation Request

Town and Country Planning Act 1990

Observations By:	**KC, Lead Local Flood Authority**

Application No.	**2025/20746**
Proposed Development:	**Pre application for residential development**
Location:	**Land off, Woodward Court, Mirfield, WF14 0PY**
Applicant/Agent:	**Paul Butler PB Planning Ltd**
Planning Officer	**Katie Chew**

Your comments on the above proposal are requested. Please e-mail your comments to the DC Admin in either a Microsoft Word or PDF Document to DC.Admin@kirklees.gov.uk by 26-Aug-2025.

The submitted plans and documents for the application can be viewed using Documents from Anite or Anite, please use the application number above.

If I do not receive your response by 26-Aug-2025 then the application may be decided without the benefit of your views.

Dated: 12-Aug-2025

Mathias Franklin
Head of Planning and Development

Kirklees Council
Planning and Development Service
PO Box 1720
Huddersfield

Consultation Response from KC, Lead Local Flood Authority		
2025/20746 at Land off, Woodward Court, Mirfield, WF14 0PY		
Pre application for residential development		
Date Responded: 19th September 2025	**Responding Officer: Paul Farndale**	**Responding Ref:**

Contours

The site falls roughly north to south with a gradient of 1 in 20 to 1 in 23.

Main River Flood Risk

This site is in main river flood zone 1 – low risk.

Sequential Test/Flood Risk Assessment

A sequential test is not necessary. The site is greater than 1 hectare and therefore an official 'full' flood risk assessment is required. We expect this will concentrate on the use of infiltration techniques (see comments in later sections) and flood routing.

Water Features

There are no known watercourses or ponds etc shown on site and in the immediate vicinity of the site.

Surface Water Flood Risk

3rd generation surface water flood risk mapping does not identify any concerns for the site in the 1 in 30 and 1 in 100 return periods which are relevant to lifespan of a site for housing development. The 1 in 1000-year return period does show a linear pattern north to south which suggests a shallow valley that may collect run off from an undeveloped site. The FRA should examine flood routing before a layout is designed so that it can manage blockage scenarios and exceedance events by routing water along roads and open space, avoiding property curtilage.

4th generation surface water flood risk mapping shows some ponding of water at the southern border. Given previous applications on this site we believe that some protection to existing properties along the boundaries of the site to hold exceedance flows and blockage scenarios in safe places on site and any overspill onto Hepworth Lane is expected.

Flood Incidents

Although we have no significant flood incidents recorded on our database. The LLFA is aware of water ingress at a property on Hepworth Lane that we believe was caused by flows along the highway adjacent to the property and not the development site.

Kirklees Council
Planning and Development Service
PO Box 1720
Huddersfield

Surface Water Disposal

In line with the hierarchy of disposal, infiltration techniques should be examined before a direct or indirect connection to watercourse. Only when these have been discounted and agreed with the LLFA can a connection to public sewer be considered.

Infiltration Techniques

This site is shown as category 1 in the British Geological Survey (highly likely to be suitable). The indicative layout provided shows and attenuation basin, so we assume soakaways are not intended.

However previous application on this site had extensive soakaway testing using triple test techniques with bowsers at several locations and submitted information that demonstrated soakaways were viable in accordance with recognised testing procedures.

The above application is available to view on planning portal. We expect these test results to be analysed in the new flood risk assessment and a demonstration alongside any new testing that has taken place as to why conclusions are different and a robust defence of said conclusion.

Due to the age of the previous testing and other such projects in the district subsequently, Kirklees LLFA would also seek a competent person to assess the contribution of previous coal mining works on soakaway tests and any remediation such as grouting that could affect infiltration techniques testing on the undeveloped site to the developed site.

We also expect a competent person to look at re-emergence where there is shallow bedrock. There is a possibility that testing runs laterally along bedrock but may not re-emerge, whereas the volumes of water on a fully developed site may re-emerge if fissures are relied upon rather than free draining strata. Cross sections of strata based on boreholes and trial pits are now expected to be presented and analysed by a geo-hydrologist. Where fissures are relied upon and given experience within the district, soakaways should consist of wide linear trenches where practicable or manhole styled soakaways with linear spokes to spread flows over a wide area. This could also be achieved by connecting individual soakaways.

We are aware that for the statutory undertaker to adopt soakaways there need to be accessible and therefore those in back gardens would remain private. For the long-term viability of soakaways, a management company must be set up to with a maintenance/management and replacement programme under section 106 of the Town and Country Planning Act. Any such agreement can be null and void upon adoption.

Highway drainage soakaways may need to be separated. Early discussion with Yorkshire Water or NAV and the Highways Authority are necessary as space will be required that is not considered in the indicative layout plan.

Watercourse

There are no known watercourses in the immediate vicinity of the site.

Kirklees Council
Planning and Development Service
PO Box 1720
Huddersfield

Public Sewers

Although there are surface water sewers located in Hepworth Close and Hepworth Drive, these appear to be transitional sewers, i.e. they connect to a combined system downstream.

A 150mm and a 225mm public combined sewer is located immediately to the site's southern border with Hepworth Lane. We advise the applicant to contact Yorkshire Water for pre-planning advice to see if these sewers are suitable for a restricted 3.5l/s connection from site given they are small diameter. A 300mm combined sewer is located 100m from the site in Flash Lane and maybe Yorkshire Water's preferred connection point. A 225mm surface water sewer is also located in Flash Lane. This is shown 170m from the site but there is a possibility that unmapped section may run closer. This surface water sewer appears to connect to a 300mm combined sewer in Shillbank Lane but I would suggest this is verified as another surface water sewer is positioned metres away from the connection point shown.

Flood Routing

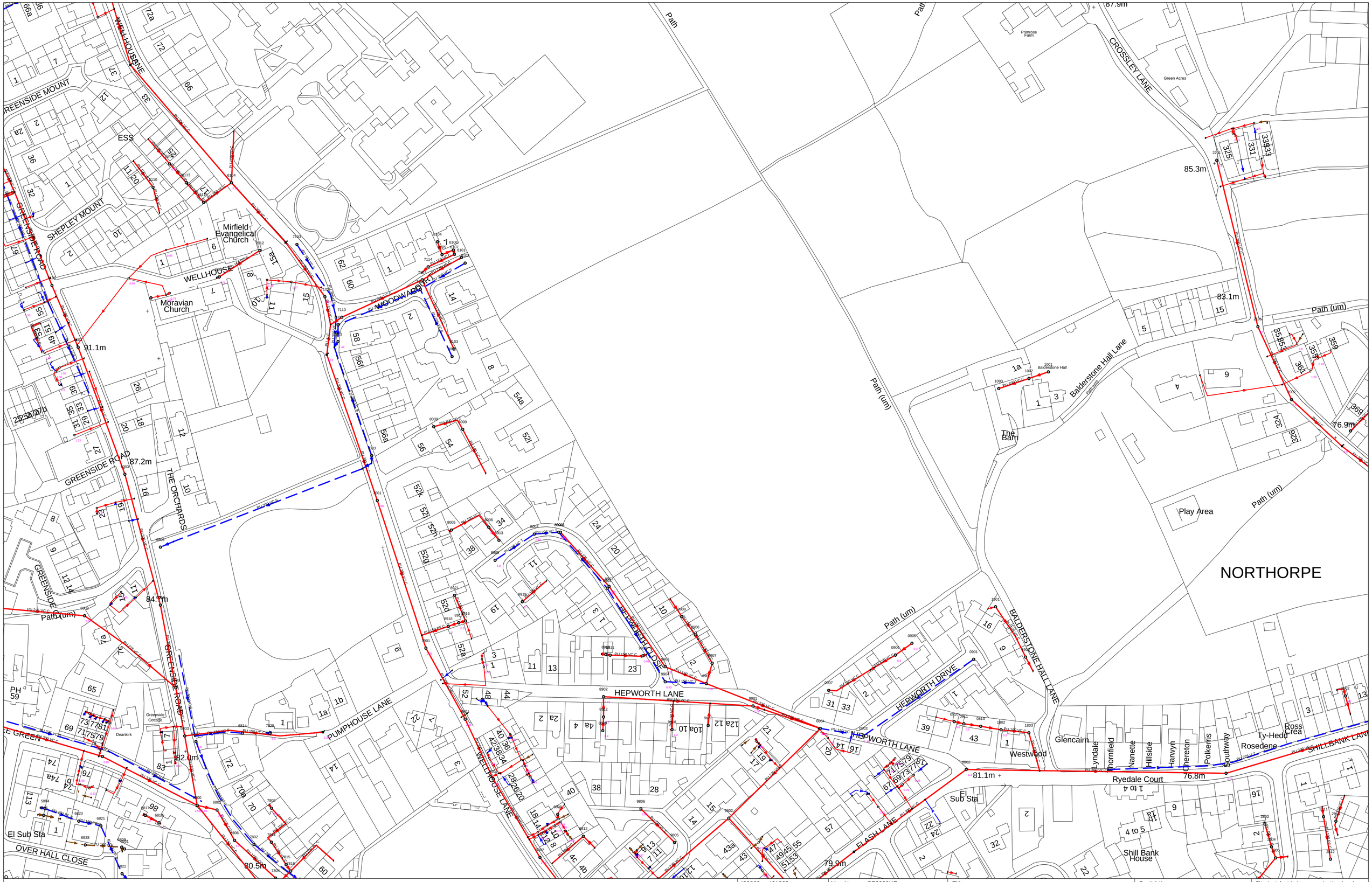
We expect the layout to be designed with flood routing in mind. This could be an exceedance event or blockage scenario where water is surcharging the drainage system and running overland. Main flow routes should avoid property curtilage and use roads and open space. Where water would go if a storm event hit a saturated undeveloped field needs to be considered in this design, i.e. the southern border. Where existing houses can be better protected without making it worse for others, as safe off-site route into the highway should be considered.

Section 106 – Management Company

Under NPPF there is an obligation for the LPA to ensure the adequate management of SUDS (surface water drainage) for the lifetime of the site. This includes from installation. A management company should be set up under Section 106 of the Town and Country Planning Act 1990 with a maintenance and management plan based on the latest CIRIA guide to SUDS but bespoke to the site, agreed by condition. The Section 106 agreement will have a breakout clause for when surface water infrastructure is adopted by Highways Authority, Statutory Undertaker and/or NAV equivalent.

Eastwood
CONSULTING ENGINEERS

APPENDIX 6



420862 : 421005	Map Name : SE2020NE	Title	Partial Key
YorkshireWater Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : G Mullaney Contact Tel :	Notes	(Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2024. All rights reserved Ordnance Survey Licence number AC0000813445	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS Date Req : 09/05/2025, 14:08:35 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 : 09/05/2025, 14:15:32

UPN: Undefined Originator: G Mullaney, ,

YorkshireWater

Yorkshire Water Services
Land and Property
Western House
Western Way
Halifax Road
Bradford
BD6 2SZ

Tel: 0345 120 8482
Fax:

Email:
technical.sewerage@yorkshirewater.co.uk

Eastwood Consulting Engineers
St Andrew's House; 23 Kingfield Road
Sheffield
S11 9AS

Your Ref:
Our Ref: A007933

For telephone enquiries ring:
George Mullaney on 0345 120 8482

9th May 2025

Dear Ms Stevenson-Steels,

Woodward Court (land off) Mirfield WF14 0PY - Pre-Planning Sewerage Enquiry V881026

Thank you for your recent enquiry. Our charge of £488.00 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.

The closest practicable point of discharge for foul will be the 225mm diameter combined public sewer in Hepworth Lane, to the south of the site, but at present it does not have

adequate capacity available to accommodate the anticipated foul water discharge from the proposed site. Subject to the submission of a Formal Planning Application and robust build plan and start date, Yorkshire Water will carry out a feasibility study to determine suitable foul connection points, any available capacity in the public sewer network, together with timescales for any potential upgrading works required.

The cost for any feasibility/modelling/upgrade works will be at Yorkshire Waters cost up-front and recouped via the sites eventual infrastructure charges.

What are infrastructure charges?

We levy infrastructure charges for all newly connected properties that have not been connected to our water or sewer network before. The charges are calculated to recover the cost of reinforcing our existing water and sewer networks needed to serve new developments. The charges are set to recover the costs over the whole of the Yorkshire Water area to increase capacity.

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.

The public sewer network does not have any capacity available to accept any discharge of surface water from the proposal. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority with a view to establishing a suitable watercourse for discharge.

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.

YorkshireWater

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 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 are valid for a period of 12 months. 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
Town Planning Technician

Eastwood
CONSULTING ENGINEERS

APPENDIX 7

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
S1	0.173	5.00	96.350	1200	420850.581	421153.002	1.425	94.925
S2			96.100	1200	420864.614	421145.688	1.960	94.140
S3	0.062	5.00	95.700	1200	420874.491	421131.738	2.460	93.240
S4	0.222	5.00	94.550	1350	420882.873	421112.936	2.370	92.180
S5	0.083	5.00	91.000	1350	420911.390	421063.196	1.650	89.350
S6	0.082	5.00	90.100	1350	420924.173	421042.185	1.870	88.230
S7	0.078	5.00	88.950	1350	420950.863	421022.635	1.820	87.130
S8	0.065	5.00	88.350	1350	420958.576	421013.179	1.730	86.620
S9	0.040	5.00	87.550	1350	420968.661	420994.530	1.725	85.825
S10	0.216	5.00	86.900	1350	420972.806	420977.847	1.725	85.175
S11			86.700	1350	420985.868	420978.064	1.950	84.750
S12	0.214	5.00	92.450	1350	420998.275	421111.368	1.500	90.950
S13	0.062	5.00	91.550	1350	420947.416	421083.439	1.575	89.975
S14	0.078	5.00	91.850	1200	421022.853	421095.413	1.350	90.500
S15			90.700	1200	421034.579	421072.446	1.700	89.000
S16	0.045	5.00	90.400	1200	421031.799	421055.464	2.140	88.260
S17	0.089	5.00	89.700	1200	421021.745	421047.891	1.680	88.020
S18	0.039	5.00	88.850	1200	421003.913	421041.811	1.270	87.580
S19	0.025	5.00	86.000	1200	420976.793	420963.111	1.050	84.950
S20			84.500	1200	420971.742	420932.034	1.050	83.450
S21	0.009	5.00	84.300	1200	420977.887	420928.278	0.920	83.380
Atten	0.360	5.00	85.000	1350	421025.045	420958.495	1.720	83.280
Outfall			85.000	1350	421028.086	420944.092	1.000	84.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	15.820	0.600	94.925	94.140	0.785	20.2	225	5.09	48.9
1.001	S2	S3	17.093	0.600	94.140	93.320	0.820	20.8	225	5.19	48.5
1.002	S3	S4	20.586	0.600	93.240	92.260	0.980	21.0	300	5.29	48.2
1.003	S4	S5	57.335	0.600	92.180	89.425	2.755	20.8	375	5.53	47.4
2.000	S12	S13	58.023	0.600	90.950	90.050	0.900	64.5	300	5.49	47.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.928	116.4	30.6	1.200	1.735	0.173	0.0
1.001	2.878	114.4	30.3	1.735	2.155	0.173	0.0
1.002	3.445	243.5	40.9	2.160	1.990	0.235	0.0
1.003	3.986	440.3	78.2	1.995	1.200	0.457	0.0
2.000	1.961	138.6	36.7	1.200	1.200	0.214	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.001	S13	S5	41.324	0.600	89.975	89.425	0.550	75.1	375	5.82	46.3
1.004	S5	S6	28.003	0.600	89.350	88.230	1.120	25.0	450	5.94	46.0
1.005	S6	S7	33.084	0.600	88.230	87.130	1.100	30.1	450	6.09	45.5
1.006	S7	S8	12.203	0.600	87.130	86.700	0.430	28.4	450	6.14	45.3
3.000	S14	S15	25.787	0.600	90.500	89.080	1.420	18.2	150	5.18	48.6
3.001	S15	S16	17.208	0.600	89.000	88.340	0.660	26.1	225	5.29	48.2
3.002	S16	S17	12.587	0.600	88.260	88.020	0.240	52.4	225	5.41	47.8
3.003	S17	S18	18.840	0.600	88.020	87.660	0.360	52.3	300	5.55	47.3
3.004	S18	S8	53.621	0.600	87.580	86.770	0.810	66.2	375	5.95	45.9
1.007	S8	S9	21.201	0.600	86.620	85.825	0.795	26.7	525	6.22	45.0
1.008	S9	S10	17.190	0.600	85.825	85.175	0.650	26.4	525	6.29	44.8
1.009	S10	S11	13.064	0.600	85.175	84.750	0.425	30.7	525	6.34	44.6
1.010	S11	Atten	18.700	0.600	84.750	83.360	1.390	13.5	525	6.39	44.5
4.000	S19	S20	31.485	0.600	84.950	83.450	1.500	21.0	150	5.24	48.4
4.001	S20	S21	7.202	0.600	83.450	83.380	0.070	102.9	150	5.36	48.0
4.002	S21	Atten	10.000	0.600	83.380	83.280	0.100	100.0	150	5.52	47.4
1.011	Atten	Outfall	5.000	0.600	84.060	84.000	0.060	83.3	525	6.42	44.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
2.001	2.092	231.0	46.2	1.200	1.200	0.276	0.0
1.004	4.078	648.6	135.7	1.200	1.420	0.816	0.0
1.005	3.717	591.2	147.5	1.420	1.370	0.898	0.0
1.006	3.827	608.7	159.7	1.370	1.200	0.976	0.0
3.000	2.374	42.0	13.7	1.200	1.470	0.078	0.0
3.001	2.572	102.3	13.6	1.475	1.835	0.078	0.0
3.002	1.810	72.0	21.2	1.915	1.455	0.123	0.0
3.003	2.178	153.9	36.2	1.380	0.890	0.212	0.0
3.004	2.229	246.2	41.6	0.895	1.205	0.251	0.0
1.007	4.349	941.5	210.2	1.205	1.200	1.292	0.0
1.008	4.367	945.4	215.7	1.200	1.200	1.332	0.0
1.009	4.050	876.7	249.8	1.200	1.425	1.548	0.0
1.010	6.129	1326.7	248.9	1.425	1.115	1.548	0.0
4.000	2.208	39.0	4.4	0.900	0.900	0.025	0.0
4.001	0.990	17.5	4.3	0.900	0.770	0.025	0.0
4.002	1.005	17.8	5.8	0.770	1.570	0.034	0.0
1.011	2.455	531.4	311.4	0.415	0.475	1.942	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.820	20.2	225	Circular	96.350	94.925	1.200	96.100	94.140	1.735
1.001	17.093	20.8	225	Circular	96.100	94.140	1.735	95.700	93.320	2.155
1.002	20.586	21.0	300	Circular	95.700	93.240	2.160	94.550	92.260	1.990
1.003	57.335	20.8	375	Circular	94.550	92.180	1.995	91.000	89.425	1.200
2.000	58.023	64.5	300	Circular	92.450	90.950	1.200	91.550	90.050	1.200
2.001	41.324	75.1	375	Circular	91.550	89.975	1.200	91.000	89.425	1.200
1.004	28.003	25.0	450	Circular	91.000	89.350	1.200	90.100	88.230	1.420
1.005	33.084	30.1	450	Circular	90.100	88.230	1.420	88.950	87.130	1.370
1.006	12.203	28.4	450	Circular	88.950	87.130	1.370	88.350	86.700	1.200
3.000	25.787	18.2	150	Circular	91.850	90.500	1.200	90.700	89.080	1.470
3.001	17.208	26.1	225	Circular	90.700	89.000	1.475	90.400	88.340	1.835
3.002	12.587	52.4	225	Circular	90.400	88.260	1.915	89.700	88.020	1.455
3.003	18.840	52.3	300	Circular	89.700	88.020	1.380	88.850	87.660	0.890
3.004	53.621	66.2	375	Circular	88.850	87.580	0.895	88.350	86.770	1.205
1.007	21.201	26.7	525	Circular	88.350	86.620	1.205	87.550	85.825	1.200
1.008	17.190	26.4	525	Circular	87.550	85.825	1.200	86.900	85.175	1.200
1.009	13.064	30.7	525	Circular	86.900	85.175	1.200	86.700	84.750	1.425
1.010	18.700	13.5	525	Circular	86.700	84.750	1.425	85.000	83.360	1.115
4.000	31.485	21.0	150	Circular	86.000	84.950	0.900	84.500	83.450	0.900
4.001	7.202	102.9	150	Circular	84.500	83.450	0.900	84.300	83.380	0.770
4.002	10.000	100.0	150	Circular	84.300	83.380	0.770	85.000	83.280	1.570
1.011	5.000	83.3	525	Circular	85.000	84.060	0.415	85.000	84.000	0.475

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	1200	Manhole	Adoptable	S2	1200	Manhole	Adoptable
1.001	S2	1200	Manhole	Adoptable	S3	1200	Manhole	Adoptable
1.002	S3	1200	Manhole	Adoptable	S4	1350	Manhole	Adoptable
1.003	S4	1350	Manhole	Adoptable	S5	1350	Manhole	Adoptable
2.000	S12	1350	Manhole	Adoptable	S13	1350	Manhole	Adoptable
2.001	S13	1350	Manhole	Adoptable	S5	1350	Manhole	Adoptable
1.004	S5	1350	Manhole	Adoptable	S6	1350	Manhole	Adoptable
1.005	S6	1350	Manhole	Adoptable	S7	1350	Manhole	Adoptable
1.006	S7	1350	Manhole	Adoptable	S8	1350	Manhole	Adoptable
3.000	S14	1200	Manhole	Adoptable	S15	1200	Manhole	Adoptable
3.001	S15	1200	Manhole	Adoptable	S16	1200	Manhole	Adoptable
3.002	S16	1200	Manhole	Adoptable	S17	1200	Manhole	Adoptable
3.003	S17	1200	Manhole	Adoptable	S18	1200	Manhole	Adoptable
3.004	S18	1200	Manhole	Adoptable	S8	1350	Manhole	Adoptable
1.007	S8	1350	Manhole	Adoptable	S9	1350	Manhole	Adoptable
1.008	S9	1350	Manhole	Adoptable	S10	1350	Manhole	Adoptable
1.009	S10	1350	Manhole	Adoptable	S11	1350	Manhole	Adoptable
1.010	S11	1350	Manhole	Adoptable	Atten	1350	Manhole	Adoptable
4.000	S19	1200	Manhole	Adoptable	S20	1200	Manhole	Adoptable
4.001	S20	1200	Manhole	Adoptable	S21	1200	Manhole	Adoptable
4.002	S21	1200	Manhole	Adoptable	Atten	1350	Manhole	Adoptable
1.011	Atten	1350	Manhole	Adoptable	Outfall	1350	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	20.0		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Node Atten Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.13932	Safety Factor	2.0	Invert Level (m)	83.060
Side Inf Coefficient (m/hr)	0.13932	Porosity	1.00	Time to half empty (mins)	376

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1002.0	1002.0	1.000	1610.0	1623.2	1.001	0.0	1623.2

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	94.987	0.062	18.4	0.2214	0.0000	OK
15 minute summer	S2	10	94.203	0.063	18.2	0.0711	0.0000	OK
15 minute summer	S3	10	93.306	0.066	24.6	0.1085	0.0000	OK
15 minute summer	S4	11	92.264	0.084	48.0	0.2770	0.0000	OK
15 minute summer	S5	11	89.462	0.112	84.4	0.2723	0.0000	OK
15 minute summer	S6	11	88.352	0.122	92.9	0.2810	0.0000	OK
15 minute summer	S7	11	87.269	0.139	101.2	0.3192	0.0000	OK
15 minute summer	S8	11	86.762	0.142	134.0	0.3097	0.0000	OK
15 minute summer	S9	11	85.968	0.143	138.1	0.2701	0.0000	OK
15 minute summer	S10	11	85.351	0.176	160.0	0.6938	0.0000	OK
15 minute summer	S11	11	84.883	0.133	159.9	0.1902	0.0000	OK
15 minute summer	S12	11	91.032	0.082	22.7	0.3502	0.0000	OK
15 minute summer	S13	11	90.065	0.090	28.4	0.2007	0.0000	OK
15 minute summer	S14	10	90.546	0.046	8.3	0.1048	0.0000	OK
15 minute summer	S15	10	89.044	0.044	8.2	0.0496	0.0000	OK
15 minute summer	S16	10	88.326	0.066	12.9	0.1022	0.0000	OK
15 minute summer	S17	10	88.100	0.080	22.3	0.1748	0.0000	OK
15 minute summer	S18	11	87.663	0.083	26.0	0.1452	0.0000	OK
15 minute summer	S19	10	84.977	0.027	2.7	0.0426	0.0000	OK
15 minute summer	S20	11	83.491	0.041	2.6	0.0461	0.0000	OK
15 minute summer	S21	11	83.427	0.047	3.5	0.0627	0.0000	OK
360 minute summer	Atten	232	83.209	-0.071	66.2	156.1966	0.0000	OK
15 minute summer	Outfall	1	84.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S2	18.2	2.029	0.157	0.1421	
15 minute summer	S2	1.001	S3	18.1	2.057	0.158	0.1501	
15 minute summer	S3	1.002	S4	24.5	2.179	0.100	0.2313	
15 minute summer	S4	1.003	S5	47.5	2.626	0.108	1.0372	
15 minute summer	S5	1.004	S6	84.6	2.598	0.130	0.9128	
15 minute summer	S6	1.005	S7	93.2	2.445	0.158	1.2627	
15 minute summer	S7	1.006	S8	101.3	2.647	0.166	0.4673	
15 minute summer	S8	1.007	S9	134.0	2.843	0.142	0.9997	
15 minute summer	S9	1.008	S10	138.1	2.497	0.146	0.9528	
15 minute summer	S10	1.009	S11	159.9	3.018	0.182	0.6951	
15 minute summer	S11	1.010	Atten	159.6	3.978	0.120	0.7509	
15 minute summer	S12	2.000	S13	22.1	1.443	0.160	0.8895	
15 minute summer	S13	2.001	S5	28.5	1.425	0.123	0.8272	
15 minute summer	S14	3.000	S15	8.2	1.819	0.195	0.1157	
15 minute summer	S15	3.001	S16	8.1	1.521	0.079	0.0916	
15 minute summer	S16	3.002	S17	12.8	1.154	0.178	0.1401	
15 minute summer	S17	3.003	S18	22.0	1.519	0.143	0.2735	
15 minute summer	S18	3.004	S8	26.1	1.462	0.106	0.9583	
15 minute summer	S19	4.000	S20	2.6	0.914	0.067	0.0930	
15 minute summer	S20	4.001	S21	2.6	0.607	0.149	0.0310	
15 minute summer	S21	4.002	Atten	3.5	0.766	0.199	0.0461	
360 minute summer	Atten	1.011	Outfall	0.0	0.000	0.000	0.0000	0.0
360 minute summer	Atten	Infiltration		20.6				

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.98%

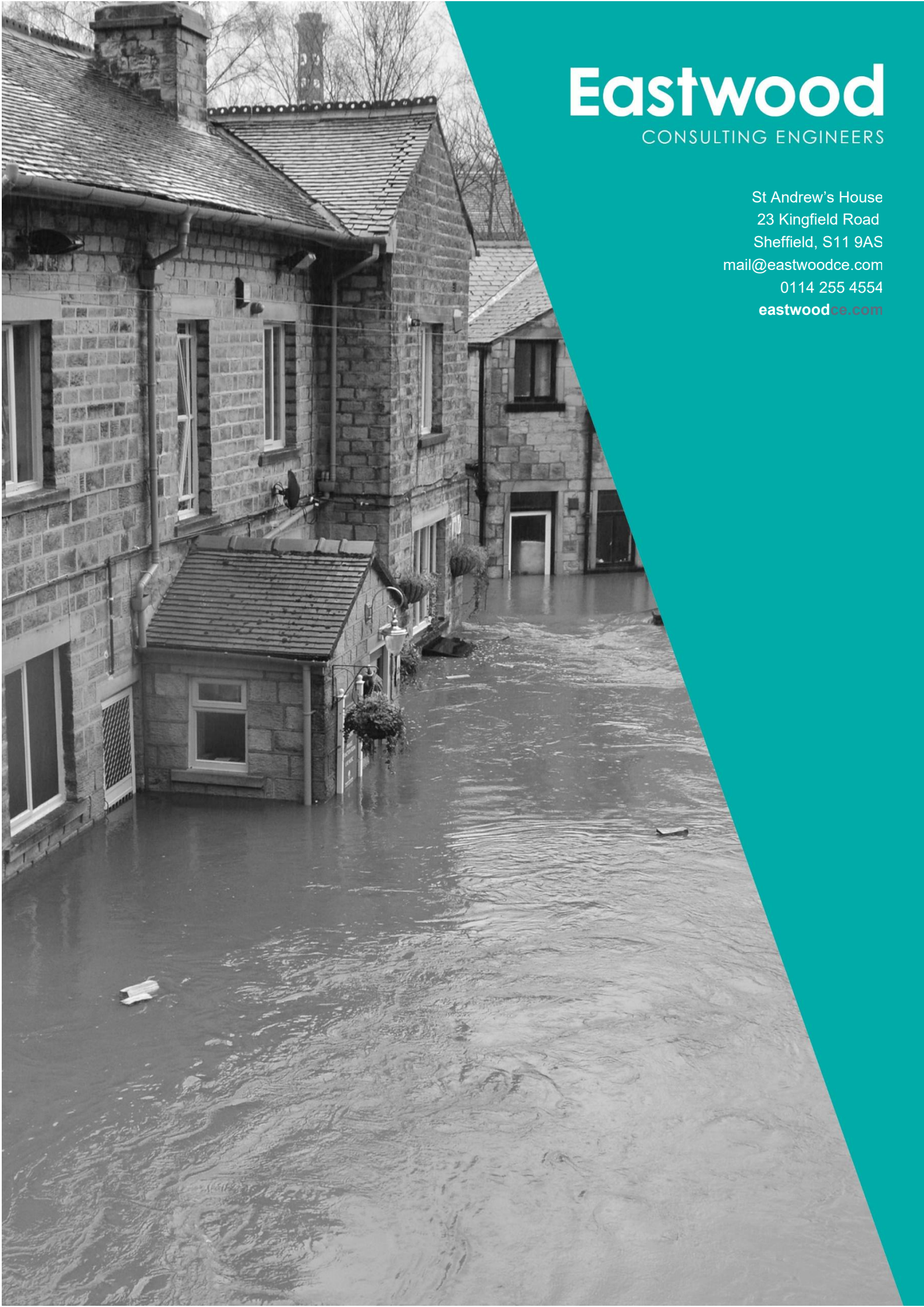
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	95.066	0.141	73.5	0.5022	0.0000	OK
15 minute summer	S2	10	94.284	0.144	73.1	0.1626	0.0000	OK
15 minute summer	S3	10	93.384	0.144	98.9	0.2357	0.0000	OK
15 minute summer	S4	10	92.359	0.179	192.8	0.5902	0.0000	OK
15 minute summer	S5	10	89.601	0.251	340.1	0.6111	0.0000	OK
15 minute summer	S6	11	88.508	0.278	373.2	0.6423	0.0000	OK
15 minute summer	S7	11	87.481	0.351	407.1	0.8034	0.0000	OK
15 minute summer	S8	11	86.955	0.335	540.1	0.7306	0.0000	OK
15 minute summer	S9	11	86.187	0.362	558.0	0.6868	0.0000	OK
15 minute summer	S10	11	85.630	0.455	647.1	1.7906	0.0000	OK
15 minute summer	S11	11	85.065	0.315	648.0	0.4508	0.0000	OK
15 minute summer	S12	10	91.131	0.181	91.0	0.7770	0.0000	OK
15 minute summer	S13	11	90.171	0.196	115.0	0.4359	0.0000	OK
15 minute summer	S14	10	90.606	0.106	33.2	0.2416	0.0000	OK
15 minute summer	S15	10	89.093	0.093	32.8	0.1048	0.0000	OK
15 minute summer	S16	10	88.422	0.162	51.8	0.2507	0.0000	OK
15 minute summer	S17	10	88.201	0.181	89.3	0.3962	0.0000	OK
15 minute summer	S18	10	87.756	0.176	105.0	0.3065	0.0000	OK
15 minute summer	S19	10	85.003	0.053	10.6	0.0855	0.0000	OK
180 minute winter	S20	176	83.570	0.120	2.4	0.1353	0.0000	OK
180 minute winter	S21	176	83.570	0.190	3.3	0.2516	0.0000	SURCHARGED
180 minute winter	Atten	176	83.570	0.290	185.2	591.1554	0.0000	OK
15 minute summer	Outfall	1	84.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S2	73.1	2.760	0.628	0.4191	
15 minute summer	S2	1.001	S3	72.6	2.881	0.634	0.4303	
15 minute summer	S3	1.002	S4	98.4	3.116	0.404	0.6501	
15 minute summer	S4	1.003	S5	192.1	3.753	0.436	2.9357	
15 minute summer	S5	1.004	S6	339.9	3.513	0.524	2.7088	
15 minute summer	S6	1.005	S7	375.3	3.171	0.635	3.8969	
15 minute summer	S7	1.006	S8	408.9	3.539	0.672	1.4008	
15 minute summer	S8	1.007	S9	541.8	3.568	0.576	3.2255	
15 minute summer	S9	1.008	S10	559.3	3.123	0.592	3.0756	
15 minute summer	S10	1.009	S11	648.0	3.819	0.739	2.1822	
15 minute summer	S11	1.010	Atten	648.1	5.435	0.489	2.2288	
15 minute summer	S12	2.000	S13	88.9	2.065	0.641	2.5062	
15 minute summer	S13	2.001	S5	115.4	2.055	0.499	2.3211	
15 minute summer	S14	3.000	S15	32.8	2.551	0.781	0.3313	
15 minute summer	S15	3.001	S16	32.6	2.208	0.319	0.2540	
15 minute summer	S16	3.002	S17	51.4	1.591	0.715	0.4074	
15 minute summer	S17	3.003	S18	88.4	2.137	0.574	0.7816	
15 minute summer	S18	3.004	S8	104.9	2.048	0.426	2.7827	
15 minute summer	S19	4.000	S20	10.5	1.244	0.269	0.2708	
180 minute winter	S20	4.001	S21	2.4	0.609	0.137	0.1176	
180 minute winter	S21	4.002	Atten	3.3	0.735	0.186	0.1760	
180 minute winter	Atten	1.011	Outfall	0.0	0.000	0.000	0.0000	0.0
180 minute winter	Atten	Infiltration		25.2				

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	11	95.845	0.920	135.9	3.2752	0.0000	SURCHARGED
15 minute summer	S2	12	94.700	0.560	121.6	0.6337	0.0000	SURCHARGED
15 minute summer	S3	11	93.439	0.199	166.7	0.3256	0.0000	OK
15 minute summer	S4	11	92.488	0.308	333.6	1.0172	0.0000	OK
15 minute summer	S5	12	91.000	1.650	561.8	4.0211	2.3115	FLOOD
15 minute summer	S6	12	90.085	1.855	562.2	4.2809	0.0000	FLOOD RISK
15 minute summer	S7	12	88.819	1.689	605.2	3.8671	0.0000	FLOOD RISK
15 minute summer	S8	12	88.033	1.413	794.7	3.0843	0.0000	SURCHARGED
15 minute summer	S9	12	87.112	1.287	822.3	2.4387	0.0000	SURCHARGED
15 minute summer	S10	11	86.255	1.080	970.8	4.2508	0.0000	SURCHARGED
15 minute summer	S11	11	85.191	0.441	965.4	0.6307	0.0000	OK
15 minute summer	S12	12	92.364	1.414	168.1	6.0577	0.0000	FLOOD RISK
15 minute summer	S13	12	91.380	1.405	187.0	3.1180	0.0000	FLOOD RISK
15 minute summer	S14	12	91.659	1.159	61.2	2.6511	0.0000	FLOOD RISK
15 minute summer	S15	12	89.349	0.349	50.7	0.3942	0.0000	SURCHARGED
15 minute summer	S16	12	89.157	0.897	82.0	1.3920	0.0000	SURCHARGED
15 minute summer	S17	12	88.790	0.770	148.1	1.6860	0.0000	SURCHARGED
15 minute summer	S18	12	88.425	0.845	174.9	1.4753	0.0000	SURCHARGED
15 minute summer	S19	10	85.025	0.075	19.7	0.1208	0.0000	OK
360 minute winter	S20	344	84.026	0.576	2.7	0.6514	0.0000	SURCHARGED
360 minute winter	S21	344	84.026	0.646	3.4	0.8571	0.0000	FLOOD RISK
360 minute winter	Atten	344	84.026	0.746	205.6	1255.4720	0.0000	OK
15 minute summer	Outfall	1	84.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S2	121.6	3.058	1.045	0.6292	
15 minute summer	S2	1.001	S3	120.7	3.036	1.055	0.6794	
15 minute summer	S3	1.002	S4	167.0	3.422	0.686	1.1019	
15 minute summer	S4	1.003	S5	322.4	3.888	0.732	5.9373	
15 minute summer	S5	1.004	S6	500.6	3.477	0.772	4.4369	
15 minute summer	S6	1.005	S7	549.7	3.470	0.930	5.2419	
15 minute summer	S7	1.006	S8	597.8	3.773	0.982	1.9335	
15 minute summer	S8	1.007	S9	797.6	3.693	0.847	4.5801	
15 minute summer	S9	1.008	S10	824.7	3.818	0.872	3.7136	
15 minute summer	S10	1.009	S11	965.4	4.508	1.101	2.6756	
15 minute summer	S11	1.010	Atten	965.8	5.734	0.728	3.1168	
15 minute summer	S12	2.000	S13	140.7	2.076	1.015	4.0859	
15 minute summer	S13	2.001	S5	180.7	2.008	0.782	4.5579	
15 minute summer	S14	3.000	S15	50.7	2.878	1.207	0.4540	
15 minute summer	S15	3.001	S16	54.1	2.049	0.529	0.6844	
15 minute summer	S16	3.002	S17	80.6	2.028	1.121	0.5006	
15 minute summer	S17	3.003	S18	144.3	2.268	0.937	1.3267	
15 minute summer	S18	3.004	S8	163.8	2.016	0.665	5.9142	
15 minute summer	S19	4.000	S20	19.6	1.393	0.501	0.4161	
360 minute winter	S20	4.001	S21	2.4	0.582	0.137	0.1268	
360 minute winter	S21	4.002	Atten	3.2	0.669	0.181	0.1760	
360 minute winter	Atten	1.011	Outfall	0.0	0.000	0.000	0.0000	0.0
360 minute winter	Atten	Infiltration		31.0				



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