

Bradford Level 2 Strategic Flood Risk Assessment - Site H270

Final Draft

May 2025

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

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Contract

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JBA Project Code	2024s1078

This report describes work commissioned by City of Bradford Metropolitan District Council (CBMDC) by an instruction dated 19 July 2024. The Client's representative for the contract was Jonathan Dicken of CBMDC. Dominic Richardson of JBA Consulting carried out this work.

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Acknowledgements

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1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for the City of Bradford Metropolitan District Council (CBMDC) Local Plan Site H270. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'CBMDC Level 1 SFRA' (2023) and read the 'CBMDC Level 2 SFRA Main Report' (2024) and is therefore familiar with the terminology used in this report.

1.1 Site H270

- Location: Cullingworth Mill
- Existing site use: Commercial and car parking
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Watercourse: N/A
- Environment Agency (EA) model: N/A
- Site area: 1.2 hectares
- Proposed development impermeable area: 1.0 hectares
- Summary of requirements from scoping stage:
 - Level 1 SFRA recommendation was for withdrawal from allocation or more detailed assessment through Level 2 SFRA
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk
 - Modelling of latest EA climate change allowances for peak rainfall intensities

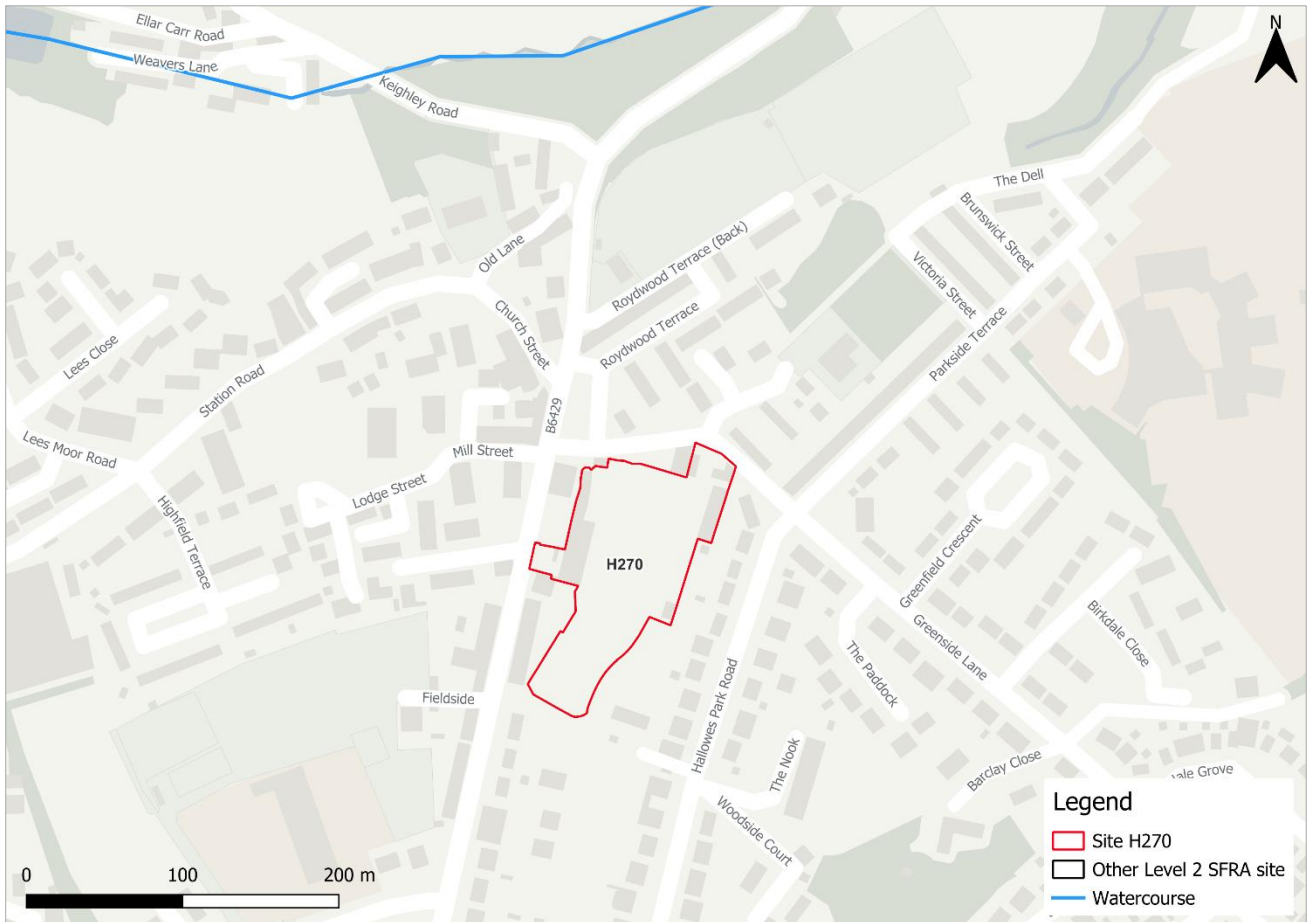


Figure 1-1: Existing site location boundary



Figure 1-2: Topography



Figure 1-3: Soils and geology

2 Flood risk from rivers

2.1 Existing risk

2.1.1 Flood Map for Planning and functional floodplain

Based on the EA's Flood Map for Planning and Flood Zone 3b (functional floodplain), as updated in this Level 2 SFRA, the percentage areas of the site within each fluvial flood zone are stated in Table 2-1 and can be viewed on Figure 2-1. This version of the Flood Map for Planning does not consider flood defence infrastructure (Section 2.3) or the impacts of climate change.

The site is entirely located within Flood Zone 1 indicating it is at low risk of flooding from rivers. Ellar Carr Beck and Manywells Beck are to the north and northeast of the site respectively. Manywells Beck likely flows through the site via a culvert from the south.

Table 2-1: Existing fluvial flood risk based on percentage area of site at risk

Flood Zone 1 (% area)	Flood Zone 2 (% area)	Flood Zone 3a (% area)	Flood Zone 3b (% area)
100	0	0	0



Figure 2-1: Existing risk from rivers to the site

2.2 Flood risk management

2.2.1 Flood defences

The site does not benefit from any formal engineered flood defences, according to the EA's spatial flood defences dataset.

2.2.2 Working with Natural Processes

The EA's Working with Natural Processes (WwNP) dataset has been interrogated to identify opportunities for Natural Flood Management (NFM) to reduce flood risk to the site and surrounding areas. Upstream of the site, to the southwest, there is mapped potential for tree planting in the wider catchment which can intercept, slow, store and filter water. There is also shown to be opportunity for riparian tree planting which can slow flows, reduce sediment delivery to the watercourse and reduce bankside erosion. These areas are shown in Figure 2-2. The WwNP mapping is broadscale and indicative. Further investigation is required for any land shown to have potential for WwNP.

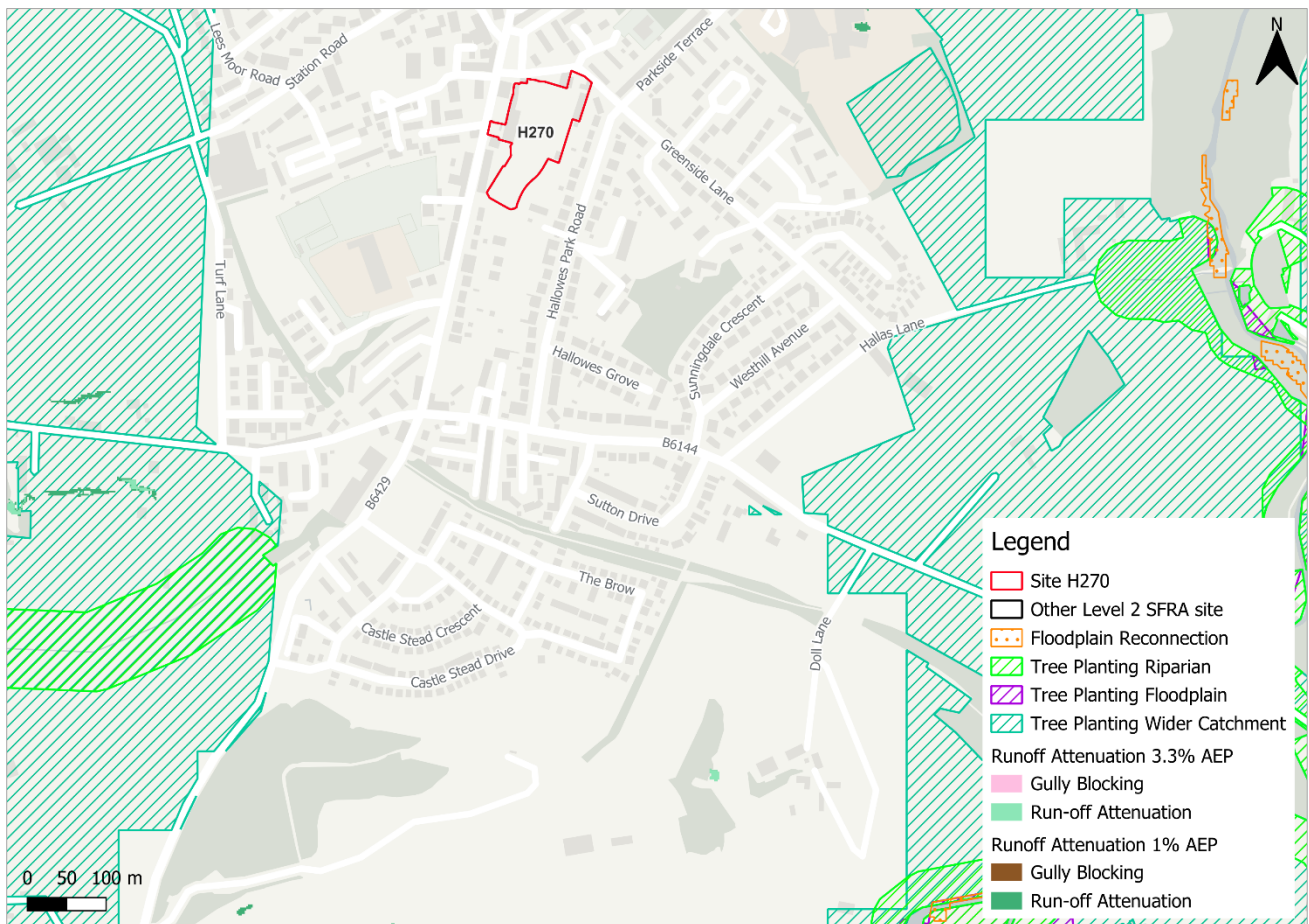


Figure 2-2: Natural Flood Management (NFM) potential mapping

2.3 Historic flood incidents

The EA's Historic Flood Map (HFM) and Recorded Flood Outlines (RFO) datasets have been considered. There are no recorded historic flood events within the vicinity of the site.

2.4 Flood warning and access and escape routes

The EA operates a Flood Warning Service for properties located within a Flood Warning Area (FWA) for when a flood event is expected to occur. The site is not located within a FWA.

Flood alerts may be issued before a flood warning for properties located within a Flood Alert Area (FAA) to provide advance notice of the possibility of flooding. A flood alert may be issued when there is less confidence that flooding will occur in a FWA. This site is not located within an FAA.

Based on available information, safe access and escape routes could likely be achieved during a flood event via multiple points surrounding the site.

2.5 Observations, mitigation options and site suitability - fluvial

- The proposed development of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF.
- Given the change in use and therefore vulnerability of the site, the FRA must show that the development can be designed to be safe and that there is adequate emergency planning provision (para 014 FRCC-PPG).
- The site is wholly located within Flood Zone 1 indicating low risk of flooding to the site from rivers.
- It is likely that Manywells Beck is culverted beneath the site, although it is not shown in any mapping datasets. The Beck is apparent above ground to the south of the site and again to the northeast. Investigations should be carried out as to the location and course of the culvert. No development should take place over the top of a culvert nor within 8m either side of the culverted section of watercourse.
- Manywells Beck should be modelled to quantify the risk from the culvert.
- Assuming the culvert is located beneath the site, opportunities for opening up the culvert should be explored for inclusion in site design as a blue green corridor. This would remove any residual risk of flooding to the site as a result of culvert failure or blockage.

3 Flood risk from surface water

3.1 Existing risk

Based on the EA's national scale Risk of Flooding from Surface Water (RoFSW) map, surface water risk is shown to vary across the site though is significant. Approximately 39% of the site is within the high risk surface water flood zone. A further 4% of the site is at medium risk and a further 15% of the site is at low surface water flood risk, as shown in Table 3-1.

In the high risk event, a surface water flow path is observed to run northwards through the centre of the site, indicating the presence of a culvert underneath the site. This encompasses the majority of the south of the site and a significant proportion of the north of the site. In the medium and low risk events, the surface water flow path can be seen to expand in both extent and depth. Surface water is shown to be present across the majority of the site in the low risk event.

Greatest surface water flood depths in the medium risk event are significant at >1.2 m (Figure 3-1) with some areas of significant hazard in the south of the site, as well as areas of extreme hazard in the north of the site (Figure 3-2). Safe access and escape route should be achievable via the B6429 and Greenside Lane in all events.

Table 3-1: Existing surface water flood risk based on percentage area at risk using the RoFSW map

Very low risk (% area)	Low risk (% area)	Medium risk (% area)	High risk (% area)
42	15	4	39

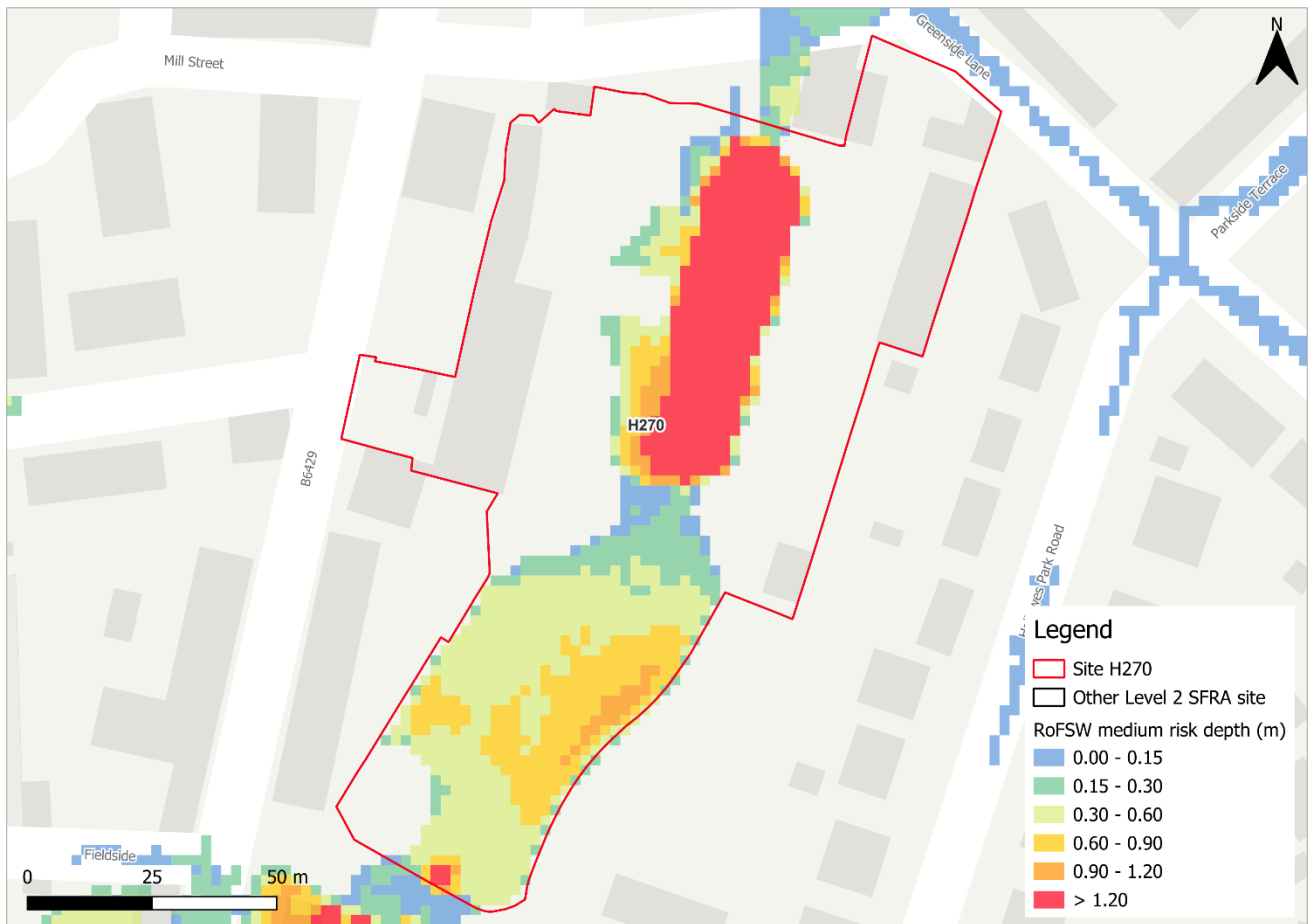


Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

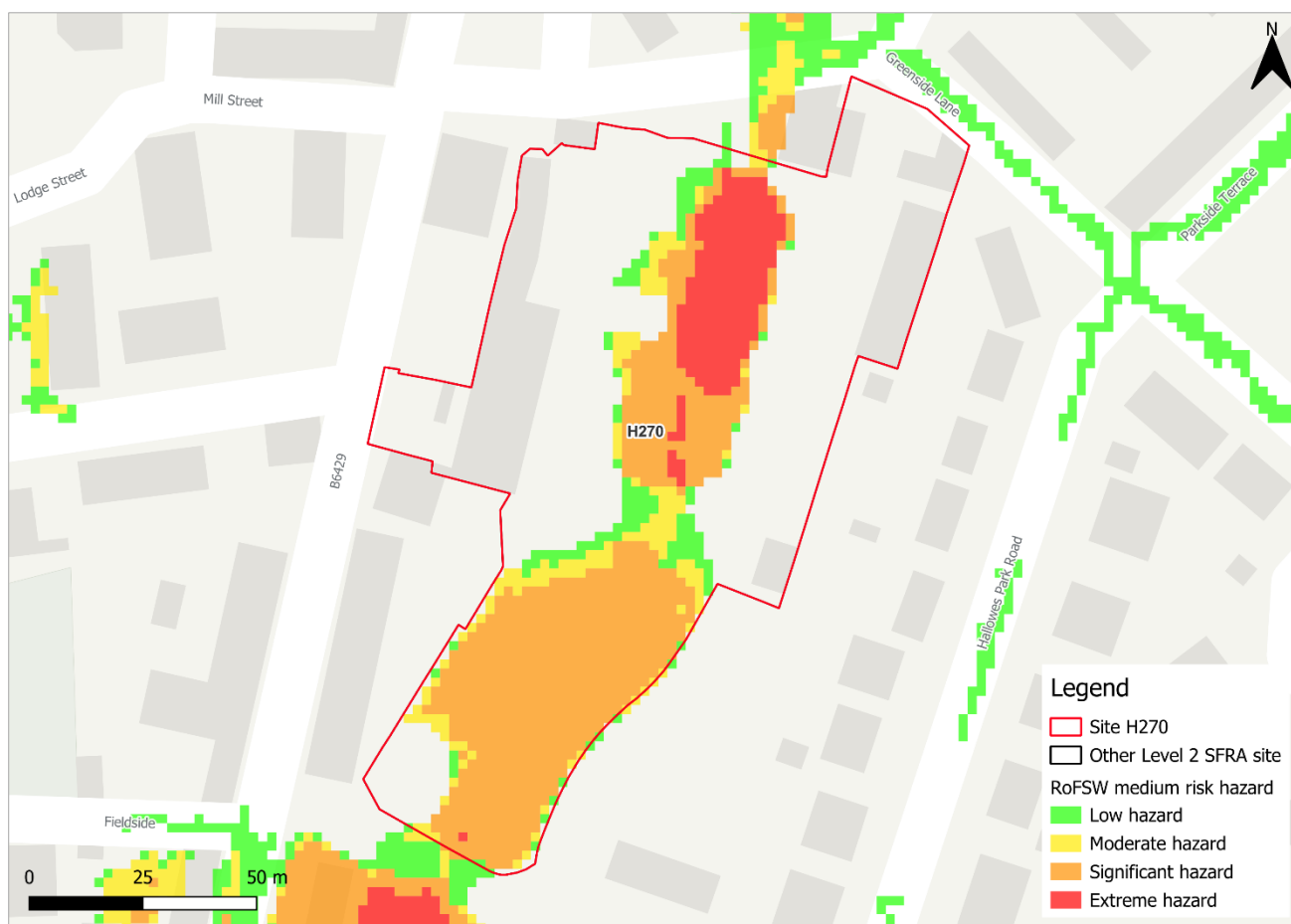


Figure 3-2: Medium risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

The impact of climate change on surface water flood risk has been modelled. This allows for direct comparison with the RoFSW map. With consideration of the EA's SFRA guidance, the latest climate change allowances have been modelled as shown in Table 3-2.

Table 3-2: Modelled climate change allowances for rainfall for the Aire and Calder management catchment

Return period	Central allowance 2070s (% increase)	Upper end allowance 2070s (% increase)
3.3% (high risk)	25%	40%
1% (medium risk)	30%	45%

Figure 3-3 shows the modelled surface water flood depths for the high-risk event +45% climate change. Risk is modelled to be significantly greater than for present day conditions,

¹ Based on Section 7.5 Hazard rating. What is the Risk of Flooding from Surface Water map? Report version 2.0. April 2019. Environment Agency

with the medium risk climate change event showing a comparable level of risk to the present-day low risk event. Maximum depths are > 1.2 m with some areas of extreme hazard (Figure 3-3).

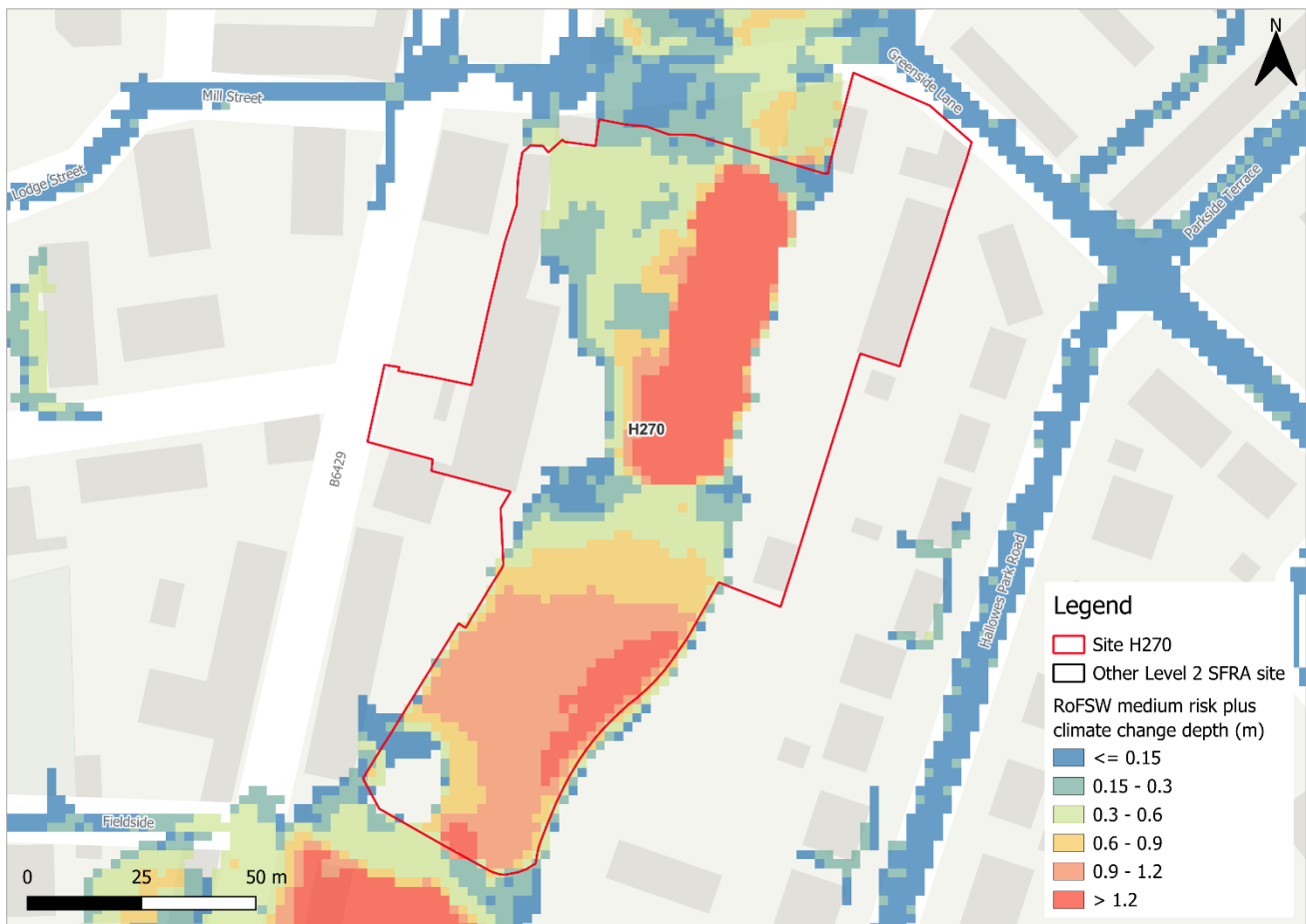


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)

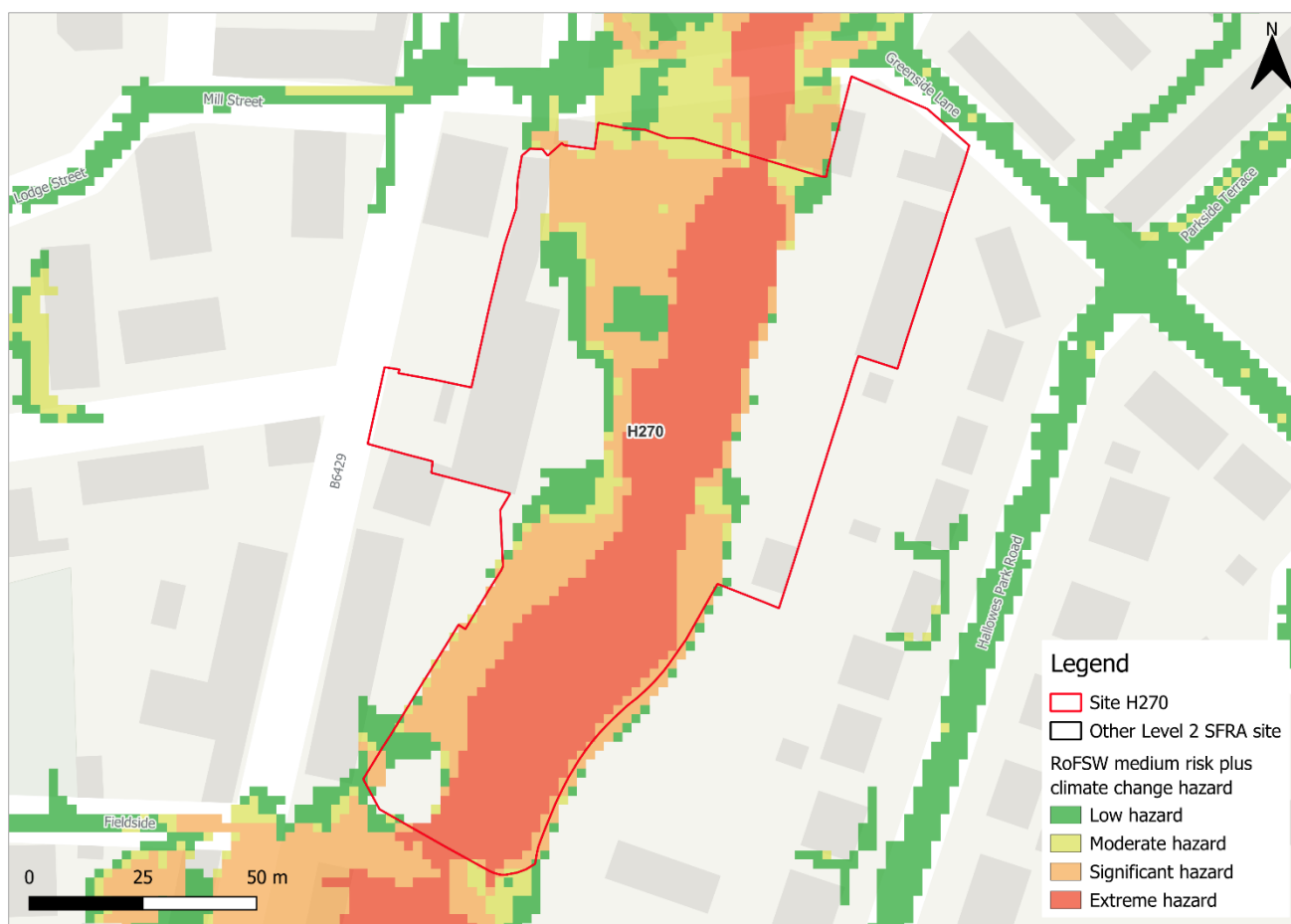


Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk is significant in large portions of the site due to a surface water flow path that runs through the centre of the site, indicating the presence of a culverted watercourse underneath the site i.e. Manywells Beck. The impacts of climate change are modelled to be significant.
- It is recommended that this site not be developed for more vulnerable uses given the significant risk and the presence of the culvert underneath the site.
- Were development to proceed, a full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on layout plans and detailed design and full consultation with the LLFA. However, it would not appear possible that surface water risk can be fully mitigated onsite. Any drainage strategy must investigate culvert removal through investigative modelling options.
- Note that the RoFSW map is not suitable for identifying whether an individual property will flood and is therefore indicative. The RoFSW map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or

assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

4 Risk from groundwater

Risk of groundwater emergence is assessed in this SFRA using JBA's 5m Groundwater Emergence Map. This dataset is recommended for use by the EA in the SFRA Good Practice Guide². Figure 4-1 shows the map covering this site and the surrounding areas whilst Table 4-1 explains the risk classifications.

The majority of the site is indicated to be in areas at risk from groundwater emergence. In the north of the site, there is indicated to be a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely. In the south of the site, there is indicated to be a risk of groundwater flooding to surface and subsurface assets, as well as a possibility of groundwater emerging at the surface locally. There are also areas in the south where groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots. The use of infiltration SuDS may therefore be constrained at this site, and ground investigations will be required through the site-specific FRA to ascertain groundwater levels and conditions.

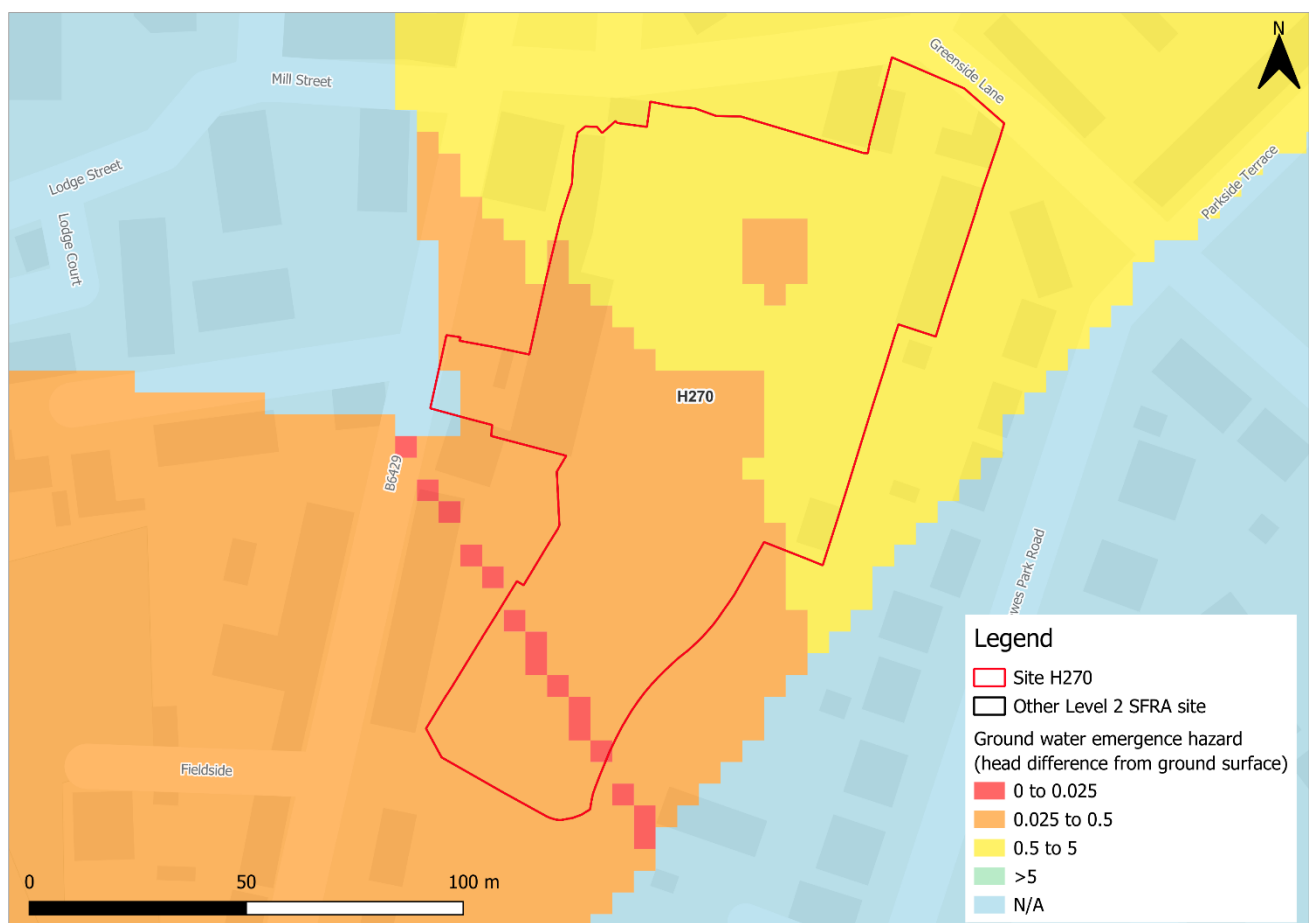


Figure 4-1: JBA 5m Groundwater Emergence Map

² [Strategic flood risk assessment good practice guide. ADEPT. December 2021.](#)

Table 4-1: Groundwater Hazard Classification

Groundwater head difference (m)*	Class label
0 to 0.025	Groundwater levels are either at very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event. There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
>5	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
*Difference is defined as ground surface in mAOD minus modelled groundwater table in mAOD.	

5 Residual risk

5.1 Manywells Beck culvert

There will be a residual risk of flooding to the site were there to be a culvert failure or blockage. A model for this watercourse is not available. Therefore, residual risk could not be modelled for this Level 2 SFRA.

5.2 Flood risk from canals

The site is not likely to be at risk from a canal breach.

5.3 Flood risk from reservoirs

The EA's Reservoir Flood Maps (RFM) (2021) show where water may go in the unlikely event of a reservoir or dam failure. A 'dry day' scenario assumes that the water level in the reservoir is the same as the spillway level or the underside of the roof for a service reservoir and the watercourses upstream and downstream of the reservoir are at a normal level. A 'wet day' scenario assumes a worst-case scenario where a reservoir releases water held on a 'wet day' when local rivers have already overflowed their banks.

The site is not modelled to be at risk from reservoir flooding.

5.4 Flood risk from sewers

Flooding from the sewer network can occur when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes overloaded, blocked or it cannot discharge due to a high-water level in the receiving watercourse.

Yorkshire Water records indicate that there have been historical flood incidents in the area over the last two years. Developers should contact Yorkshire Water directly to check specific details at the FRA stage.

5.5 Observations, mitigation options and site suitability - residual risk

- There is no modelled residual risk to the site.
- The Manywells Beck culvert represents potential residual risk of flooding to the site through culvert failure or blockage. This should be further investigated and modelled at the FRA stage.
- Given the historic sewer flooding in the area, developers should contact Yorkshire Water directly to check specific details at the FRA stage.

6 Overall site assessment

6.1 Can part b) of the exception test be passed?

This site is not required to pass part b) of the exception test³ as it is located within Flood Zone 1, however it must still be proven that the development can be safe for its lifetime, which is 100 years for residential development.

6.2 Recommendations, FRA requirements, and further work

Based on the evidence presented in the Level 1 SFRA (2023) and this Level 2 SFRA:

- Given the significant level of surface water risk, this site would ideally be left free of development and left for car parking or ideally converted to open greenspace enabling storage of surface water and would provide amenity benefits.
- Modelling of Manywells Beck and the culvert must be carried out as part of a site-specific FRA to quantify the risk from the watercourse. Modelling should include for residual risk and options for culvert removal. No development should take place over the top of a culvert nor within 8m either side of the culverted section of watercourse.
- Assuming the culvert is located beneath the site, opportunities for opening up the culvert should be explored for inclusion in site design as a blue green corridor. This would remove any residual risk of flooding to the site as a result of culvert failure or blockage.
- Given the historic sewer flooding in the area, developers should contact Yorkshire Water directly to check specific details at the FRA stage.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA online guidance; the CBMDC Local Plan and national and local SuDS policy and guidelines.
- Throughout the FRA process, consultation should be carried out with the following, where applicable, the local planning authority; the lead local flood authority; emergency planning officers; the Environment Agency; Yorkshire Water; the highways authorities; and the emergency services.

³ Para 178 National Planning Policy Framework 2024

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Bradford Level 2 Strategic Flood Risk Assessment - Site H798

Final Draft

May 2025

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1 Background

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1.1 Site H798

- Location: Providence Farm, Providence Lane, Oakworth
- Existing site use: Agriculture
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 1.4 hectares
- Proposed development impermeable area: 1.2 hectares
- Watercourse: River Worth (main river)
- Environment Agency (EA) river model: River Worth 2022
- Summary of requirements from scoping stage:
 - Level 1 SFRA recommendation was for withdrawal from allocation or more detailed assessment through Level 2 SFRA
 - Assessment of modelled fluvial flood depths, velocities and hazards
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk
 - Modelling of latest EA climate change allowances for peak river flows and peak rainfall intensities
 - Modelling of residual risk from Providence Lane culvert

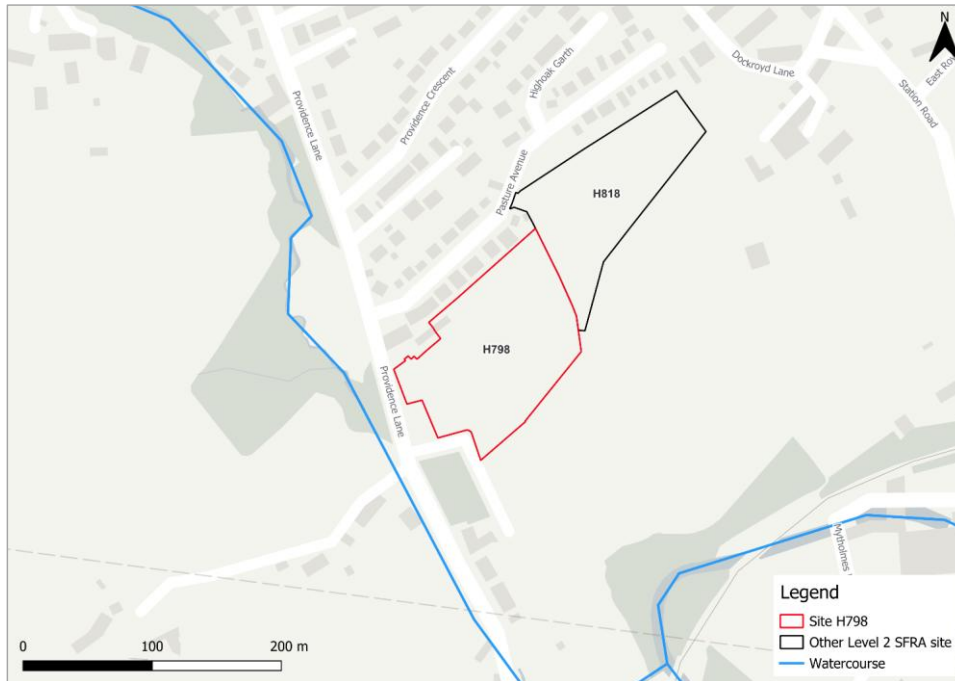


Figure 1-1: Existing site location boundary

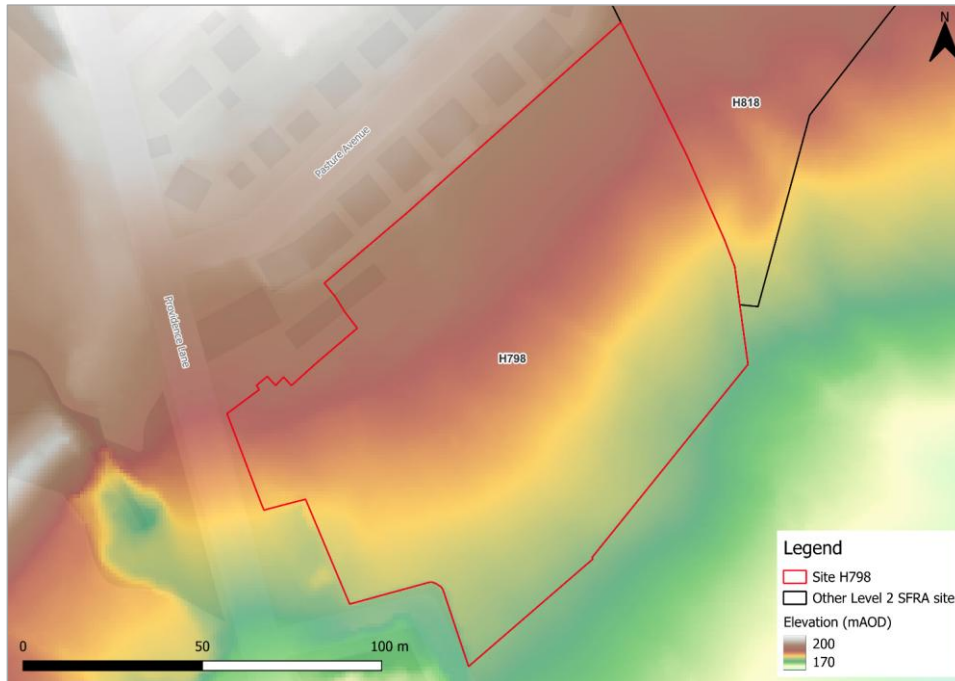


Figure 1-2: Topography

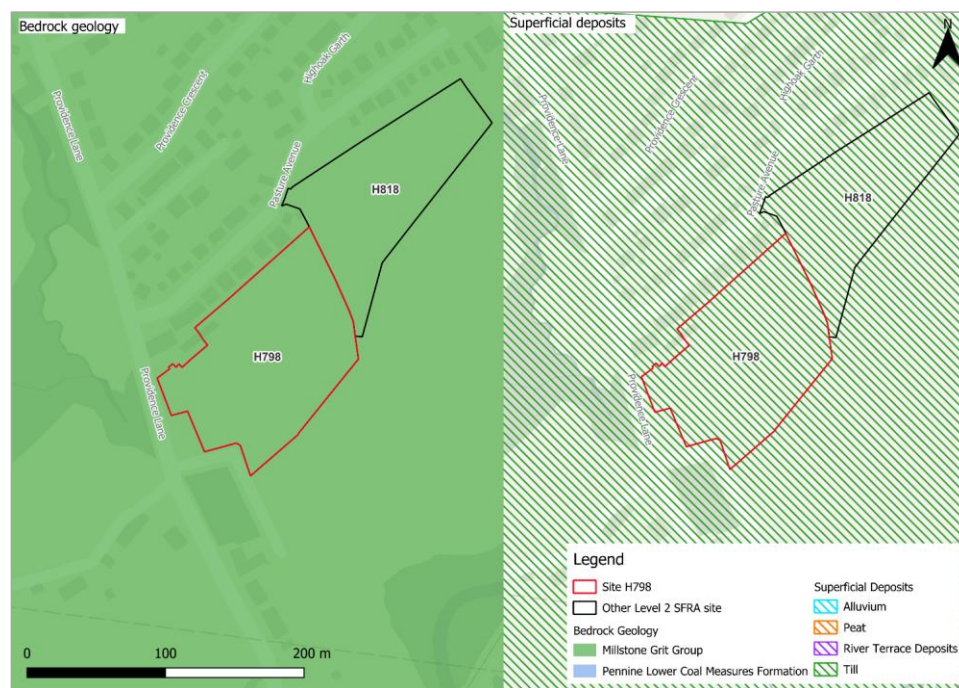


Figure 1-3: Soils and geology

2 Flood risk from rivers

2.1 Existing risk

2.1.1 Flood Map for Planning and functional floodplain

Based on the EA's Flood Map for Planning (September 2024) and Flood Zone 3b (functional floodplain), as updated in this Level 2 SFRA, the percentage areas of the site within each fluvial flood zone are stated in Table 2-1 and can be viewed on Figure 2-1. This version of the Flood Map for Planning does not consider flood defence infrastructure (Section 2.3) or the impacts of climate change (Section 2.2).

Fluvial flood risk to the site comes from the River Worth to the west of the site. The River Worth is designated main river. Almost the entire site is located within Flood Zone 1. There is a very small area along the western boundary of the site within Flood Zone 2 and therefore at medium risk.

Table 2-1: Existing fluvial flood risk based on percentage area of site at risk

Flood Zone 1 (% area)	Flood Zone 2 (% area)	Flood Zone 3a (% area)	Flood Zone 3b (% area)
99	1	0	0

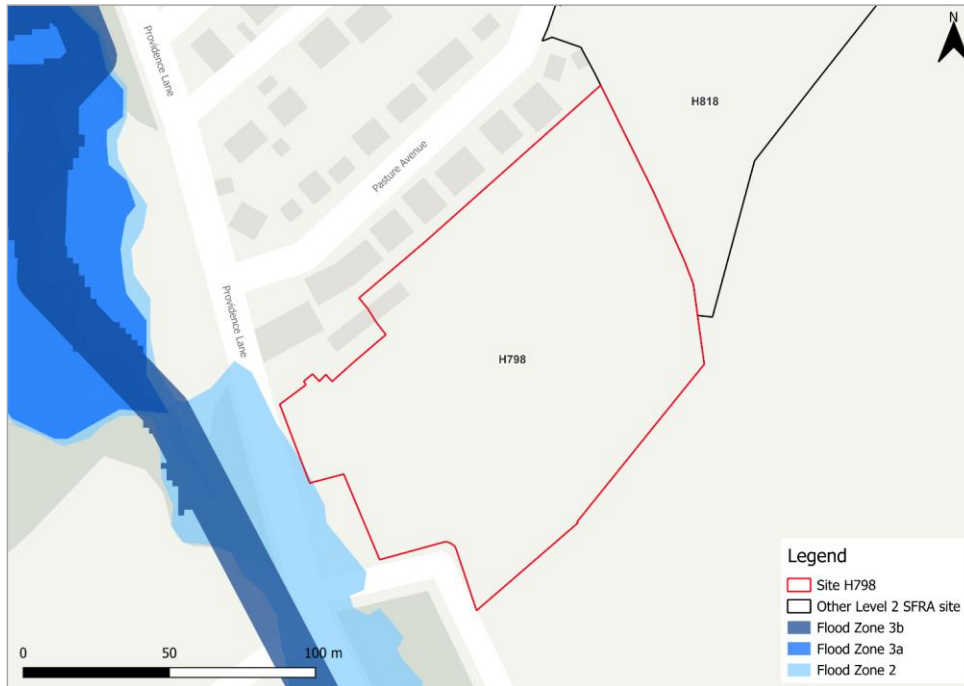


Figure 2-1: Existing risk from rivers to the site

2.1.2 River Worth 2022 model outputs

The River Worth 2022 outputs are different to the Flood Map for Planning and will therefore mean recommendations on development will also be different when accounting for the Flood Map for Planning or the River Worth 2022 model.

Figure 2-2 shows the modelled flood depths for the 0.1% AEP undefended event which is the event Flood Zone 2 of the Flood Map for Planning is based on. There is no modelled risk to the site in the 0.1% AEP undefended event. Safe access and escape routes should be possible via Providence Lane to the west of the site. Section 2.3.1 discusses the defended model outputs.

Commented [MW1]: Question for the EA as to why



Figure 2-2: Flood depths for 0.1% AEP undefended flood event

2.2 Impacts from climate change

The impacts of climate change on flood risk from the River Worth have been modelled without flood defence infrastructure in place. This allows for direct comparison with the existing risk of the Flood Map for Planning.

With consideration of the EA's SFRA guidance, the latest climate change central and higher central allowances have been modelled as shown in Table 2-2. The EA's SFRA guidance states that SFRAs should assess the central allowance for less, more, and highly vulnerable development, and also water compatible development. The higher central should be assessed for essential infrastructure.

Table 2-2: Modelled climate change allowances for peak river flows for the Aire and Calder Management Catchment

Return period (AEP event)	Central allowance 2080s (% increase)	Higher central allowance 2080s (% increase)	Upper end allowance 2080s (% increase)
3.3% (functional floodplain)	23%	31%	51%
1%	23%	31%	51%

There is no significant increase to the area of the site within the functional floodplain as a result of climate change.

Figure 2-3 shows the onsite modelled flood depths for the 1% AEP undefended event +23% for climate change. There is no modelled risk to the site in this event, which is consistent with the higher central and upper end allowances. Safe access and escape routes should remain achievable via Providence Lane to the west of the site.

Due to stability issues with the model, the 0.1% AEP plus climate change event could not be modelled.

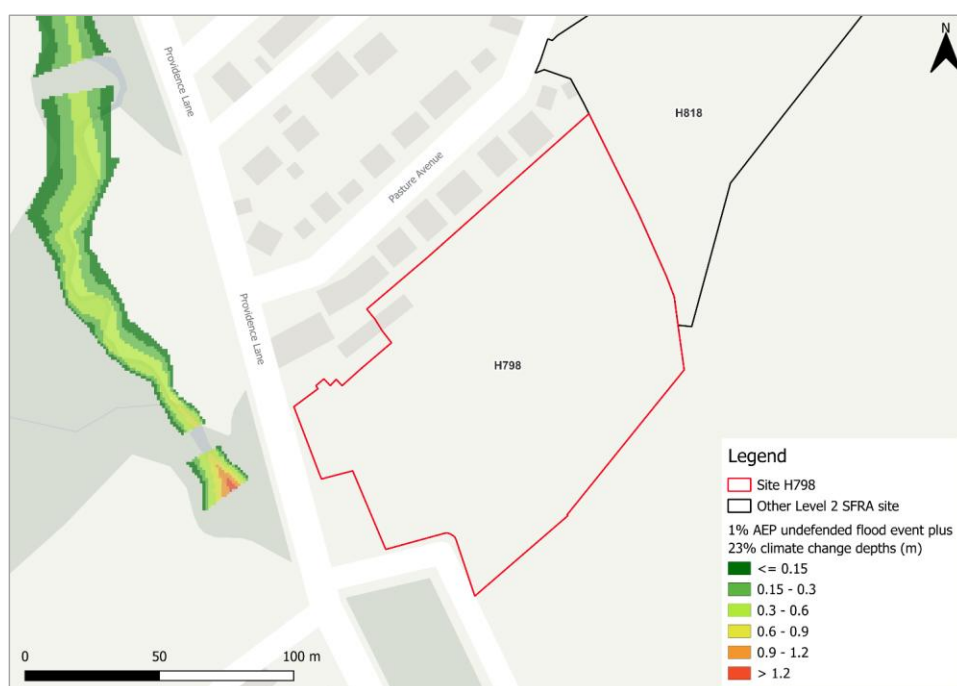


Figure 2-3: Flood depths for 1% AEP undefended flood event +23% (central climate change allowance)

2.3 Flood risk management

2.3.1 Flood defences

The site does not benefit from any formal engineered flood defences, according to the EA's spatial flood defences dataset. This is reflected in the modelled defended event showing a similar level of risk to the undefended event (Figure 2-4). There are some areas of natural high ground along the banks of the River Worth.



Figure 2-4: Flood depths for 0.1% AEP defended flood event

2.3.2 Working with Natural Processes

The EA's Working with Natural Processes (WwNP) dataset has been interrogated to identify opportunities for Natural Flood Management (NFM) that may help to reduce flood risk to the site and surrounding areas. Both within and upstream of the site, there is potential for tree planting indicating locations where woodland planting may be possible, and effective to attenuate flooding. These areas are shown in Figure 2-5. The WwNP mapping is broadscale and indicative. Further investigation is required for any land shown to have potential for WwNP.

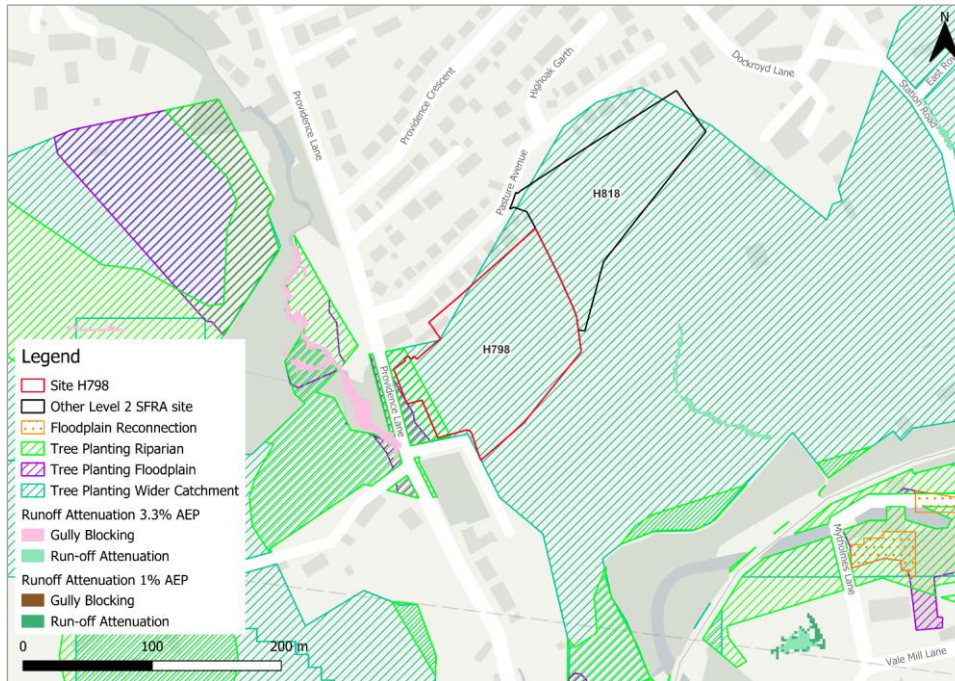


Figure 2-5: Natural Flood Management (NFM) potential mapping

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) has been considered. There are no recorded historic flood events within the vicinity of the site.

2.5 LLFA flood incidents

The LLFA have records of one flood incident taking place to the west of the site, which occurred in 2020. Developers should contact the LLFA for further information at the FRA stage, to assess potential flood risk to the site associated with these incidents.

2.6 Flood warning and access and escape routes

The EA operates a Flood Warning Service for properties located within a Flood Warning Area (FWA) for when a flood event is expected to occur. The site is partially located within a FWA, namely 123FWF202 - Tributaries of the River Worth at Grey Scar Road to Hebble Row.

Flood alerts may be issued before a flood warning for properties located within a Flood Alert Area (FAA) to provide advance notice of the possibility of flooding. A flood alert may be issued when there is less confidence that flooding will occur in a FWA. The site is also partially located within a FAA, namely 123WAF981 - River Worth catchment.

Based on the Flood Map for Planning, safe access and escape routes would likely need to be made available via Pasture Avenue, through adjacent site H818, given the presence of Flood Zone 2 along Providence Lane. However, the modelled 0.1% AEP undefended event for the River Worth indicates Providence Lane would likely not be impacted during the extreme event, meaning this could be a viable route.

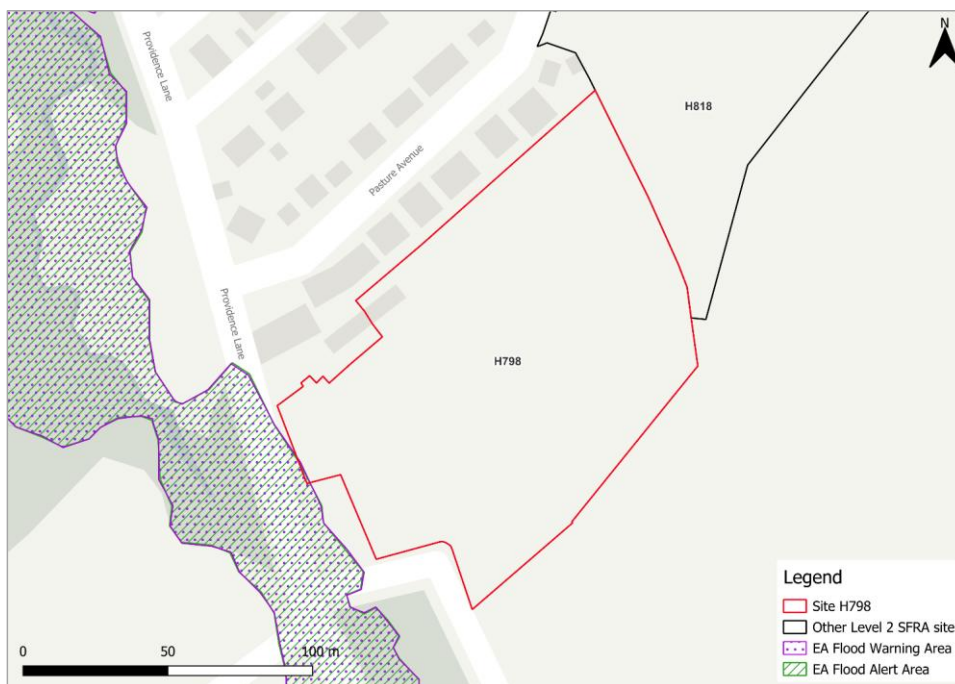


Figure 2-6: EA Flood Warning Areas and Flood Alert Areas

2.7 Observations, mitigation options and site suitability - fluvial

- The proposed development of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF.
- Given the change in use and therefore vulnerability of the site, the FRA must show that the development can be designed to be safe and that there is adequate emergency planning provision (para 014 FRCC-PPG).
- Based on the Flood Map for Planning, the site is modelled to be partially located within Flood Zone 2. The River Worth 2022 outputs are different to the Flood Map for Planning and will therefore mean recommendations on development will also be different when accounting for the Flood Map for Planning or the River Worth 2022 model.

- The site is not modelled to be at risk from fluvial sources in either the present day or when accounting for climate change (according to the River Worth 2022 model).
- Were development of this site to proceed, given the proximity of this site to neighbouring site H818, it would be prudent to formulate a strategy to develop these sites in tandem and for consultation between each developer to take place to ensure a joined-up approach for sustainable development is in place.

3 Flood risk from surface water

3.1 Existing risk

Based on the EA's national scale Risk of Flooding from Surface Water (RoFSW) map (November 2024), surface water risk to the site is predominantly very low. Approximately 4% of the site is at low surface water risk, as shown in Table 3-1.

In the low risk event, surface water risk is confined to shallow flow path through the north and east of the site. Greatest flood depths are between 0.15 and 0.3 m (Figure 3-1) with hazard largely categorised as low, and a small area modelled to be moderate (Figure 3-2). Although inundated in the low risk surface water event, Providence Lane is likely to be a viable safe access and escape route given depths are modelled to be shallow.

Table 3-1: Existing surface water flood risk based on percentage area at risk using the RoFSW map

Very low risk (% area)	Low risk (% area)	Medium risk (% area)	High risk (% area)
96	4	0	0

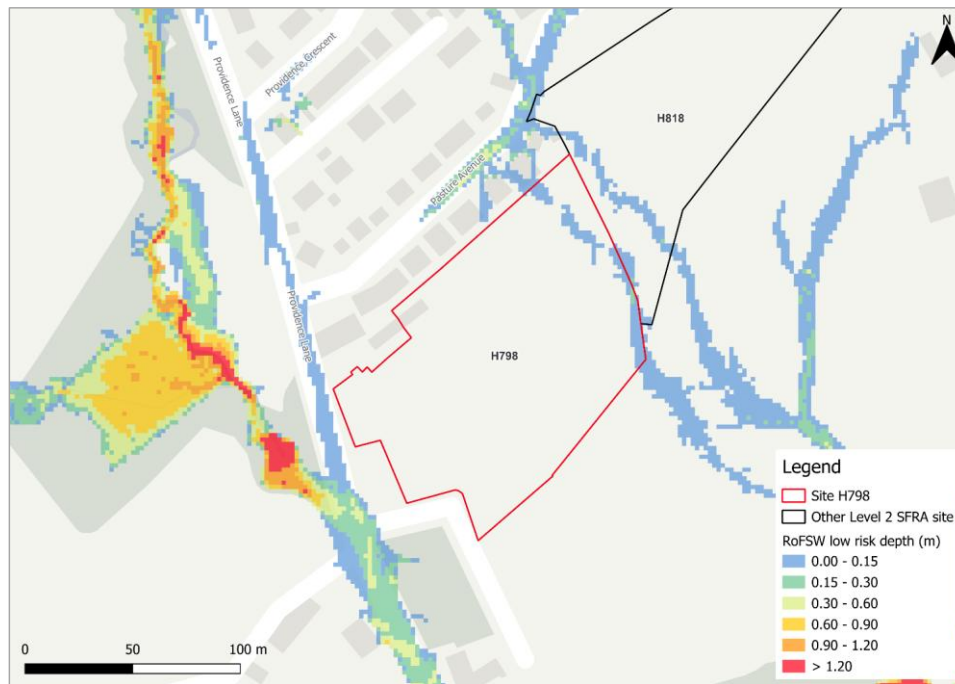


Figure 3-1: Low risk event surface water flood depths (Risk of Flooding from Surface Water map)

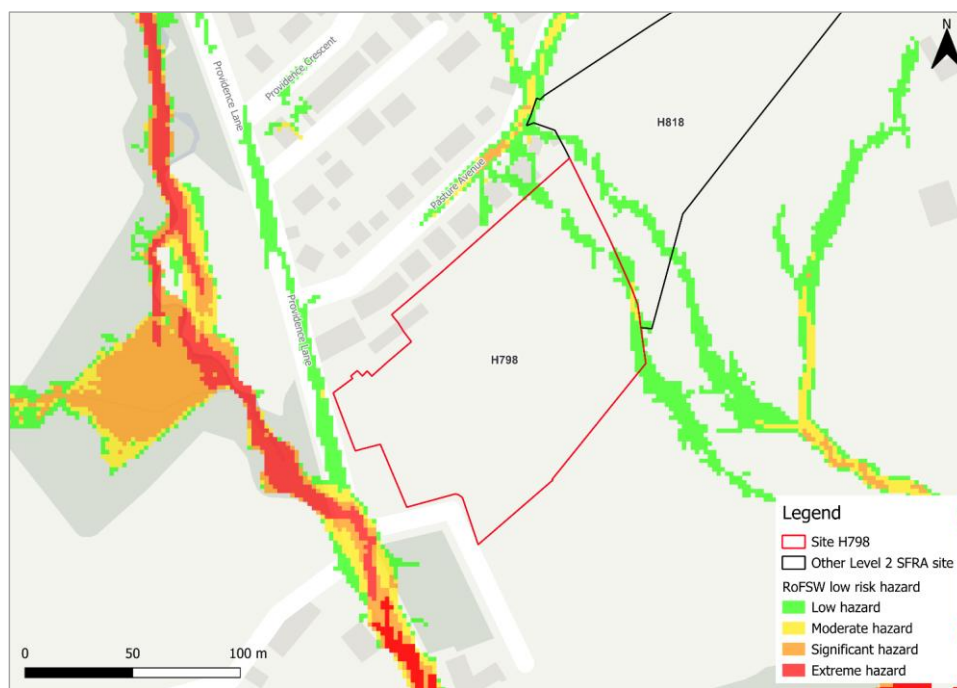


Figure 3-2: Low risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

The impact of climate change on surface water flood risk has been modelled. This allows for direct comparison with the RoFSW map. With consideration of the EA's SFRA guidance, the latest climate change allowances have been modelled as shown in Table 3-2.

Table 3-2: Modelled climate change allowances for rainfall for the Aire and Calder management catchment

Return period	Central allowance 2070s (% increase)	Upper end allowance 2070s (% increase)
3.3% (high risk)	25%	40%
1% (medium risk)	30%	45%

Figure 3-3 shows the modelled surface water flood depths for the medium risk event plus 45% climate change. Risk is modelled to be greater than for present day conditions, with

¹ Based on Section 7.5 Hazard rating. What is the Risk of Flooding from Surface Water map? Report version 2.0. April 2019. Environment Agency

the medium risk climate change event showing a greater level of risk to the present day low risk event. However, depths remain low, with maximum depths modelled to be between 0.15 and 0.3 m. This is reflected in the modelled hazard being largely categorised as low, and a small area modelled to be moderate (Figure 3-4). Safe access and escape routes should remain possible via Providence Lane.

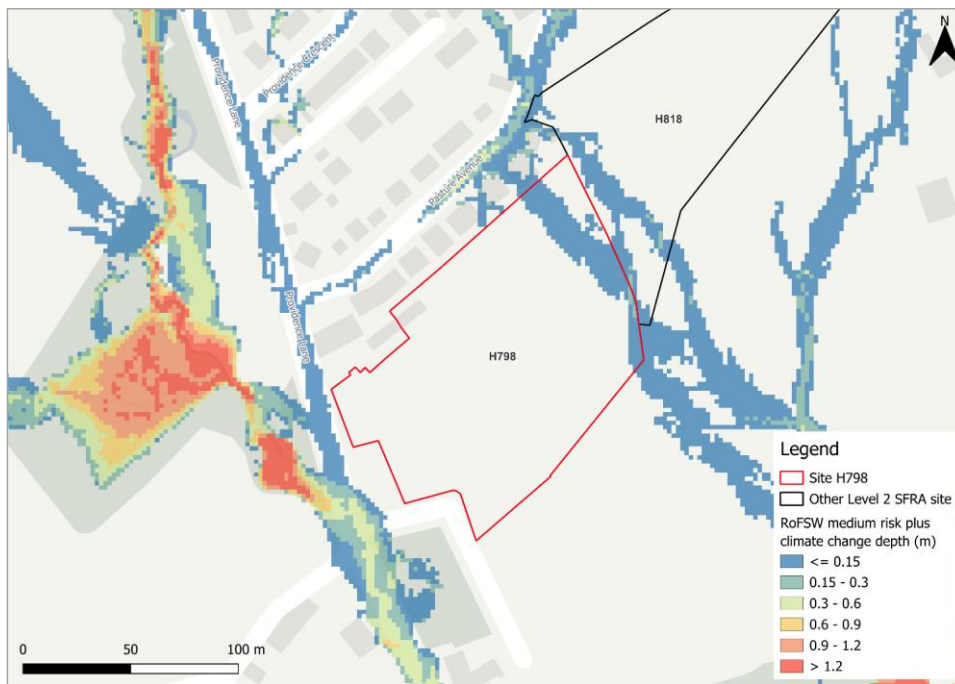


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)

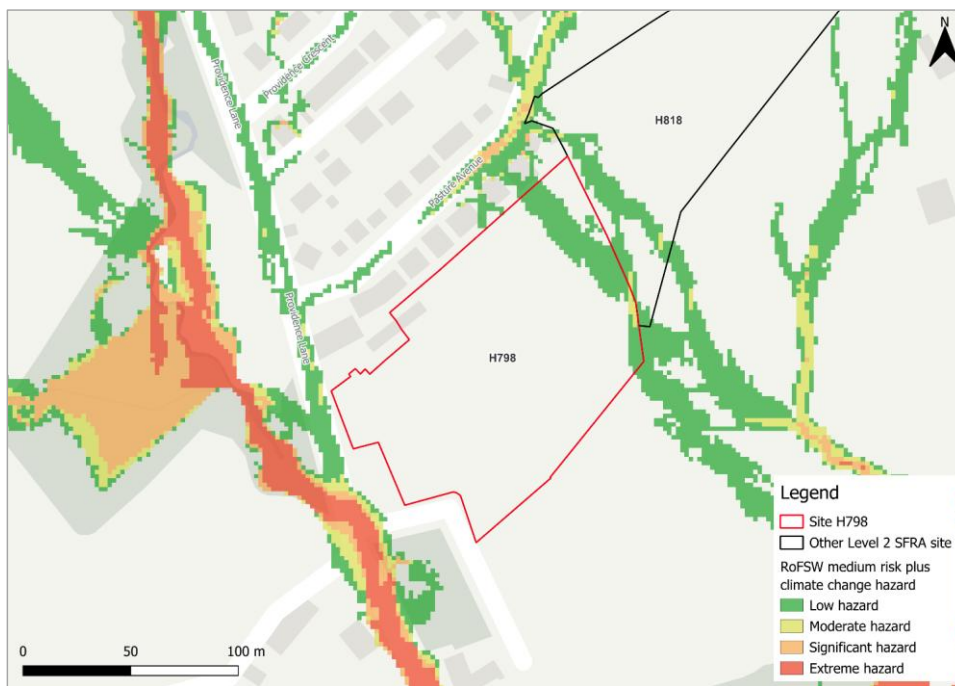


Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk is confined to a shallow flow path within the north and east of the site. The medium surface water plus climate change event indicates a slightly greater extent of risk to the site in comparison to the present day low risk event, however depths remain low.
- Topographic flow routes should be considered and included in site design and ideally left in place to flood naturally when required. Any regrading of land must include for like for like volumes to ensure risk is contained safely onsite for the lifetime of development.
- Safe access and escape routes would likely be possible via Providence Lane, however this should be explored further as part of a site-specific FRA based on detailed surface water modelling to confirm surface water depths and hazards.
- A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This may require surface water modelling based on layout plans and detailed design and consultation with the LLFA. Runoff volumes must not exceed existing greenfield rates and, if possible, betterment should be achieved.

- Note that the RoFSW map is not suitable for identifying whether an individual property will flood and is therefore indicative. The RoFSW map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

4 Risk from groundwater

Risk of groundwater emergence is assessed in this SFRA using JBA's 5m Groundwater Emergence Map. This dataset is recommended for use by the EA in the SFRA Good Practice Guide². Figure 4-1 shows the map covering this site and the surrounding areas and Table 4-1 explains the risk classifications.

The entirety of the site is in an area where there is no risk of groundwater emergence. Groundwater conditions may therefore be suited to infiltration SuDS across the site.

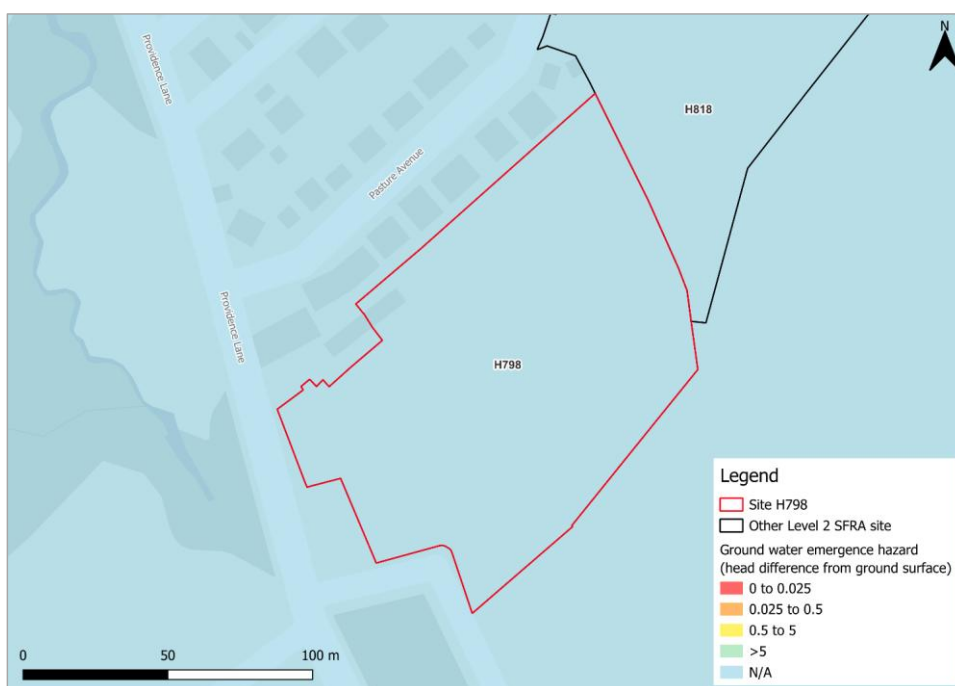


Figure 4-1: JBA 5m Groundwater Emergence Map

² Strategic flood risk assessment good practice guide. ADEPT. December 2021.

Table 4-1: Groundwater Hazard Classification

Groundwater head difference (m)*	Class label
0 to 0.025	Groundwater levels are either at very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event. There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
>5	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
*Difference is defined as ground surface in mAOD minus modelled groundwater table in mAOD.	

5 Residual risk

Although a site may be afforded some protection from defences and / or drainage infrastructure, there is always a residual risk of flooding from asset failure i.e. breaching / overtopping of flood defences, blockages of culverts or bridge openings.

There is potential residual risk to the site from a blockage of the structure along the River Worth beneath Providence Lane. Section 5.1 presents the blockage modelling outputs.

5.1 Providence Lane culvert blockage

Figure 5-1 shows the culvert blockage modelled depths were there to be a 75% blockage of the culvert along the River Worth, which flows beneath Providence Lane. There is no modelled risk to the site as a result of a blockage at this structure.



Figure 5-1: Providence Lane culvert blockage depths (based on a 1% AEP plus higher central climate change event)

5.2 Flood risk from reservoirs

The EA's Reservoir Flood Maps (RFM) (2021) show where water may go in the unlikely event of a reservoir or dam failure. A 'dry day' scenario assumes that the water level in the reservoir is the same as the spillway level or the underside of the roof for a service reservoir

and the watercourses upstream and downstream of the reservoir are at a normal level. A 'wet day' scenario assumes a worst-case scenario where a reservoir releases water held on a 'wet day' when local rivers have already overflowed their banks.

The site is not modelled to be at risk from reservoir flooding.

5.3 Flood risk from sewers

Flooding from the sewer network can occur when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes overloaded or blocked, or it cannot discharge due to high water levels in the receiving watercourse.

According to Yorkshire Water's records, there have been no incidents of sewer flooding in the area over the last two years.

5.4 Observations, mitigation options and site suitability - residual risk

- There is no modelled residual risk to the site.

6 Overall site assessment

6.1 Can part b) of the exception test be passed?

This site is not required to pass part b) of the exception test³ as it is not located within Flood Zone 3a, however it must still be proven that the development can be safe for its lifetime, which is 100 years for residential development. Based on the available information documented within this Level 2 SFRA, it should be possible to make this site safe for its lifetime.

6.2 Recommendations, FRA requirements, and further work

Based on the evidence presented in the Level 1 SFRA (2023) and this Level 2 SFRA:

- It should be possible to develop this site for more vulnerable uses.
- Any FRA should consider surface water modelling of the site and consider safe access and escape routes.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA online guidance; the CBMDC Local Plan and national and local SuDS policy and guidelines.
- Throughout the FRA process, consultation should be carried out with the following, where applicable, the local planning authority; the lead local flood authority; emergency planning officers; the Environment Agency; Yorkshire Water; the highways authorities; and the emergency services.

³ Para 178 National Planning Policy Framework 2024

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Bradford Level 2 Strategic Flood Risk Assessment - Site H833

Final Draft

May 2025

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

www.jbaconsulting.com

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Contract

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This report describes work commissioned by City of Bradford Metropolitan District Council (CBMDC) by an instruction dated 19 July 2024. The Client's representative for the contract was Jonathan Dicken of CBMDC. Dominic Richardson of JBA Consulting carried out this work.

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1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for the City of Bradford Metropolitan District Council (CBMDC) Local Plan Site H833. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'CBMDC Level 1 SFRA' (2023) and read the 'CBMDC Level 2 SFRA Main Report' (2024) and is therefore familiar with the terminology used in this report.

1.1 Site H833

- Location: Crossfield Road
- Existing site use: Agriculture (grazing land)
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 0.7 hectares
- Proposed development impermeable area: 0.6 hectares
- Watercourse: Unnamed watercourse
- Environment Agency (EA) river model: N/A
- Summary of requirements from scoping stage:
 - Level 1 SFRA recommendation was for withdrawal from allocation or more detailed assessment through Level 2 SFRA
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk
 - Modelling of latest EA climate change allowances for peak rainfall intensities

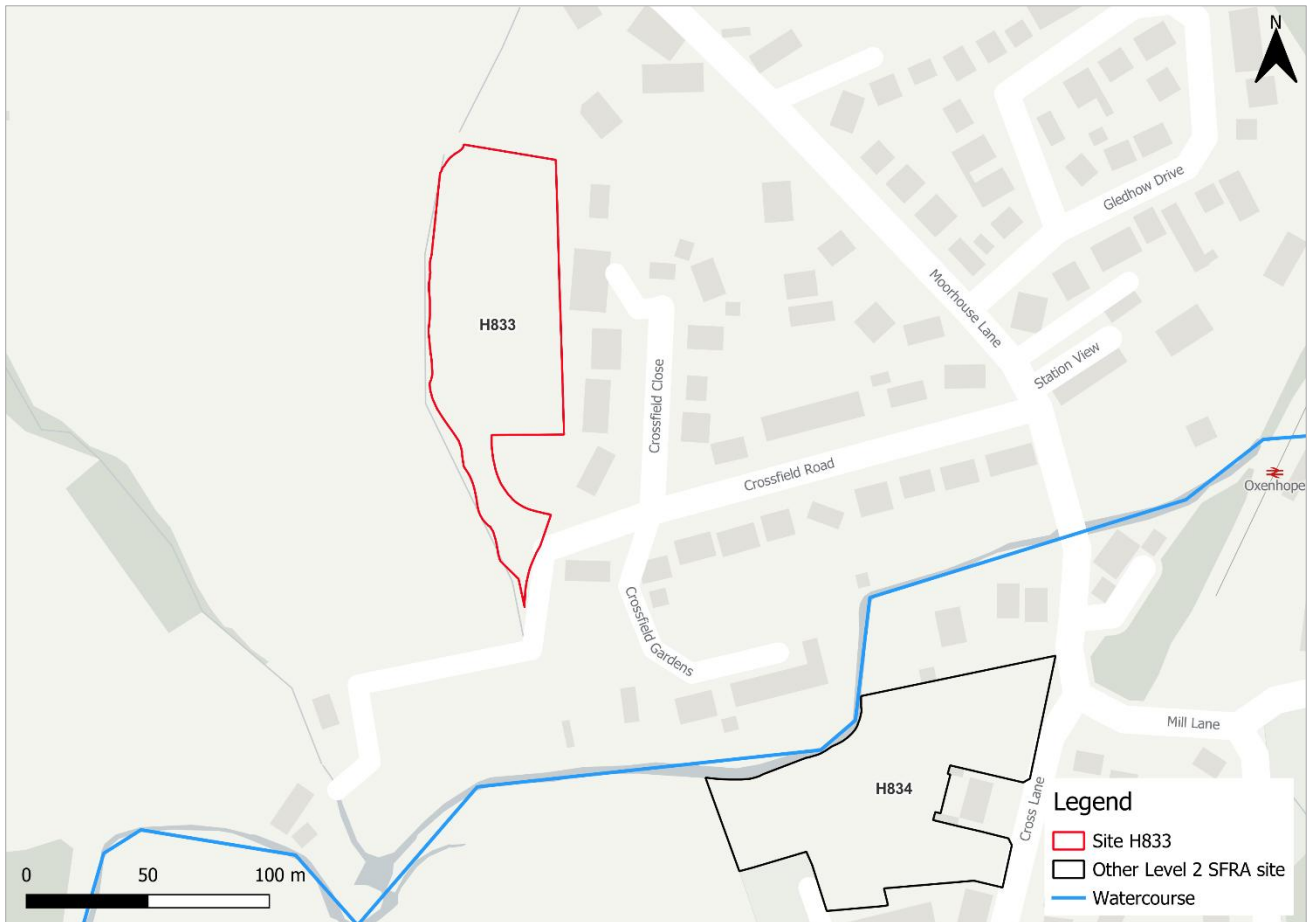


Figure 1-1: Existing site location boundary

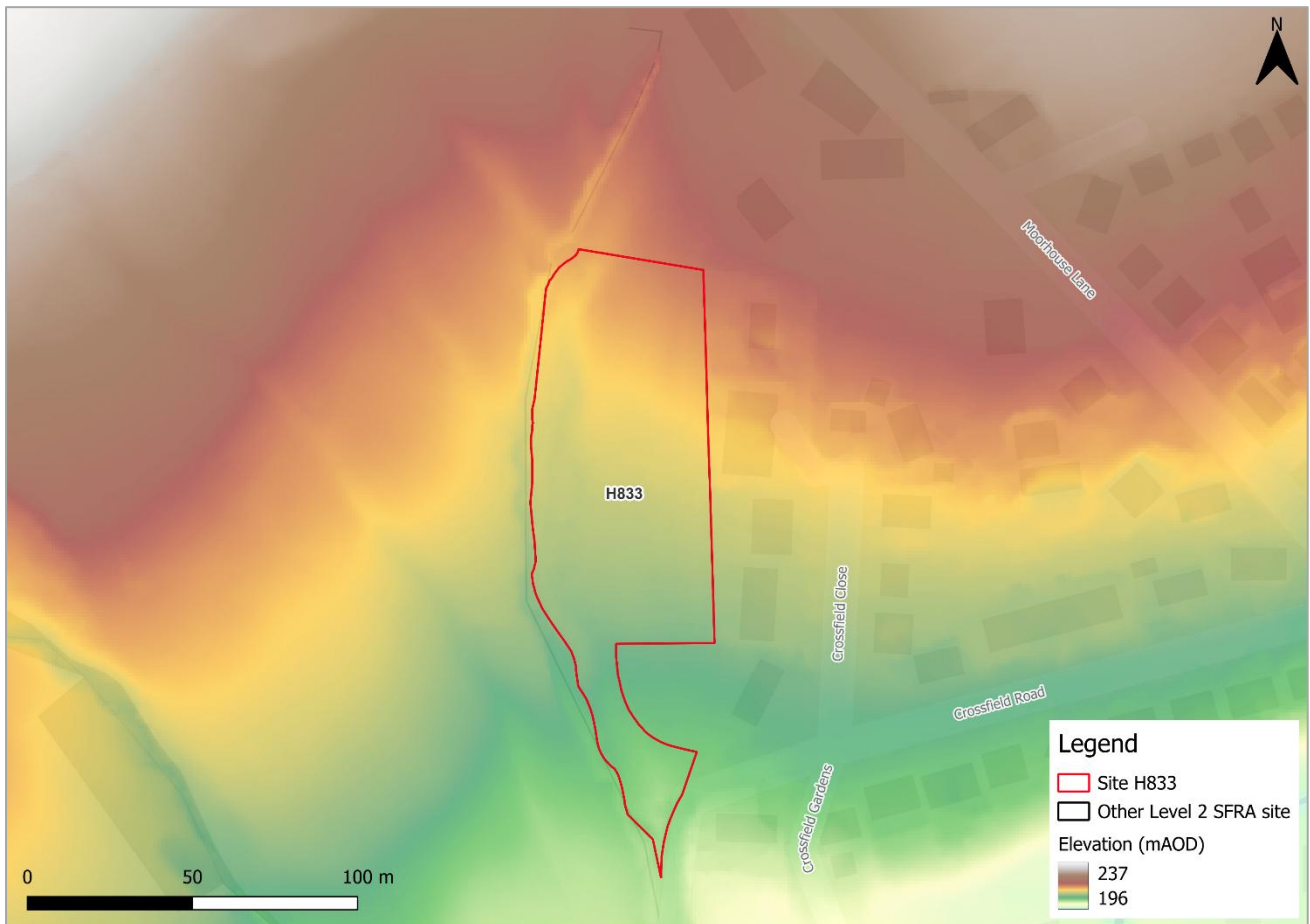


Figure 1-2: Topography



Figure 1-3: Soils and geology

2 Flood risk from rivers

2.1 Existing risk

2.1.1 Flood Map for Planning and functional floodplain

Based on the EA's Flood Map for Planning and Flood Zone 3b (functional floodplain), as updated in this Level 2 SFRA, the percentage areas of the site within each fluvial flood zone are stated in Table 2-1 and can be viewed on Figure 2-1. This version of the Flood Map for Planning does not consider flood defence infrastructure (Section 2.2) or the impacts of climate change.

The entire site is modelled to be within Flood Zone 1 indicating it is at low risk of flooding from rivers. Flood extents from the Moorhouse Beck which flows to the south of the site are not modelled to enter the site area. However, an unnamed and unmodelled watercourse flows along the western boundary of the site from north to south and into Moorhouse Beck. Risk from this watercourse is unknown and may need to be quantified at the FRA stage.

Table 2-1: Existing fluvial flood risk based on percentage area of site at risk

Flood Zone 1 (% area)	Flood Zone 2 (% area)	Flood Zone 3a (% area)	Flood Zone 3b (% area)
100	0	0	0

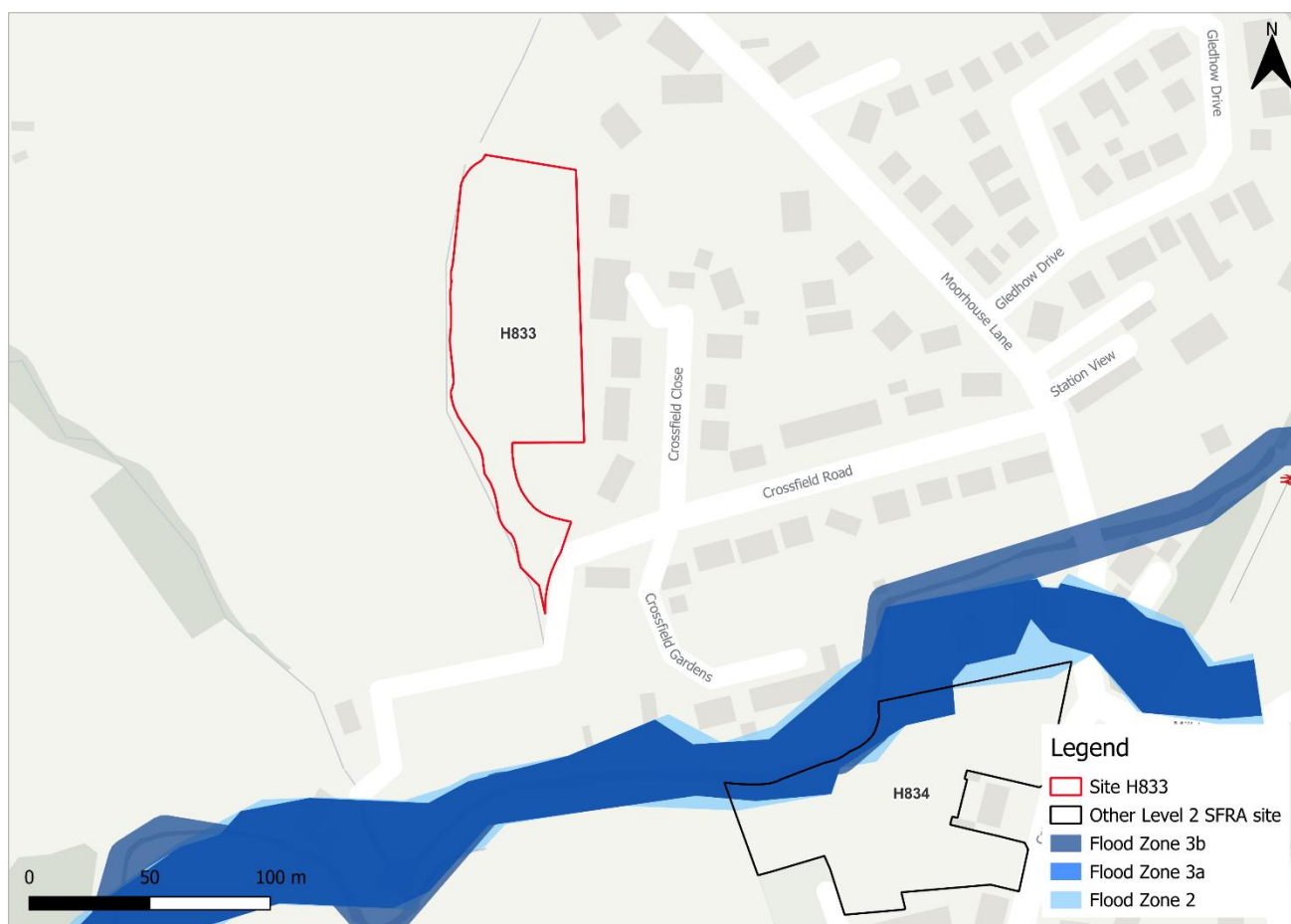


Figure 2-1: Existing risk from rivers to the site

2.2 Flood risk management

2.2.1 Flood defences

The site does not benefit from any formal engineered flood defences, according to the EA's spatial flood defences dataset.

2.2.2 Working with Natural Processes

The EA's Working with Natural Processes (WwNP) dataset has been interrogated to identify opportunities for Natural Flood Management (NFM) to reduce flood risk to the site and surrounding areas. Upstream of the site to the north and west, there is potential for wider catchment tree planting which can intercept, slow, store and filter water. There is also potential for riparian tree planting, which can slow flows, reduce sediment delivery to the watercourse and reduce bankside erosion. Furthermore, there are also areas to the north of the site where surface water runoff can be attenuated in the 3.3% AEP and 1.0% AEP events. These areas are shown in Figure 2-2. The WwNP mapping is broadscale and indicative. Further investigation is required for any land shown to have potential for WwNP.

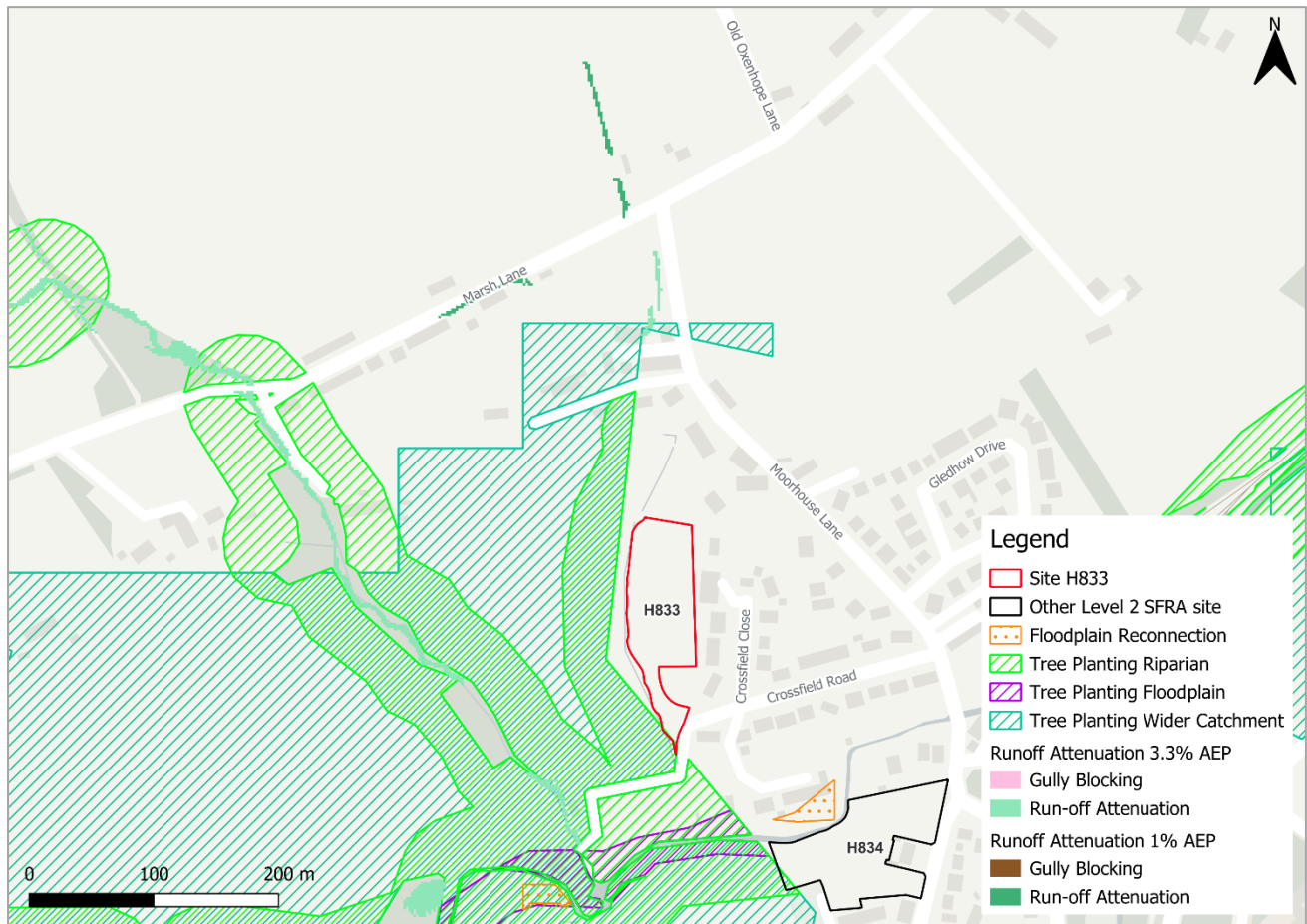


Figure 2-2: Natural Flood Management (NFM) potential mapping

2.3 Historic flood incidents

The EA's Historic Flood Map (HFM) and Recorded Flood Outlines (RFO) datasets have been considered. There are no recorded historic flood events at the site.

2.4 LLFA flood incidents

The LLFA have records of numerous incidents linked to culverted watercourses upstream of and adjacent to the site. Developers should contact the LLFA for further information at the FRA stage, to assess potential flood risk to the site associated with these incidents.

2.5 Flood warning and access and escape routes

The EA operates a Flood Warning Service for properties located within a Flood Warning Area (FWA) for when a flood event is expected to occur. The site is not located within a FWA.

Flood alerts may be issued before a flood warning for properties located within a Flood Alert Area (FAA) to provide advance notice of the possibility of flooding. A flood alert may be

issued when there is less confidence that flooding will occur in a FWA. This site is not located within a FAA.

Based on available information, safe access and escape routes could likely be achieved during a flood event via Crossfield Road.

2.6 Observations, mitigation options and site suitability - fluvial

- The proposed development of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF.
- Given the change in use and therefore vulnerability of the site, the FRA must show that the development can be designed to be safe and that there is adequate emergency planning provision (para 014 FRCC-PPG).
- The site is wholly located within Flood Zone 1, indicating it is modelled to be at low risk of flooding from rivers.
- The unnamed tributary of Moorhouse Beck is not modelled. Current and future risk from this watercourse must be quantified through appropriate modelling, at the FRA stage, before any development planning can commence.
- No development should take place over the top of a culvert nor within 8m either side of the culverted section of watercourse.

3 Flood risk from surface water

3.1 Existing risk

Based on the EA's national scale Risk of Flooding from Surface Water (RoFSW) map, surface water to the site is predominantly very low. Approximately 11% of the site is within the high-risk surface water risk zone. A further 10% is in the medium surface water risk zone and a further 14% is at low surface water risk, as shown in Table 3-1.

In the high-risk event, two surface water flow routes can be seen to flow southwards in the west of the site. In the medium and low risk events, these flow routes can be seen to expand in extent and depth, with some areas where connectivity between flow paths is observed. The westernmost flow route includes the unnamed watercourse.

Surface water flow routes through the site are shown to be constrained by topography. These flow routes should be maintained within site design.

Greatest surface water flood depths in the medium risk event are shown to be 0.6 - 0.9 m (Figure 3-1) with some areas of significant hazard (Figure 3-2).

Since floodwater of significant hazard is shown to occur in the area of the site adjoining Crossfield Road, safe access and escape routes may be challenging to achieve in this event.

Table 3-1: Existing surface water flood risk based on percentage area at risk using the RoFSW map

Very low risk (% area)	Low risk (% area)	Medium risk (% area)	High risk (% area)
65	14	10	11

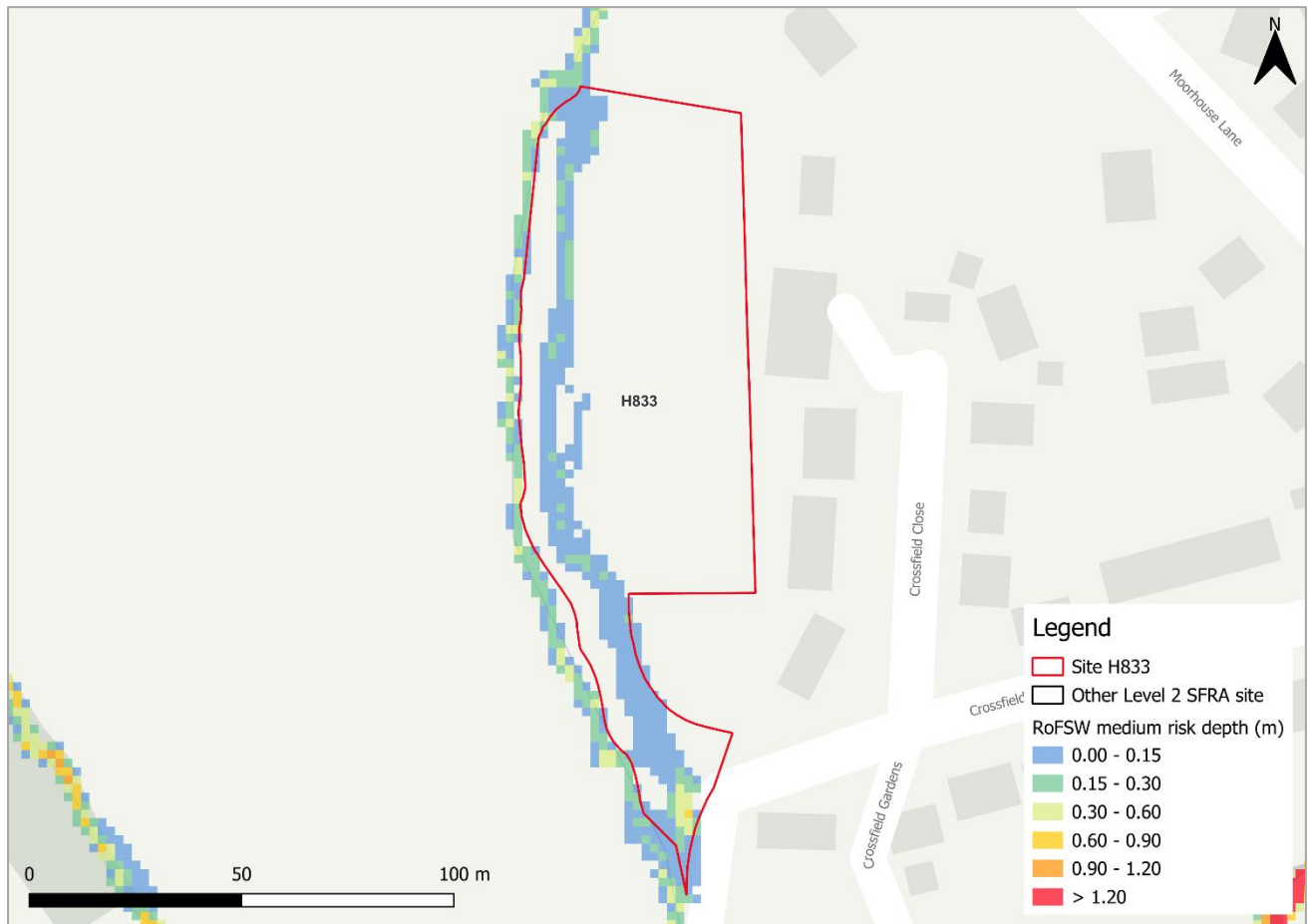


Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

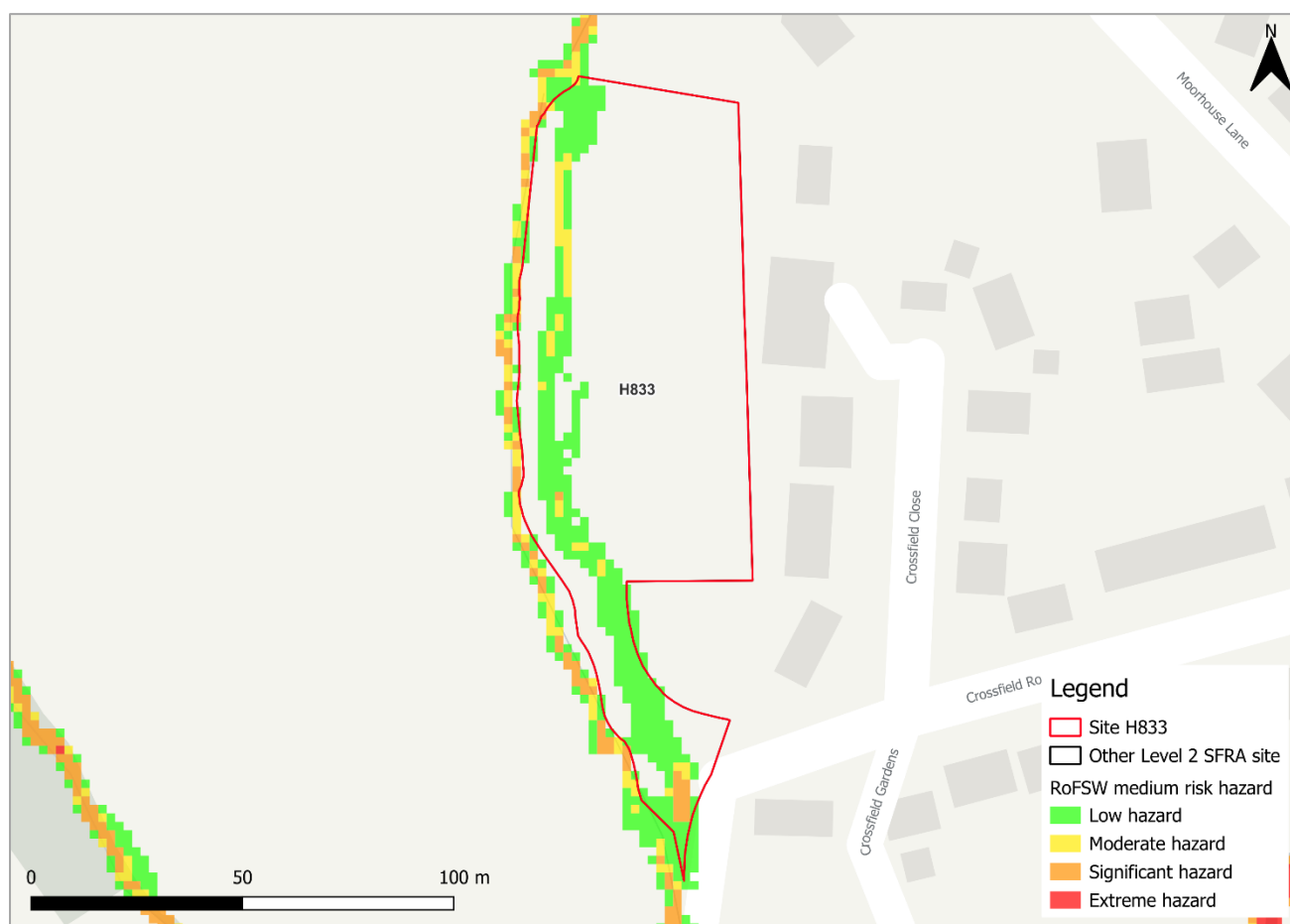


Figure 3-2: Medium risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

The impact of climate change on surface water flood risk has been modelled. This allows for direct comparison with the RoFSW map. With consideration of the EA's SFRA guidance, the latest climate change allowances have been modelled as shown in Table 3-2.

Table 3-2: Modelled climate change allowances for rainfall for the Aire and Calder management catchment

Return period	Central allowance 2070s (% increase)	Upper end allowance 2070s (% increase)
3.3% (high risk)	25%	40%
1% (medium risk)	30%	45%

Figure 3-3 shows the modelled surface water flood depths for the medium risk event +45% climate change. Risk is modelled to be greater than for present day conditions, with the

¹ Based on Section 7.5 Hazard rating. What is the Risk of Flooding from Surface Water map? Report version 2.0. April 2019. Environment Agency

medium risk climate change event showing a similar level of risk to the low-risk present day event. There is a major flow path flowing from north of the site southwards through the west of the site. Greatest flood depths within the site are approximately 1 m (Figure 3-3), with areas of hazard categorised as extreme in places (Figure 3-4).

Ideally, the surface water flow paths in the west of the site should be maintained onsite, however there may be potential for these flow routes to be diverted via greenfield land to the west of the site boundary. Therefore, options for mitigation should be explored offsite as well as onsite to limit the impacts of these flow routes.

Safe access and escape routes may be challenging to achieve in this event.

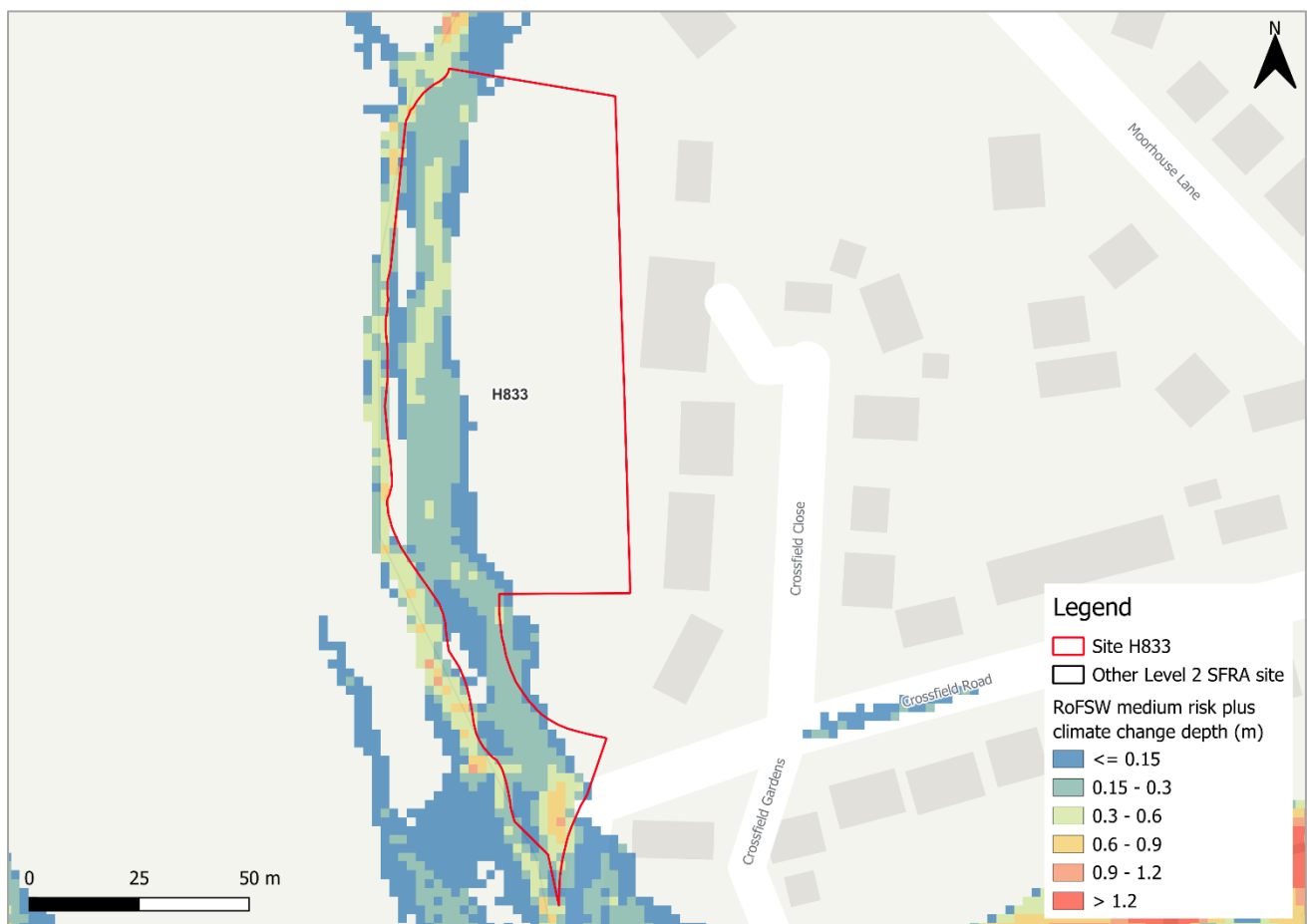


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)

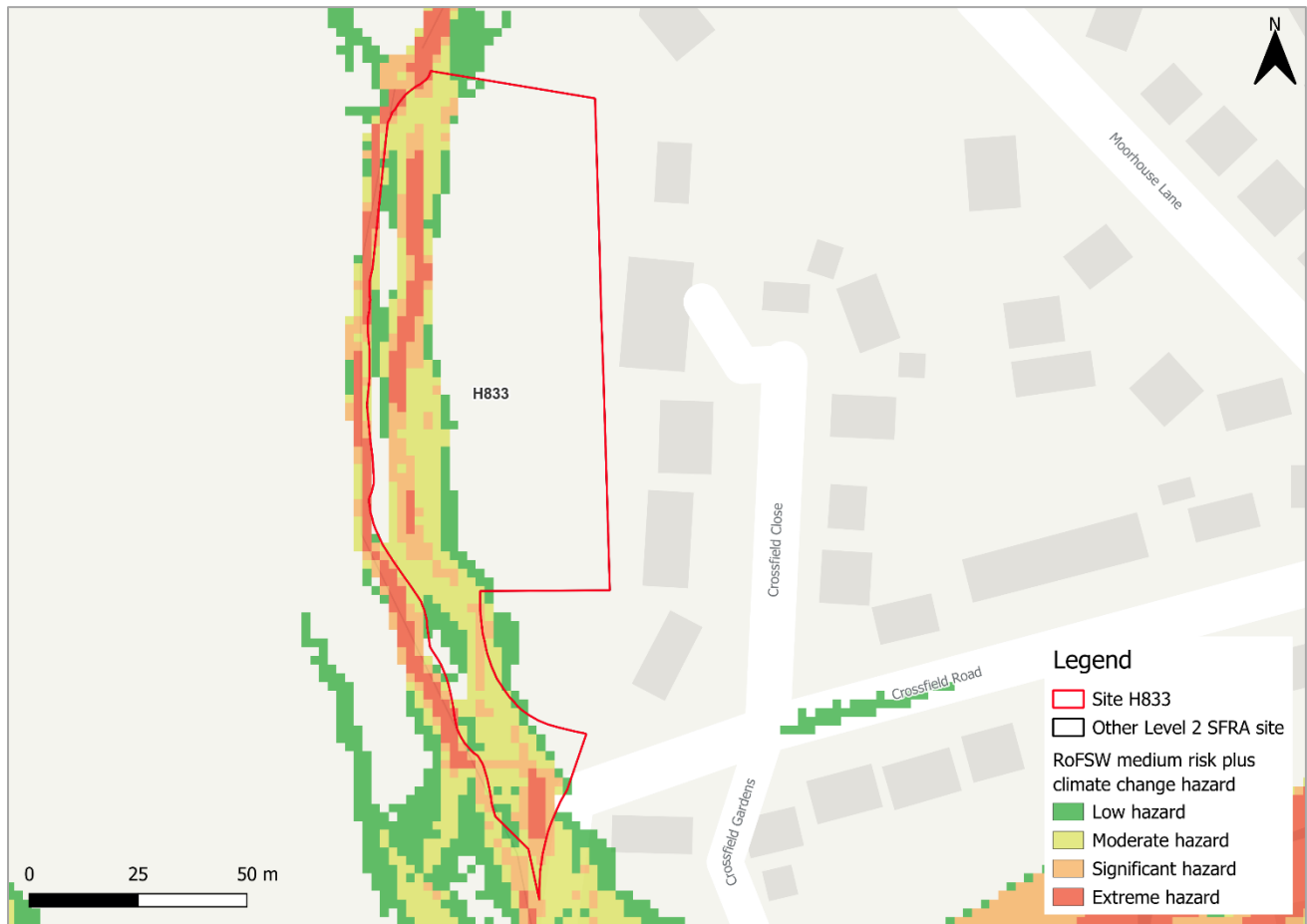


Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk to the site is modelled to be significant in the western and southern areas of the site.
- The modelled medium risk climate change outputs indicate a similar extent of risk to the present-day low risk event, with increased flood depths and extents.
- Ideally, the onsite surface water flow paths would be maintained onsite, however there may be potential for these routes to be diverted through greenfield land to the west of the site. Options for mitigation should be explored offsite as well as onsite to limit the impacts of these flow routes.
- The Groundwater Emergence Map (Figure 3-4) indicates that ground conditions may be suitable for infiltration SuDS across the majority of the site. This should be further explored through appropriate ground survey as part of the FRA and drainage strategy
- Any regrading of land must include like for like volumes to ensure risk is contained safely onsite for the lifetime of development. A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development, unless these constitute part of a strategy involving the diversion of surface water via greenfield land to the west of

the site which must have appropriate measures and agreements in place. Runoff rates should be restricted greenfield rates with betterment achieved if possible. This will require surface water modelling based on layout plans and detailed design as well as full consultation with the LLFA.

- Safe access and escape routes should be explored further as part of a site-specific FRA to ascertain whether they can be achieved during the extreme surface water events.
- Were development of this site to proceed, given the proximity of this site to neighbouring site H834, it would be prudent to formulate a strategy to develop these sites in tandem and for consultation between each developer to take place to ensure a joined-up approach for sustainable development is in place. A wider strategy would be beneficial at both sites given the large flow route originating offsite.
- Note that the RoFSW map is not suitable for identifying whether an individual property will flood and is therefore indicative. The RoFSW map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

4 Risk from groundwater

Risk of groundwater emergence is assessed in this SFRA using JBA's 5m Groundwater Emergence Map. This dataset is recommended for use by the EA in the SFRA Good Practice Guide². Figure 4-1 shows the map covering this site and the surrounding areas whilst Table 4-1 explains the risk classifications.

The majority of the site is in an area where there is no groundwater risk, indicating that groundwater conditions may be suited to infiltration SuDS across most of the site.

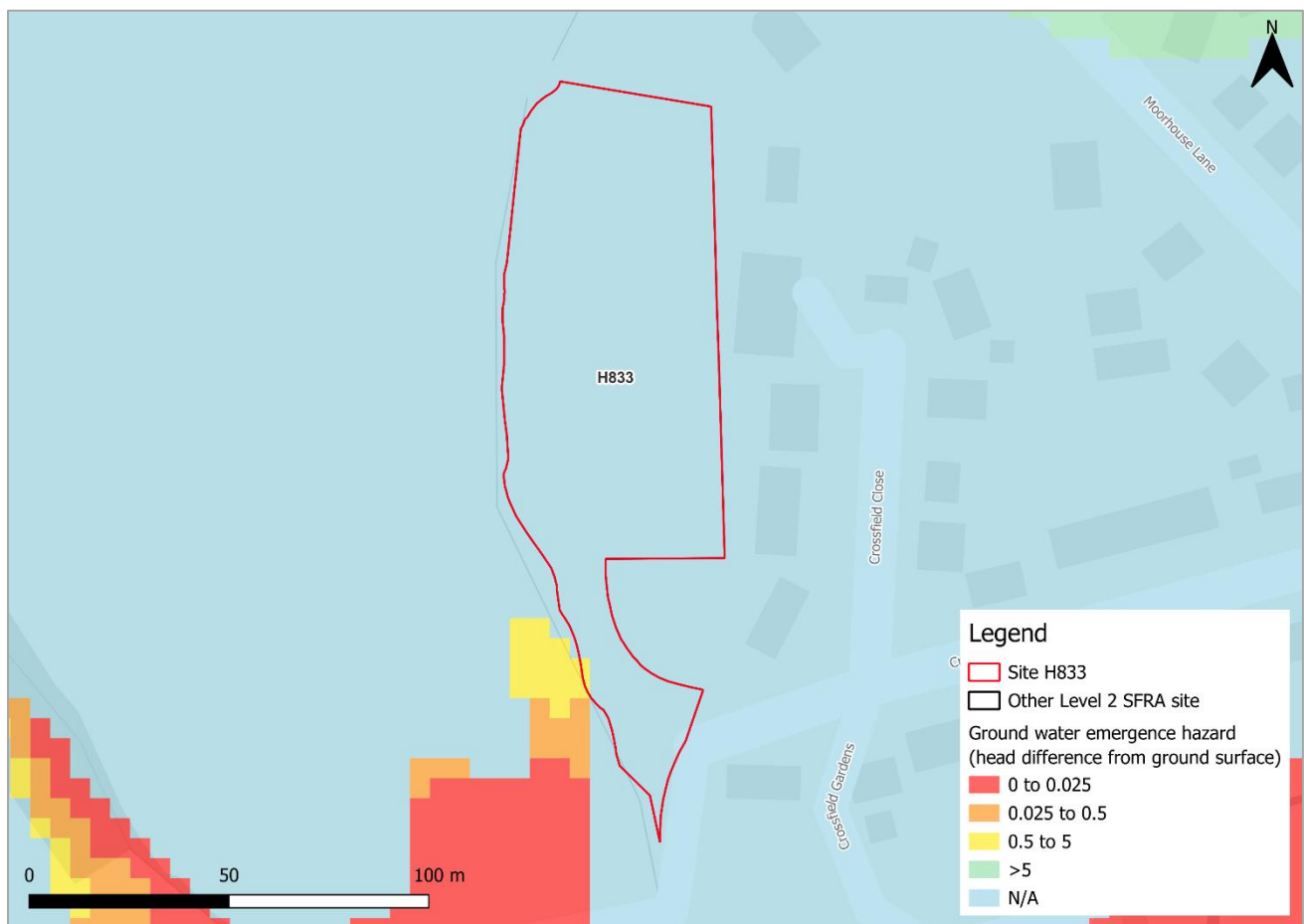


Figure 4-1: JBA 5m Groundwater Emergence Map

² [Strategic flood risk assessment good practice guide. ADEPT. December 2021.](#)

Table 4-1: Groundwater Hazard Classification

Groundwater head difference (m)*	Class label
0 to 0.025	Groundwater levels are either at very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event. There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
>5	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
*Difference is defined as ground surface in mAOD minus modelled groundwater table in mAOD.	

5 Residual risk

5.1 Flood risk from canals

The site is not likely to be at risk from a canal breach.

5.2 Flood risk from reservoirs

The EA's Reservoir Flood Maps (RFM) (2021) show where water may go in the unlikely event of a reservoir or dam failure. Figure 5-1 shows the RFM in a 'dry day' and 'wet day' scenario. A 'dry day' scenario assumes that the water level in the reservoir is the same as the spillway level or the underside of the roof for a service reservoir and the watercourses upstream and downstream of the reservoir are at a normal level. A 'wet day' scenario assumes a worst-case scenario where a reservoir releases water held on a 'wet day' when local rivers have already overflowed their banks.

The site is potentially at risk from Leeshaw Reservoir located within the Bradford authority area, owned and maintained by Yorkshire Water Services Ltd.

The EA's SFRA guidance states that where a proposed development site is at flood risk from a reservoir, then an assessment into whether the reservoir design or maintenance schedule needs improving should be carried out. Expert advice may be required from an all-reservoirs panel engineer. The Council should consult the reservoir owner, Yorkshire Water Services Ltd, to ascertain whether the proposed development could affect the reservoir's risk designation, its design category or how it is operated. The Council, as category 1 responders, can access more detailed information about reservoir risk and reservoir owners using the [Resilience Direct](#) system.

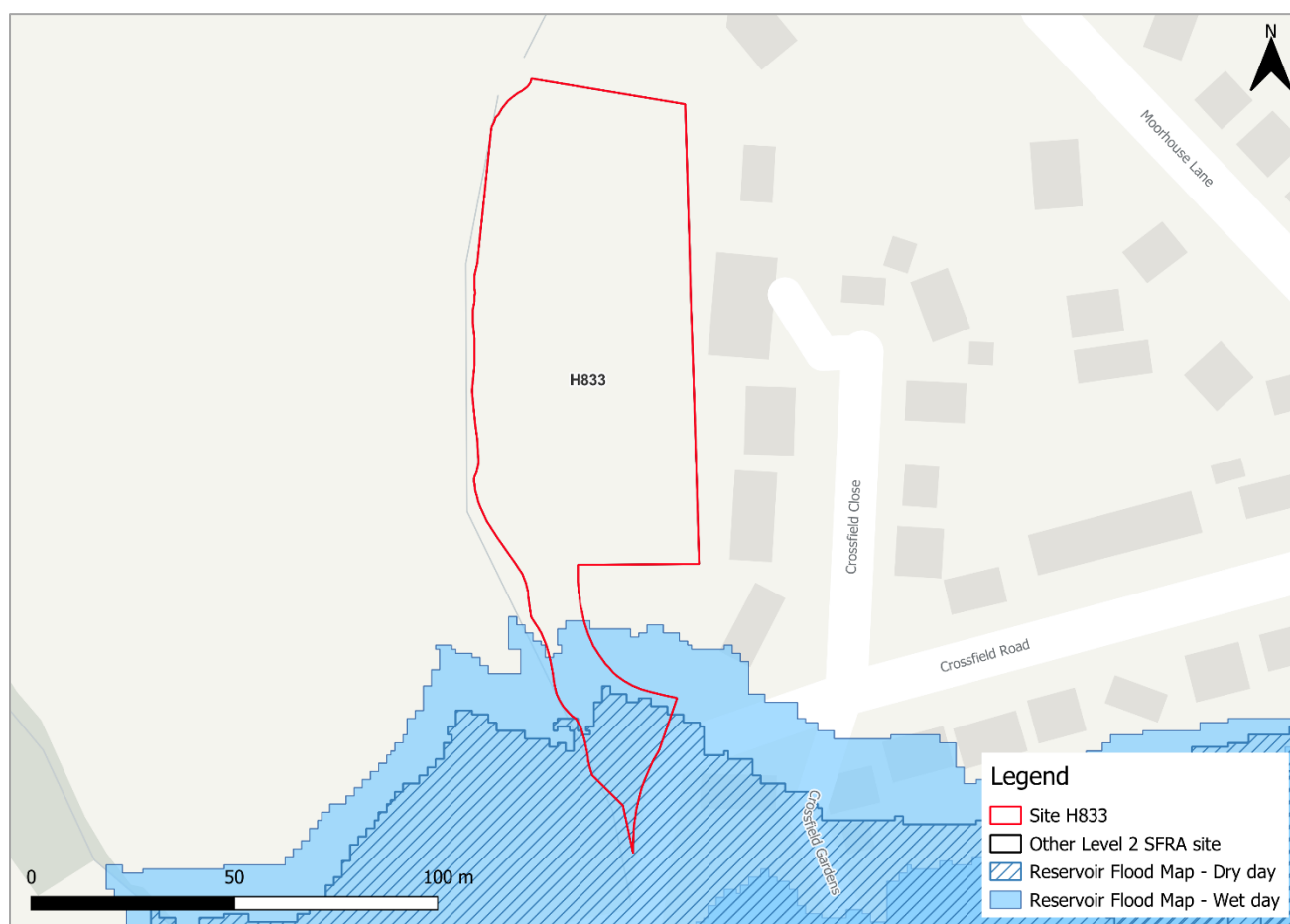


Figure 5-1: Flood risk from reservoirs

5.3 Flood risk from sewers

Flooding from the sewer network can occur when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes overloaded or blocked, or it cannot discharge due to high water levels in the receiving watercourse.

According to Yorkshire Water's records, there have been no incidents of sewer flooding in the area over the last two years.

5.4 Observations, mitigation options and site suitability - residual risk

- The site is at potential residual risk from a breach of Leeshaw Reservoir located in the Bradford authority area. The site is impacted by both the 'dry day' and 'wet day' modelled flood extents.
- Given the potential reservoir risk to the site, developers should consider³:
 - Consulting with the local resilience forum for advice on emergency planning,
 - Consulting with Yorkshire Water to understand the impact development may have on their reservoir, including for potential changes in designation, and;

³ [Reservoir flood maps: when and how to use them | Environment Agency | 2021](#)

- Use this Level 2 SFRA to understand whether any proposed development will be safe throughout its lifetime.
- The LPA should use the information on residual risk in this Level 2 SFRA to state in the local plan strategic policies a preferred mitigation strategy for ensuring development will be safe throughout its lifetime in relation to urban form, risk management and where flood mitigation measures are likely to have wider sustainable design implications (para 042, FRCC-PPG).
- The following should be also considered in any development that is proposed in affected areas:
 - Use of flood resistance and resilience measures,
 - Adequate flood warnings and alerts should be implemented, in consultation with the EA,
 - Provision of emergency escape routes including for vehicular access for emergency services. Judgements on whether the site can be regarded as safe will need to consider the feasibility and provision of evacuation from the site during a flood,
 - Provision of detailed emergency plans and signage for site users.

6 Overall site assessment

6.1 Can part b) of the exception test be passed?

This site is not required to pass part b) of the exception test⁴ as it is located within Flood Zone 1, however it must still be proven that the development can be safe for its lifetime, which is 100 years for residential development.

6.2 Recommendations, FRA requirements, and further work

Based on the evidence presented in the Level 1 SFRA (2023) and this Level 2 SFRA:

- This site could be allocated if development avoids areas of the site modelled to be at surface water flood risk, as well as areas in the south of the site modelled to be at residual risk from reservoir failure.
- The unmodelled tributary should be modelled to ascertain current and future fluvial flood risk to this site.
- No development should take place over the top of a culvert nor within 8m either side of the culverted section of watercourse.
- Surface water management is required which may reduce units, although if surface water was diverted in greenfield land to the west of the site, then the target number of units may be met. This will require detailed surface water modelling based on layout plans and detailed design as well as full consultation with the LLFA on required runoff rates, likely to be greenfield or betterment. The use of infiltration SuDS should be investigated for suitability across the majority of the site.
- Safe access and escape routes are likely to be challenging to achieve during the medium risk surface water flood event for the present day as well as when allowing for climate change. Therefore, any FRA for this site would need to be accompanied with a detailed drainage strategy informed by further pluvial modelling informing the identification of access and escape routes that are safe in all observed events.
- The LPA must make it clear that this site cannot be developed until the required information detailed in this SFRA on existing and future flood risk from reservoirs and surface water has been provided.
- Groundwater conditions in the south of the site must be investigated further through the site-specific FRA to ascertain groundwater levels and conditions.
- The Council highways department should be consulted, along with Yorkshire Water and the LLFA regarding existing highway drainage networks, surface water sewers and LLFA assets, and whether increased capacities may be required to enable sustainable development in the long term.

⁴ Para 170 National Planning Policy Framework 2023

- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA online guidance; the CBMDC Local Plan and national and local SuDS policy and guidelines.
- Throughout the FRA process, consultation should be carried out with the following, where applicable, the local planning authority; the lead local flood authority; emergency planning officers; the Environment Agency; Yorkshire Water; the highways authorities; and the emergency services.

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Bradford Level 2 Strategic Flood Risk Assessment - Site H834

Final Draft

May 2025

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

www.jbaconsulting.com

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Contract

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This report describes work commissioned by City of Bradford Metropolitan District Council (CBMDC) by an instruction dated 19 July 2024. The Client's representative for the contract was Jonathan Dicken of CBMDC. Freya Nation of JBA Consulting carried out this work.

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1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for the City of Bradford Metropolitan District Council (CBMDC) Local Plan Site H834. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'CBMDC Level 1 SFRA' (2023) and read the 'CBMDC Level 2 SFRA Main Report' (2024) and is therefore familiar with the terminology used in this report.

1.1 Site H834

- Location: Cross Lane
- Existing site use: Agricultural (grazing land)
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Residential
- Proposed site use vulnerability: More vulnerable
- Site area: 0.8 hectares
- Proposed development impermeable area: 0.7 hectares
- Environment Agency (EA) river model: N/A
- Watercourse: Moorhouse Beck
- Summary of requirements from scoping stage:
 - Level 1 SFRA recommendation was for withdrawal from allocation or more detailed assessment through Level 2 SFRA
 - Subject to the exception test as more vulnerable development proposed in Flood Zone 3a
 - Assessment of modelled fluvial flood depths, velocities and hazards
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk



Figure 1-1: Existing site location boundary

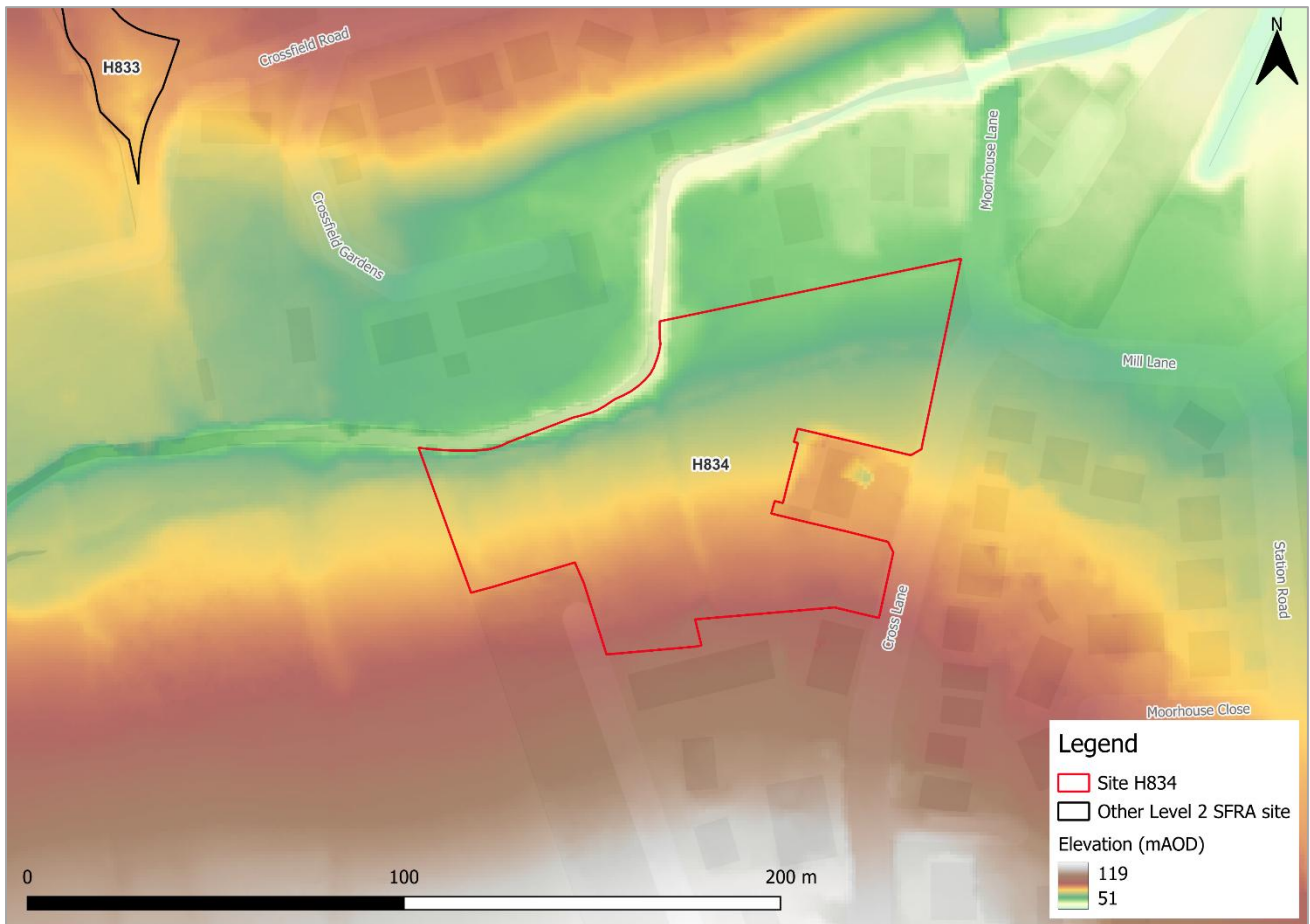


Figure 1-2: Topography



Figure 1-3: Soils and geology

2 Flood risk from rivers

2.1 Existing risk

2.1.1 Flood Map for Planning and functional floodplain

Based on the EA's Flood Map for Planning and Flood Zone 3b (functional floodplain), as updated in this Level 2 SFRA, the percentage areas of the site within each fluvial flood zone are stated in Table 2-1 and can be viewed on Figure 2-1. This version of the Flood Map for Planning does not consider flood defence infrastructure (Section 2.3) or the impacts of climate change (Section 2.2).

The majority of the site is modelled to be within Flood Zone 1. 12% of the site, namely along the course of Moorhouse Beck (along the northern boundary) is within Flood Zone 3b, indicating it is at high risk of flooding from rivers. Additionally, further parts along the northern site boundary are within Flood Zone 2, indicating they are at medium risk of flooding from rivers. Moorhouse Beck is an ordinary watercourse.

A model of Moorhouse Beck has not been made available for this Level 2 SFRA. Therefore, the functional floodplain in this area is based on Flood Zone 3a of the Flood Map for Planning. The EA should be consulted on the data source of the Flood Map for Planning in this location. If the Flood Map for Planning is based on a detailed model of Moorhouse Beck, any updates to this Level 2 SFRA and/or any site-specific FRA should make use of this model to understand modelled depths and hazards within the site.

Table 2-1: Existing fluvial flood risk based on percentage area of site at risk

Flood Zone 1 (% area)	Flood Zone 2 (% area)	Flood Zone 3a (% area)	Flood Zone 3b (% area)
84	4	0	12

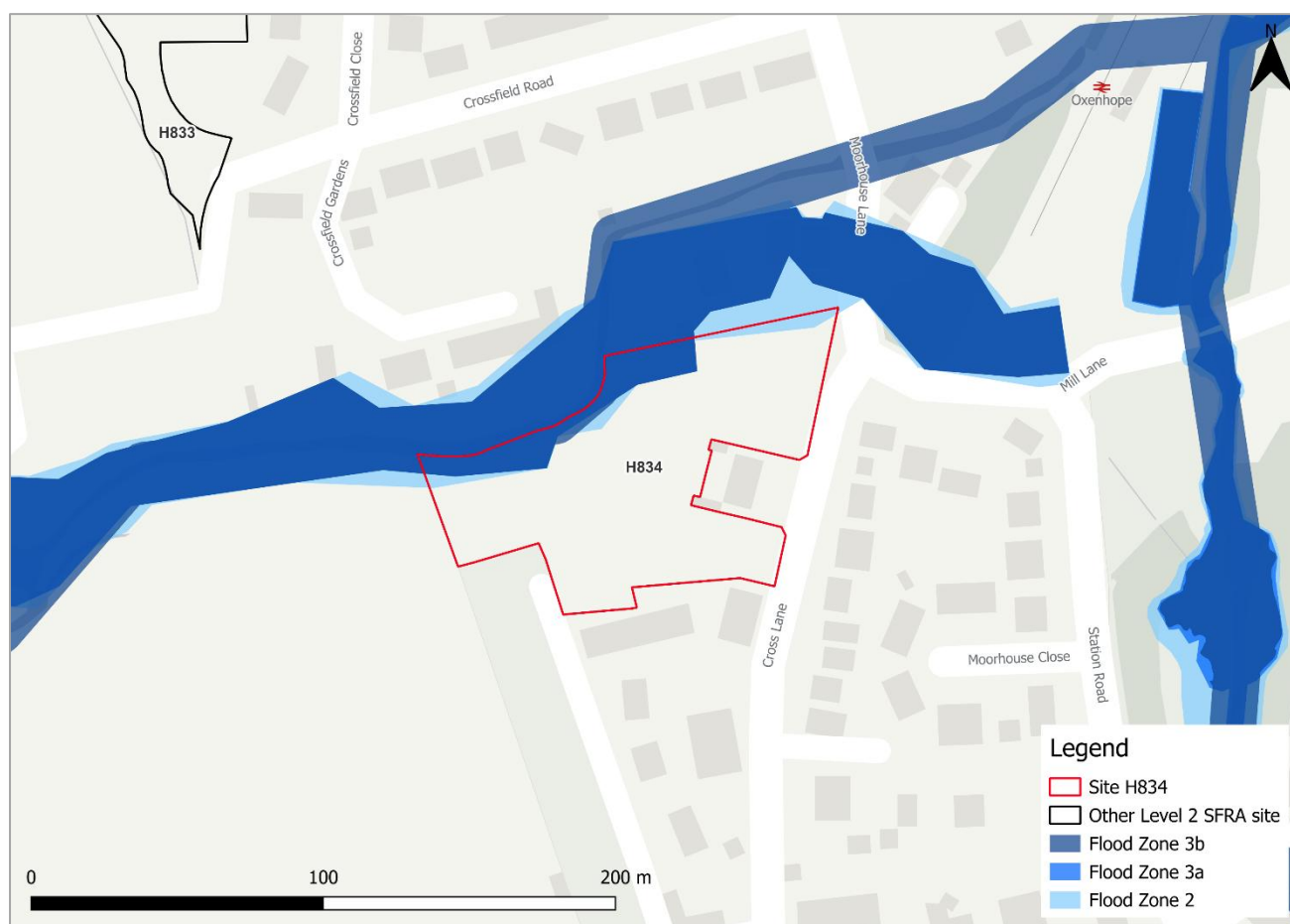


Figure 2-1: Existing risk from rivers to the site

2.2 Impacts from climate change

The impact of climate change on flood risk from Moorhouse Beck has not been modelled for this SFRA, as a model covering this watercourse was not made available for consideration. Therefore, in the absence of modelled climate change information, Flood Zone 2 of the Flood Map for Planning (based on the 0.1% AEP undefended event) can be used as a precautionary proxy for Flood Zone 3 plus climate change. Based on this approach, fluvial risk is modelled to increase in extent in comparison to the present day risk (Figure 2-1).

The impacts of climate change must be modelled using the EA's latest allowances for peak river flows to inform whether the site can be safe for its lifetime. The EA should be consulted on the data source of the Flood Map for Planning in this location. If the Flood Map for Planning is based on a detailed model of Moorhouse Beck, any updates to this Level 2 SFRA and/or any site-specific FRA should make use of this model and include the most up to date climate change allowances.

2.3 Flood risk management

2.3.1 Flood defences

The site does not benefit from any formal engineered flood defences, according to the EA's spatial flood defences dataset.

2.3.2 Working with Natural Processes

The EA's Working with Natural Processes (WwNP) dataset has been interrogated to identify opportunities for Natural Flood Management (NFM) to reduce flood risk to the site and surrounding areas. At the western site boundary there is a small area with potential for riparian tree planting which can intercept, slow, store and filter water. In turn, this can reduce flood peaks and frequency, reduce sediment delivery to the watercourse and reduce bankside erosion. This area is shown in Figure 2-2. The WwNP mapping is broadscale and indicative. Further investigation is required for any land shown to have potential for WwNP.

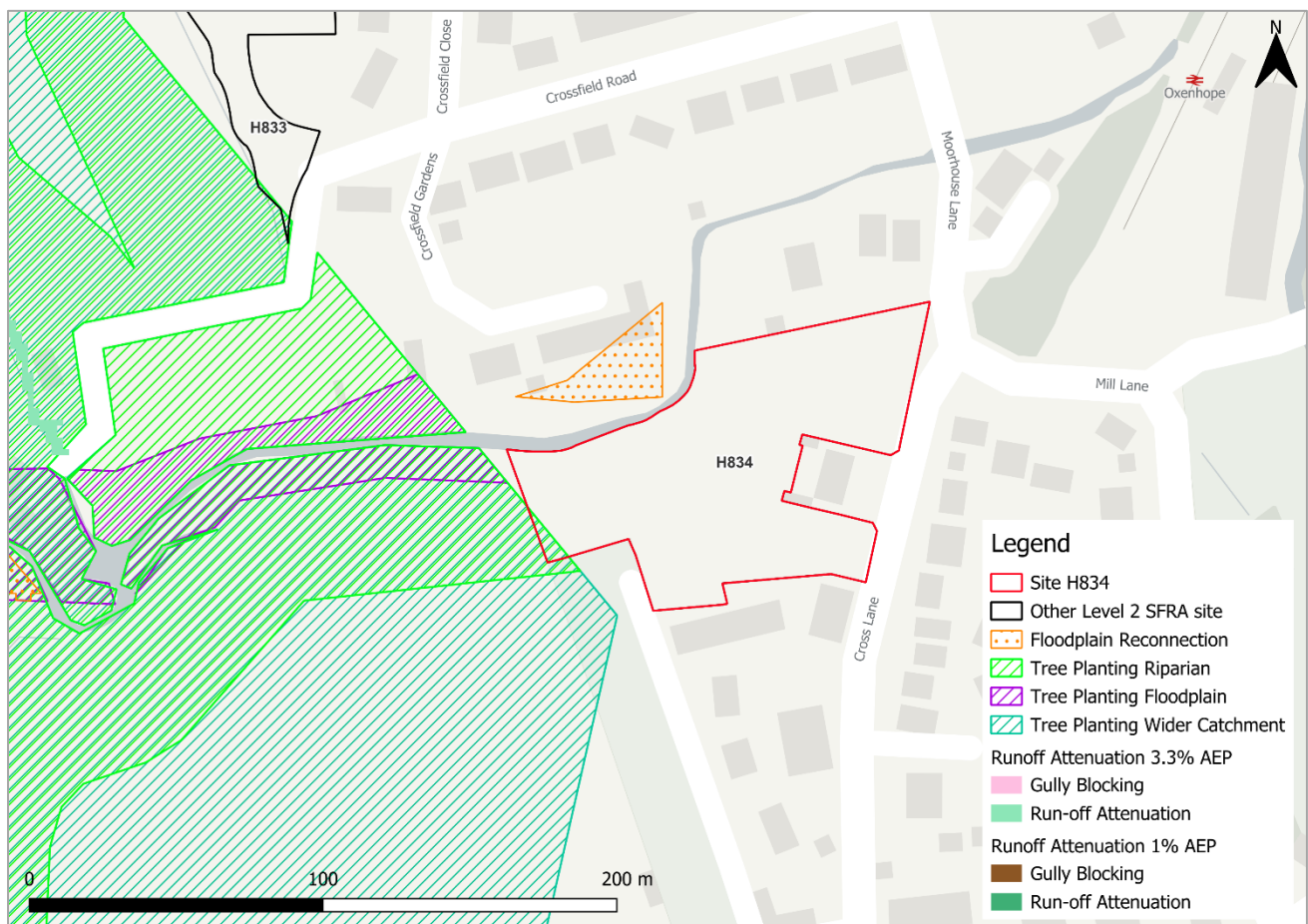


Figure 2-2: Natural Flood Management (NFM) potential mapping

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) and Recorded Flood Outlines (RFO) datasets have been considered. There are no recorded historic flood incidents within the vicinity of the site.

2.5 Flood warning and access and escape routes

The EA operates a Flood Warning Service for properties located within a Flood Warning Area (FWA) for when a flood event is expected to occur. The site is not located within a FWA.

Flood alerts may be issued before a flood warning for properties located within a Flood Alert Area (FAA) to provide advance notice of the possibility of flooding. A flood alert may be issued when there is less confidence that flooding will occur in a FWA. This site is partially located within a FAA, namely 123WAF981 - River Worth catchment, as shown in Figure 2-3.

Based on available information, safe access and escape routes could likely be achieved during a flood event via Cross Lane to the east of the site, travelling south.

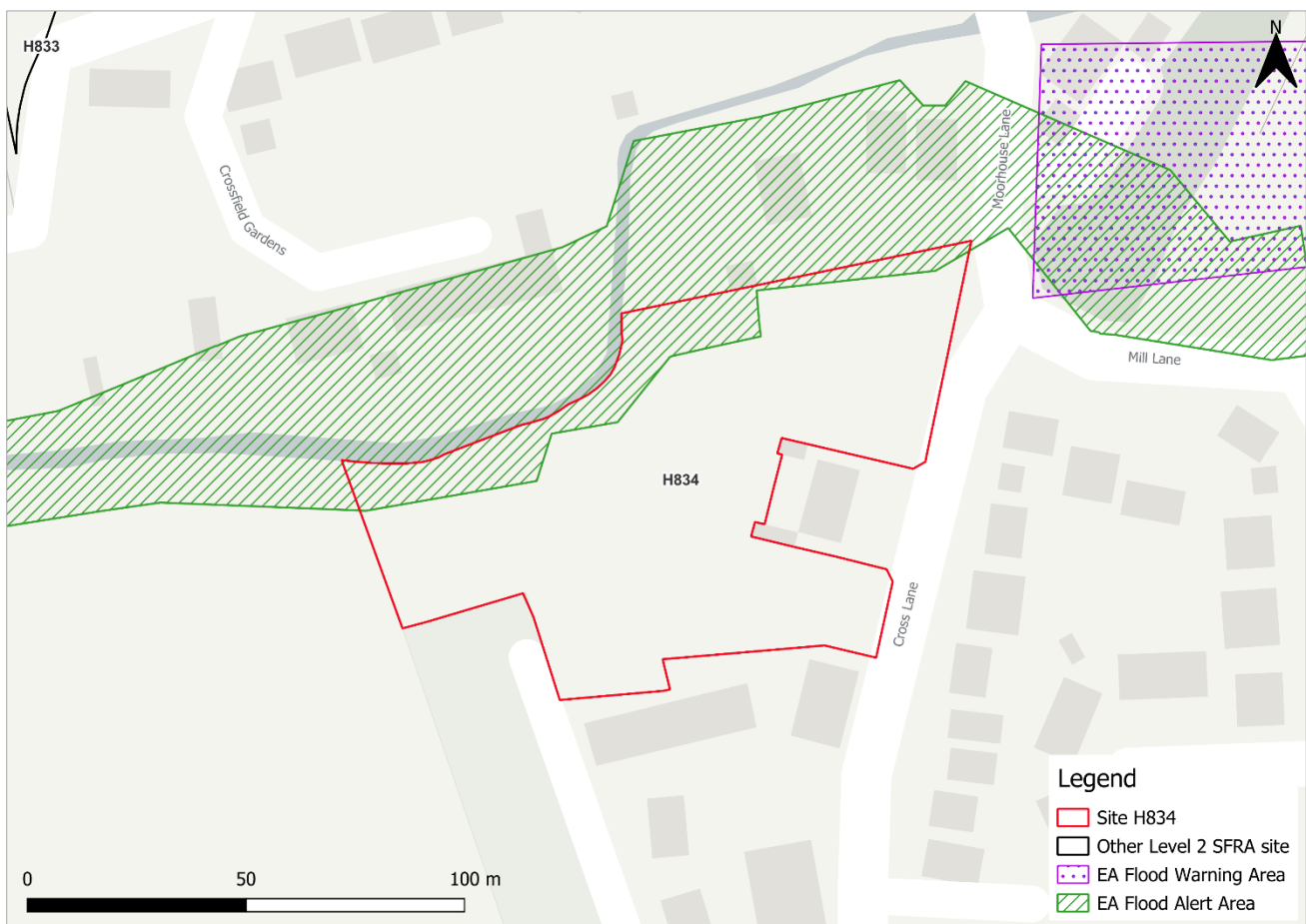


Figure 2-3: EA Flood Warning Areas and Flood Alert Areas

2.6 Observations, mitigation options and site suitability - fluvial

- The proposed development of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF.
- Given the change in use and therefore vulnerability of the site, the FRA must show that the development can be designed to be safe and that there is adequate emergency planning provision (para 014 FRCC-PPG).

- The site is modelled to be partially within the functional floodplain and Flood Zone 3a along the northern boundary of the site, adjacent to Moorhouse Beck. Development is not permitted within the functional floodplain, and development should avoid Flood Zone 3a. If feasible, this area would be used as a green / blue corridor which can provide multifunctional benefits providing ecological, social and amenity value.
- Given the site is more vulnerable and within Flood Zone 3a the site must be subject to and must pass the exception test.
- For any works on or near the ordinary watercourse, which have the potential to obstruct flow, the developer must apply for Ordinary Watercourse Consent from the LLFA.
- The EA's Flood Zone 2 extent has been used as a proxy to provide a precautionary estimate of the 1% AEP undefended event plus climate change. Based on this approach, fluvial risk may marginally increase in extent in comparison to the present day Flood Zone 3b and 3a, impacting the northern boundary of the site.
- The EA should be consulted on the data source of the Flood Map for Planning in this location. If the Flood Map for Planning is based on a detailed model of Moorhouse Beck, any updates to this Level 2 SFRA and/or any site-specific FRA should make use of this model and include for the most up to date climate change allowances.
- EA flood alerts should continue to be in place to ensure early evacuation of site users before an extreme flood event occurs.
- Safe access and escape routes could likely be achieved during a flood event via the Cross Lane to the east of the site, based on available information.

3 Flood risk from surface water

3.1 Existing risk

Based on the EA's national scale Risk of Flooding from Surface Water (RoFSW) map, surface water risk to the site is largely very low. However, 6% of the site is within the low risk surface water zone, 1% in the medium risk and 2% in the high risk zone, as shown in Table 3-1.

In the high risk event, surface water flooding is confined to the northwestern site boundary, following Moorhouse Beck. In the medium risk event, flooding encroaches slightly further over the northwestern site boundary and ponding to depths up to 0.15 m forms on Cross Lane. In the low risk event, flooding spreads to encroach further into the site and along more of the northern site boundary. Ponding on Cross Lane also expands.

Greatest flood depths within the site during the medium risk event are significant at > 1.2 m (Figure 3-1) with areas of hazard classified as extreme (Figure 3-2). Safe access and escape routes should be achievable in all events via Cross Lane given the shallow depths of flooding on the road.

Table 3-1: Existing surface water flood risk based on percentage area at risk using the RoFSW map

Very low risk (% area)	Low risk (% area)	Medium risk (% area)	High risk (% area)
91	6	1	2

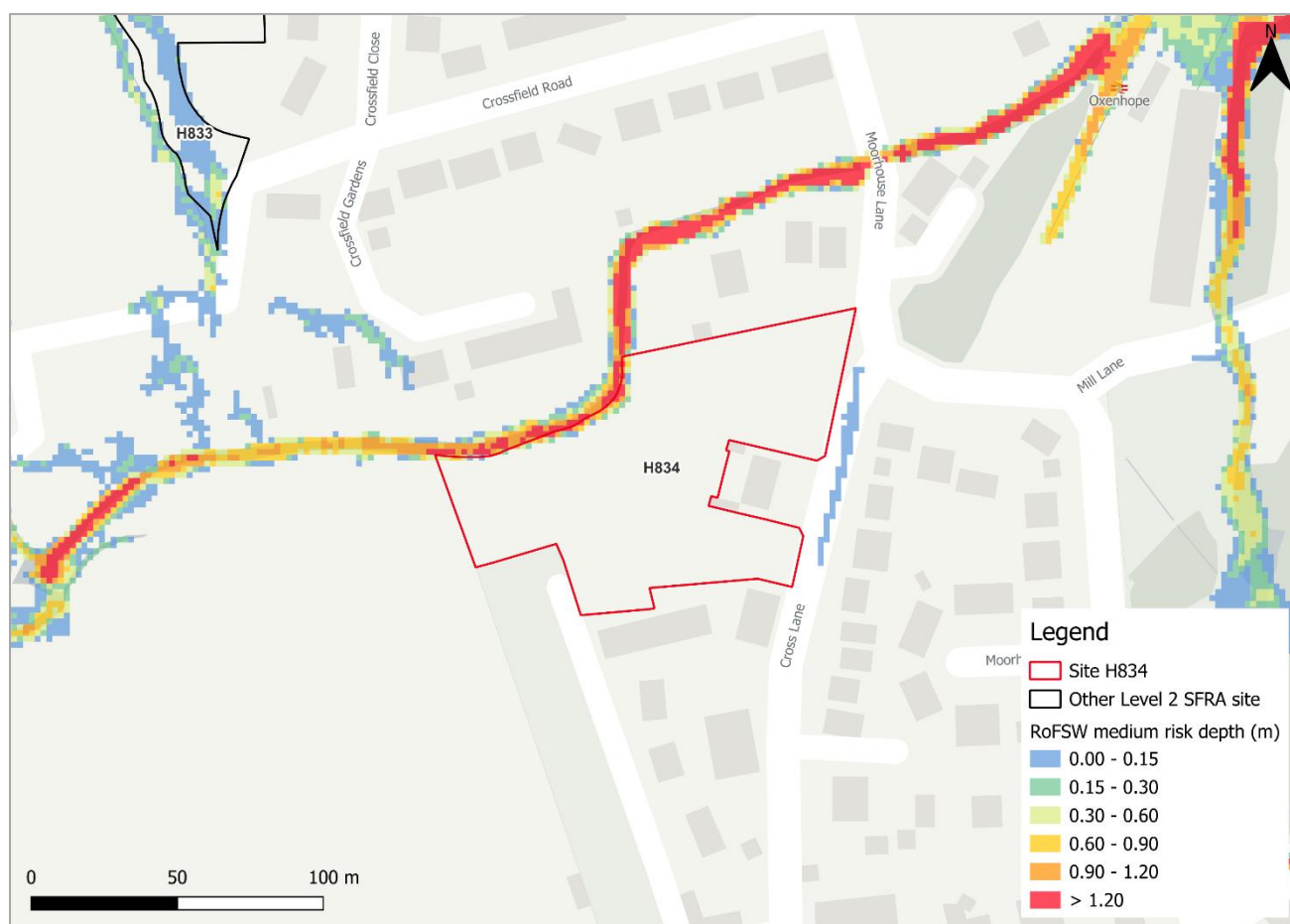


Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

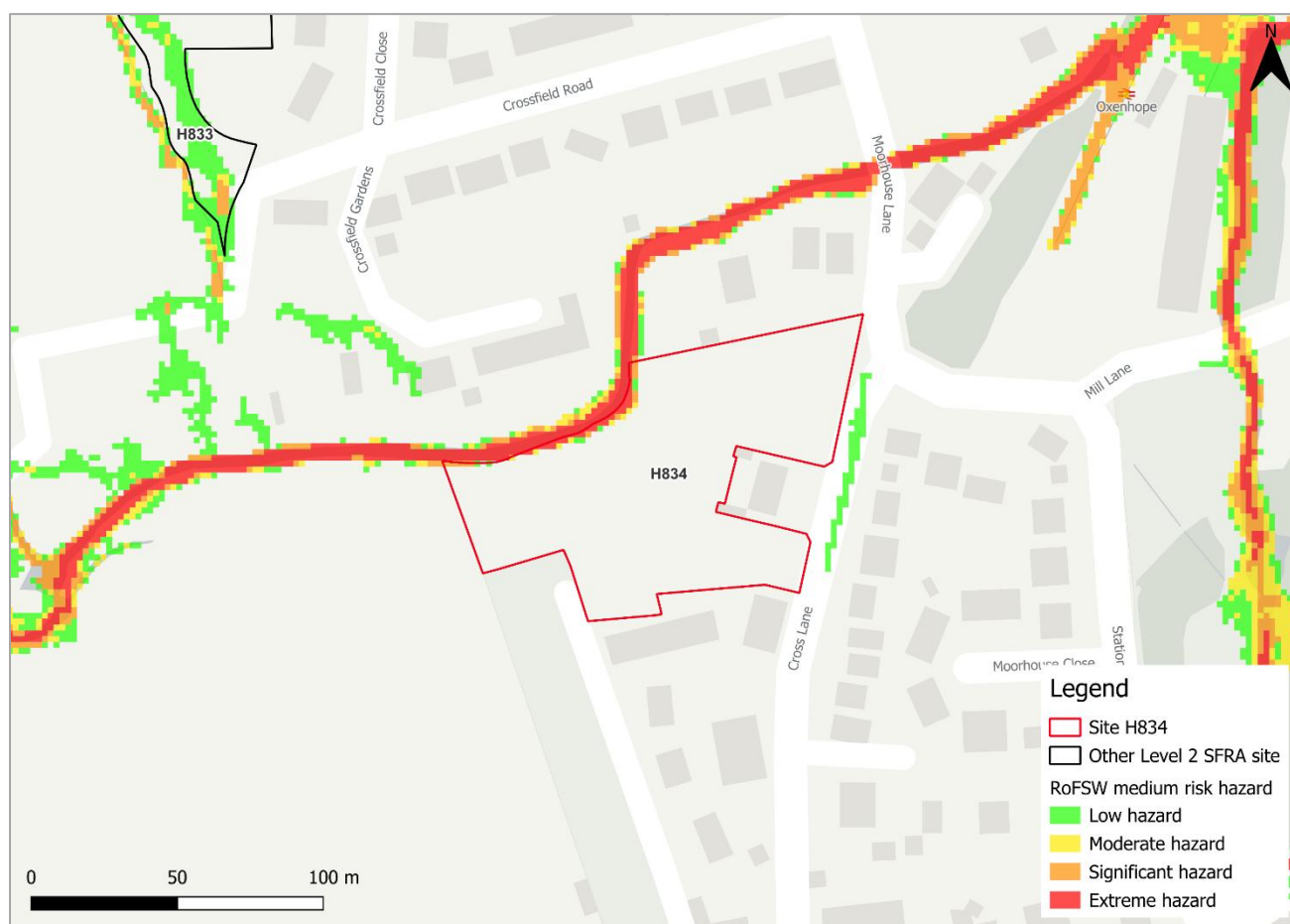


Figure 3-2: Medium risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

The impact of climate change on surface water flood risk has been modelled. This allows for direct comparison with the RoFSW map. With consideration of the EA's SFRA guidance, the latest climate change allowances have been modelled as shown in Table 3-2.

Table 3-2: Modelled climate change allowances for rainfall for the Aire and Calder management catchment

Return period	Central allowance 2070s (% increase)	Upper end allowance 2070s (% increase)
3.3% (high risk)	25%	40%
1% (medium risk)	30%	45%

Figure 3-3 shows modelled surface water flood depths for the medium risk event +45% climate change. Risk is modelled to be greater than both the medium and low risk event in

¹ Based on Section 7.5 Hazard rating. What is the Risk of Flooding from Surface Water map? Report version 2.0. April 2019. Environment Agency

present day conditions. Flooding is modelled to encroach further across the northern boundary and the ponding on Cross Lane is modelled to join the flow path along Moorhouse Lane. Maximum depths within the site remain > 1.2 m, with areas of hazard categorised as extreme (Figure 3-4). Safe access and escape routes may remain achievable via Cross Lane to the east of the site, travelling south during the climate change event, given the low depth of flooding on this road which have a low hazard classification.

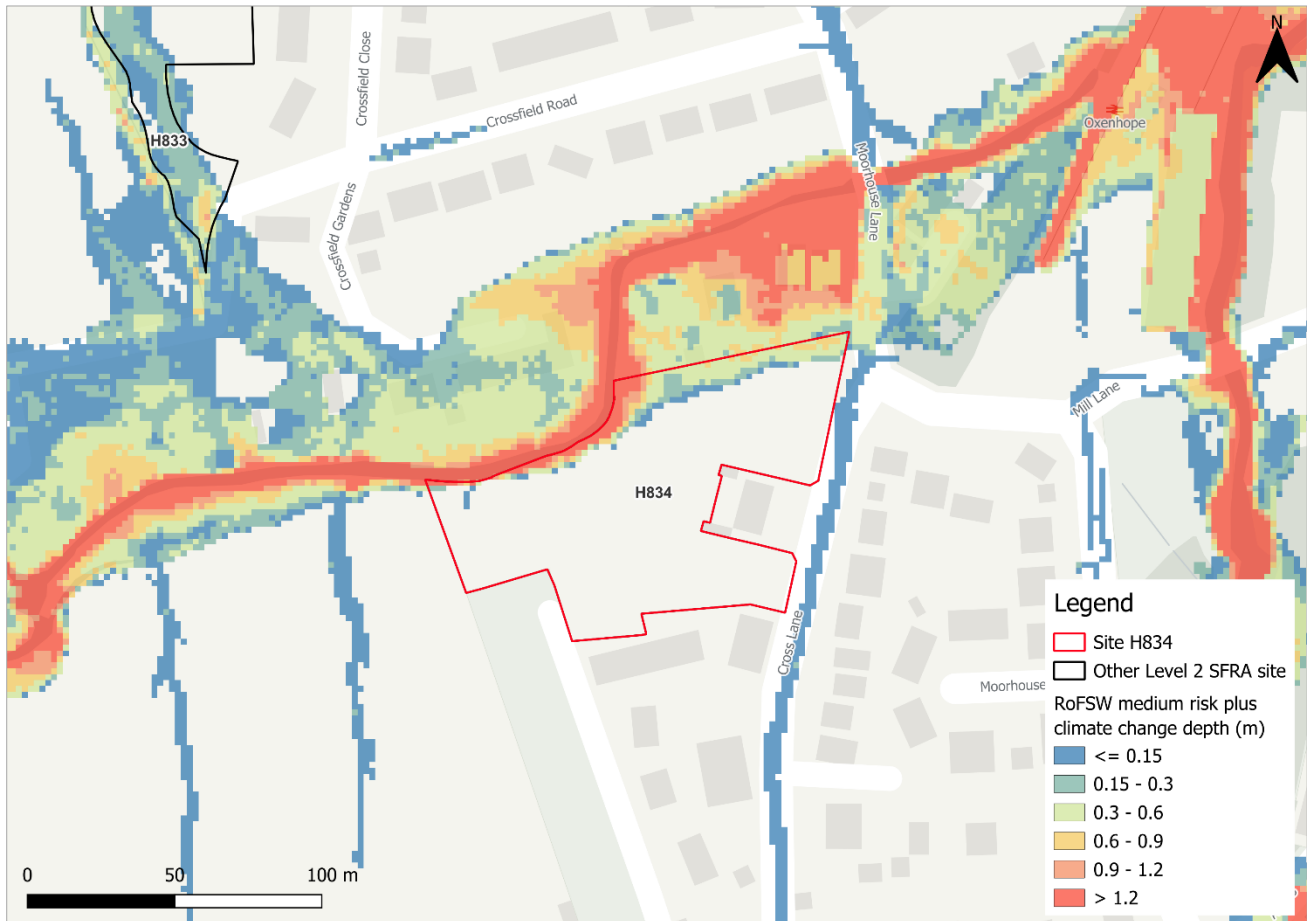


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)

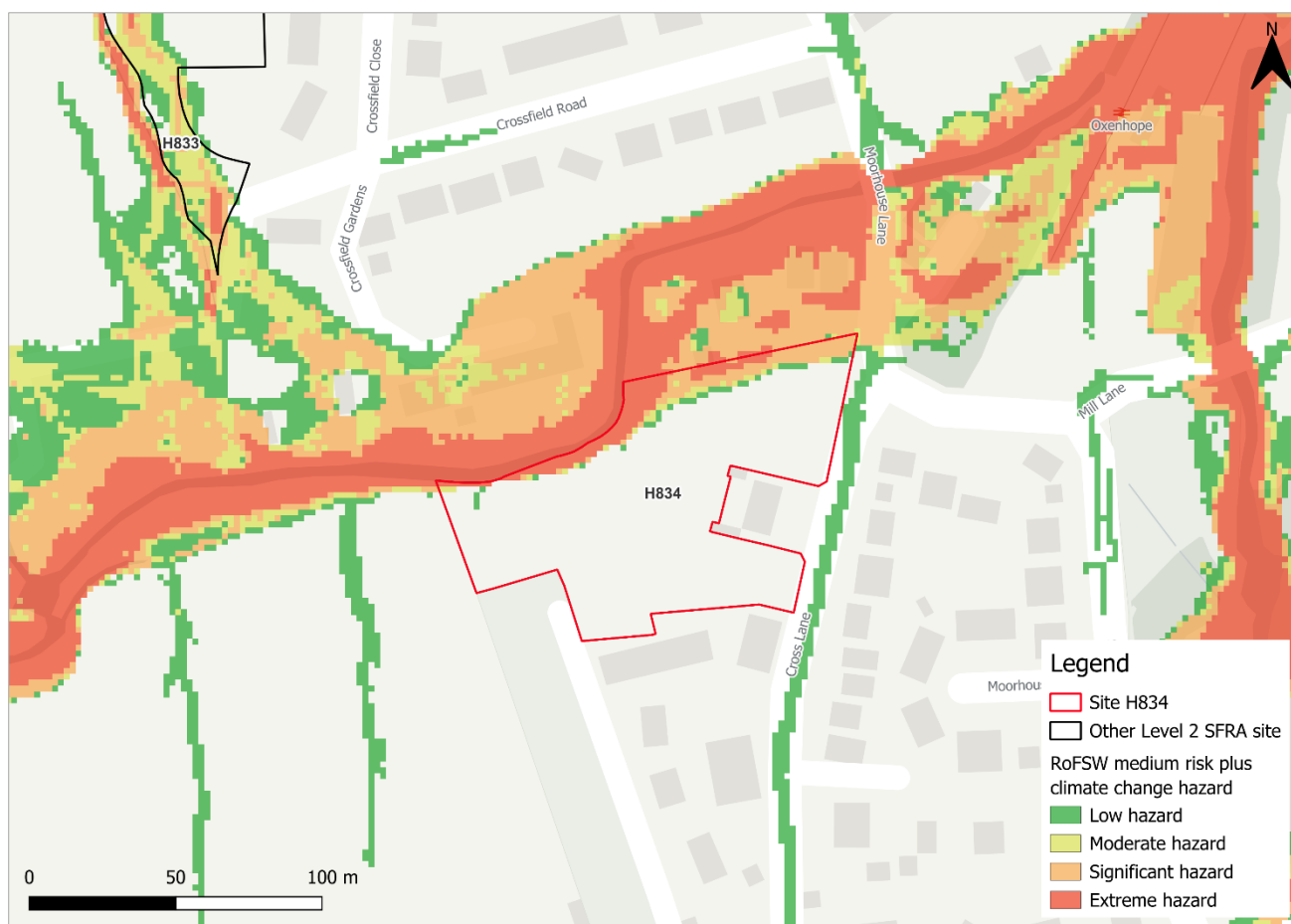


Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk to the site is predominantly very low, with approximately 91% of the site being at very low risk. However, there is significant risk to the northwestern / northern site boundary during all events due to Moorhouse Beck. Surface water risk in the high risk event is confined to the northwestern boundary of the site. In the medium risk event flooding expands to more of the northwestern boundary and in the low risk event flooding additionally impacts part of the northern boundary of the site. Safe access and escape routes should remain achievable via Cross Lane in the extreme event given the shallow depths of flooding on this road.
- The modelled medium risk surface water climate change outputs indicate a greater risk than the present day low risk event. Safe access and escape routes may remain achievable via the Cross Lane in the extreme event due to the low depths of flooding in the flow paths on this road.
- There should be no development within the functional floodplain which should include for the majority of the surface water flood risk. A blue green corridor should be in place along the northern boundary of the site, containing all the flood risk.

- Note that the RoFSW map is not suitable for identifying whether an individual property will flood and is therefore indicative. The RoFSW map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

4 Risk from groundwater

Risk of groundwater emergence is assessed in this SFRA using JBA's 5m Groundwater Emergence Map. This dataset is recommended for use by the EA in the SFRA Good Practice Guide². Figure 4-1 shows the map covering this site and the surrounding areas and Table 4-1 explains the risk classifications.

The majority of the site is in an area where there is no risk of groundwater emergence. However, at the north of the site there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots. Groundwater conditions are therefore unlikely to be suited to infiltration SuDS within the north of the site.

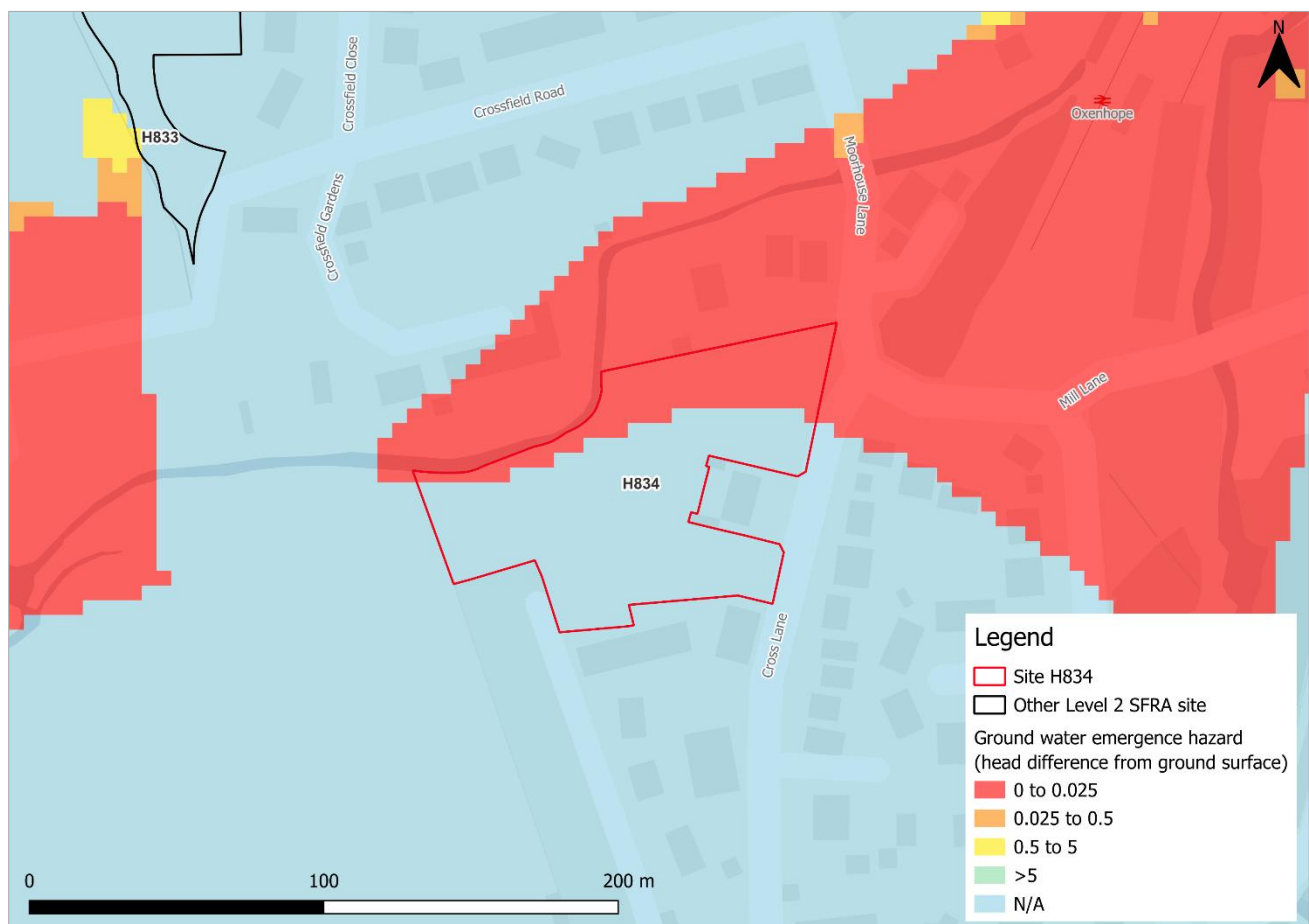


Figure 4-1: JBA 5m Groundwater Emergence Map

² [Strategic flood risk assessment good practice guide. ADEPT. December 2021.](#)

Table 4-1: Groundwater Hazard Classification

Groundwater head difference (m)*	Class label
0 to 0.025	Groundwater levels are either at very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event. There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
>5	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
*Difference is defined as ground surface in mAOD minus modelled groundwater table in mAOD.	

5 Residual risk

Although a site may be afforded some protection from defences and / or drainage infrastructure, there is always a residual risk of flooding from asset failure i.e. breaching / overtopping of flood defences, blockages of culverts or bridge openings.

Residual risk at this site comes from possible blockage of the structure beneath Moorhouse Lane, as shown in Figure 5-1. The EA should be consulted on the data source of the Flood Map for Planning in this location. If the Flood Map for Planning is based on a detailed model of Moorhouse Beck, any updates to this Level 2 SFRA and/or any site-specific FRA should make use of this model to understand modelled residual risk of culvert blockage within the site.

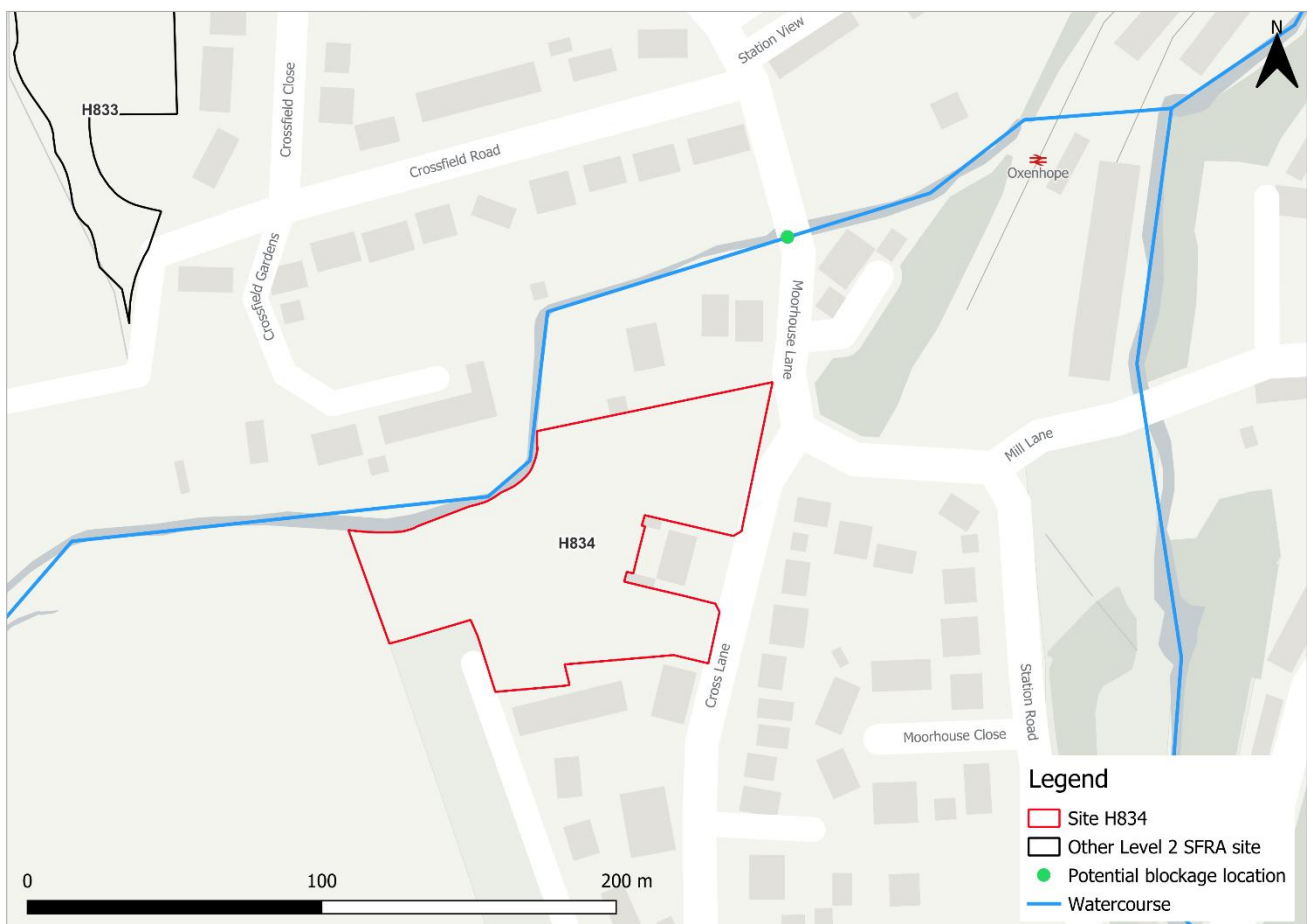


Figure 5-1: Potential blockage location

5.1 Flood risk from canals

The site is not likely to be at risk from a canal breach.

5.2 Flood risk from reservoirs

The EA's Reservoir Flood Maps (RFM) (2021) show where water may go in the unlikely event of a reservoir or dam failure. Figure 5-2 shows the RFM in a 'dry day' and 'wet day'

scenario. A 'dry day' scenario assumes that the water level in the reservoir is the same as the spillway level or the underside of the roof for a service reservoir and the watercourses upstream and downstream of the reservoir are at a normal level. A 'wet day' scenario assumes a worst-case scenario where a reservoir releases water held on a 'wet day' when local rivers have already overflowed their banks.

The site is potentially at risk from two reservoirs during the 'dry day' and 'wet day' scenario. Risk from Leeming Reservoir is largely confined to the north of the site, in both the wet and dry day scenario. Risk from Leeshaw Reservoir impacts approximately two thirds of the site during the wet day scenario. Both reservoirs are located within Bradford district and owned / operated by Yorkshire Water.

The EA's SFRA guidance states that where a proposed development site is at flood risk from a reservoir, then an assessment into whether the reservoir design or maintenance schedule needs improving should be carried out. Expert advice may be required from an all-reservoirs panel engineer. The Council should consult Yorkshire Water to ascertain whether the proposed development could affect the reservoir's risk designation, it's design category or how it is operated. The Council, as category 1 responders, can access more detailed information about reservoir risk and reservoir owners using the [Resilience Direct](#) system.

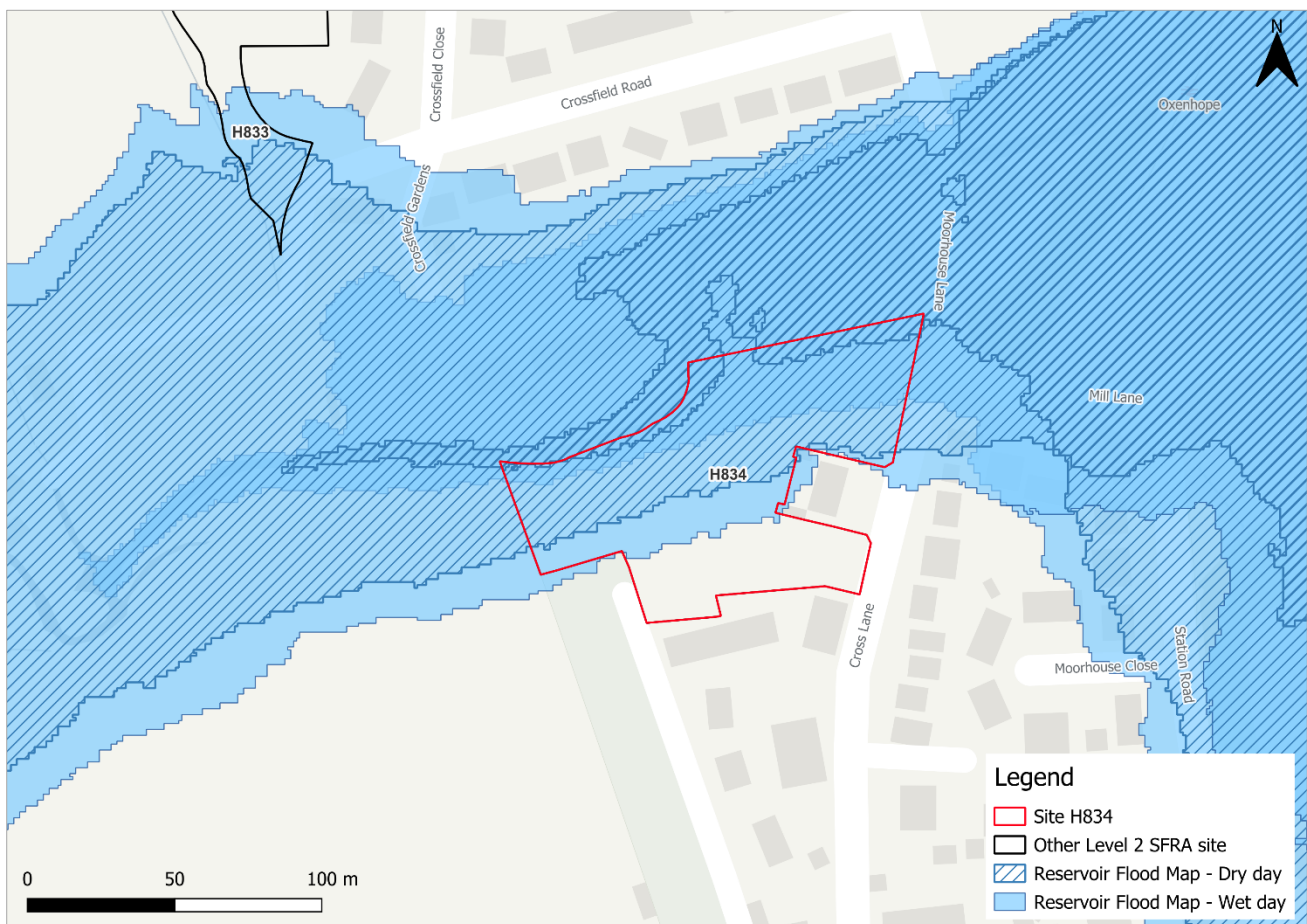


Figure 5-2: Flood risk from reservoirs

5.3 Flood risk from sewers

Flooding from the sewer network can occur when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes overloaded, blocked or it cannot discharge due to a high water level in the receiving watercourse.

According to Yorkshire Water's records, there have been no incidents of sewer flooding in the area over the last two years.

5.4 Observations, mitigation options and site suitability - residual risk

- The site is at potential residual risk from a breach of Leeming Reservoir and Leeshaw Reservoir, both located in Bradford. Leeshaw Reservoir presents a large risk to the site during the 'wet day' scenario though this represents a prediction of the credible worst case scenario, therefore it is unlikely that any potential flood would be this large.
- Given the potential reservoir risk to the site, developers should consider³:
 - Consulting with the local resilience forum for advice on emergency planning,
 - Consulting with relevant reservoir owners to understand the impact development may have on their reservoirs, and
 - Use this Level 2 SFRA to understand whether any proposed development will be safe throughout its lifetime.
- There is residual risk to the site from a blockage of the Moorhouse Beck culvert beneath Moorhouse Lane. The owner of this culvert is currently unknown. Once ownership information is established, the owner should be able to advise on funding and maintenance arrangements for this asset into the future. Consultation with the EA will also be required on whether this site is suitable for development.
- Areas adjacent to culverts and bridges are at particular risk from the rapid onset of fast flowing and deep flooding, with little or no warning if structures become blocked. Emergency plans must be in place for such areas and safe access and egress routes must be in place for the lifetime of development. Resistance and resilience measures may also be put in place to manage residual flood risk when avoidance measures have been exhausted.
- The LPA should use the information on residual risk in this Level 2 SFRA to state in the local plan strategic policies a preferred mitigation strategy for ensuring development will be safe throughout its lifetime in relation to urban form, risk management and where flood mitigation measures are likely to have wider sustainable design implications (para 042, FRCC-PPG).
- Given the residual risk to this site, the following should be considered:
 - Use of flood resistance and resilience measures,
 - Adequate flood alerts should remain in place, in consultation with the EA,

³ [Reservoir flood maps: when and how to use them | Environment Agency | 2021](#)

- Provision of emergency escape routes including for vehicular access for emergency services. Judgements on whether the site can be regarded as safe will need to consider the feasibility and provision of evacuation from the site during a flood,
- Provision of detailed emergency plans and signage for site users.

6 Overall site assessment

6.1 Can part b) of the exception test be passed?

This site is required to pass part b) of the exception test⁴ due to its location in Flood Zone 3a. The site should be able to pass the exception test if development avoids the area of the site within Flood Zone 3a and the functional floodplain / Flood Zone 3b.

6.2 Recommendations, FRA requirements, and further work

Based on the evidence presented in the Level 1 SFRA (2023) and this Level 2 SFRA:

- Updated present day and climate change modelling of Moorhouse Beck should be used to update this Level 2 SFRA at the earliest opportunity to provide an up-to-date strategic assessment of flood risk to this site and the surrounding areas.
- This site could be allocated if development can avoid the northwestern / northern boundary of the site at modelled fluvial and surface water risk. This area should be used as a blue green corridor. However, the LPA must make it clear that this site cannot be developed until the required information detailed in this SFRA on existing and future flood risk from Moorhouse Beck is fully ascertained.
- Given the potential reservoir risk to the site, developers should consider⁵:
 - Consulting with the local resilience forum for advice on emergency planning,
 - Consulting with relevant reservoir owners to understand the impact development may have on their reservoirs, and
 - Use this Level 2 SFRA to understand whether any proposed development will be safe throughout its lifetime.
- There is residual risk to the site from a blockage of the Moorhouse Beck culvert beneath Moorhouse Lane. The owner of this culvert is currently unknown. Once ownership information is established, the owner should be able to advise on funding and maintenance arrangements for this asset into the future. Consultation with the EA will also be required on whether this site is suitable for development.
- Any FRA should produce a detailed drainage strategy which should include ground investigation for infiltration SuDS suitability.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA online guidance; the CBMDC Local Plan and national and local SuDS policy and guidelines.
- Throughout the FRA process, consultation should be carried out with the following, where applicable, the local planning authority; the lead local flood authority; emergency planning officers; the Environment Agency; Yorkshire Water; the highways authorities; and the emergency services.

⁴ Para 178 National Planning Policy Framework 2024

⁵ [Reservoir flood maps: when and how to use them | Environment Agency | 2021](#)

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Bradford Level 2 Strategic Flood Risk Assessment - Site H1337

Final Draft

May 2025

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

www.jbaconsulting.com

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Contract

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This report describes work commissioned by City of Bradford Metropolitan District Council (CBMDC) by an instruction dated 19 July 2024. The Client's representative for the contract was Jonathan Dicken of CBMDC. Freya Nation of JBA Consulting carried out this work.

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1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for the City of Bradford Metropolitan District Council (CBMDC) Local Plan Site H1337. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'CBMDC Level 1 SFRA' (2023) and read the 'CBMDC Level 2 SFRA Main Report' (2024) and is therefore familiar with the terminology used in this report.

1.1 Site H1337

- Location: Prospect Mill, Main Street
- Existing site use: Manufacturing, car park, woodland
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Residential
- Proposed site use vulnerability: More vulnerable
- Site area: 0.7 hectares
- Proposed development impermeable area: 0.6 hectares
- Environment Agency (EA) river model: N/A
- Watercourse: N/A
- Summary of requirements from scoping stage:
 - Level 1 SFRA recommendation was for withdrawal from allocation or more detailed assessment through Level 2 SFRA
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk



Figure 1-1: Existing site location boundary

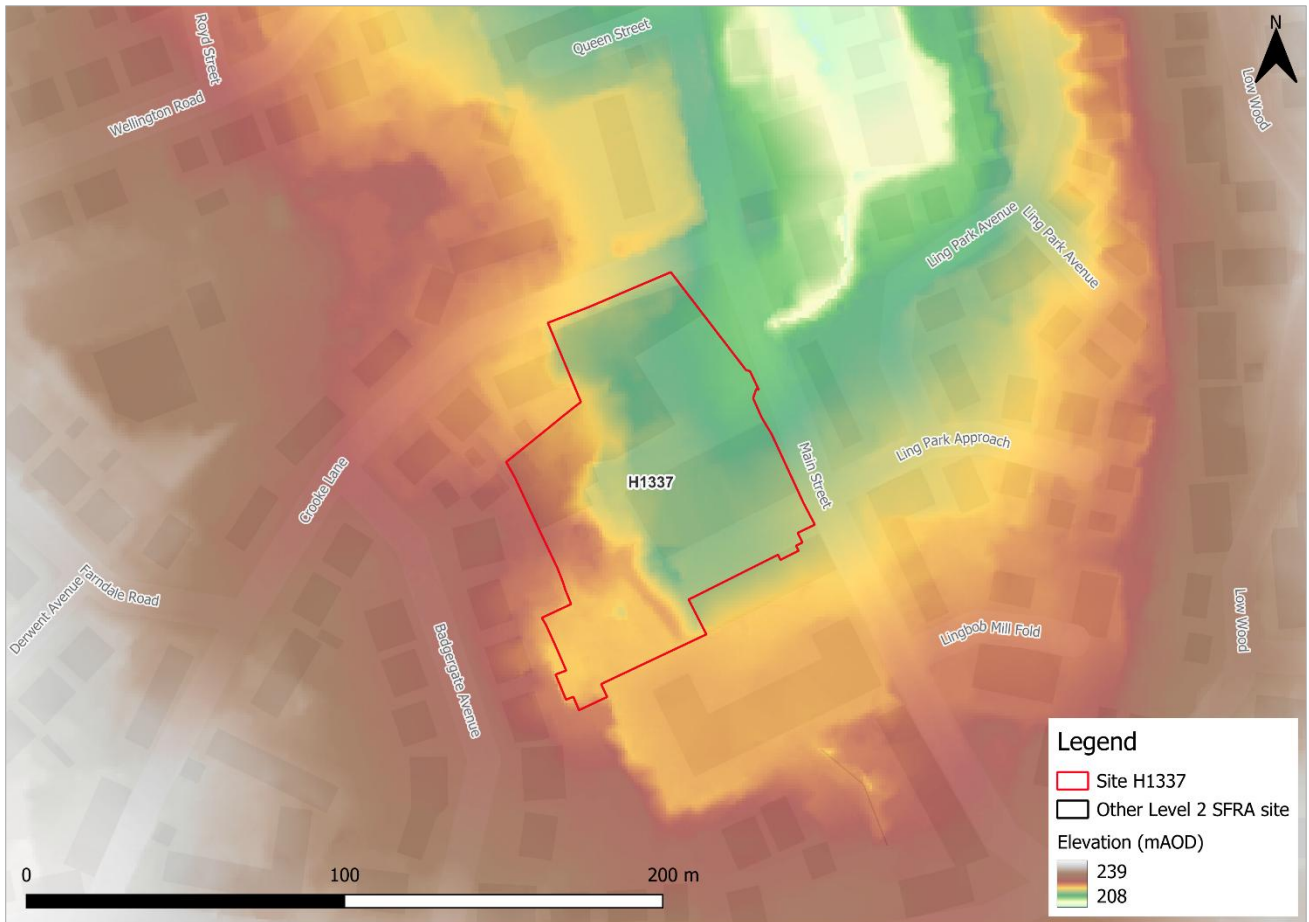


Figure 1-2: Topography



Figure 1-3: Soils and geology

2 Flood risk from rivers

2.1 Existing risk

2.1.1 Flood Map for Planning and functional floodplain

Based on the EA's Flood Map for Planning and Flood Zone 3b (functional floodplain), as updated in this Level 2 SFRA, the percentage areas of the site within each fluvial flood zone are stated in Table 2-1 and can be viewed on Figure 2-1. This version of the Flood Map for Planning does not consider flood defence infrastructure (Section 2.3) or the impacts of climate change.

The site is modelled to be wholly within Flood Zone 1 and is therefore at low risk of flooding from rivers.

Table 2-1: Existing fluvial flood risk based on percentage area of site at risk

Flood Zone 1 (% area)	Flood Zone 2 (% area)	Flood Zone 3a (% area)	Flood Zone 3b (% area)
100	0	0	0

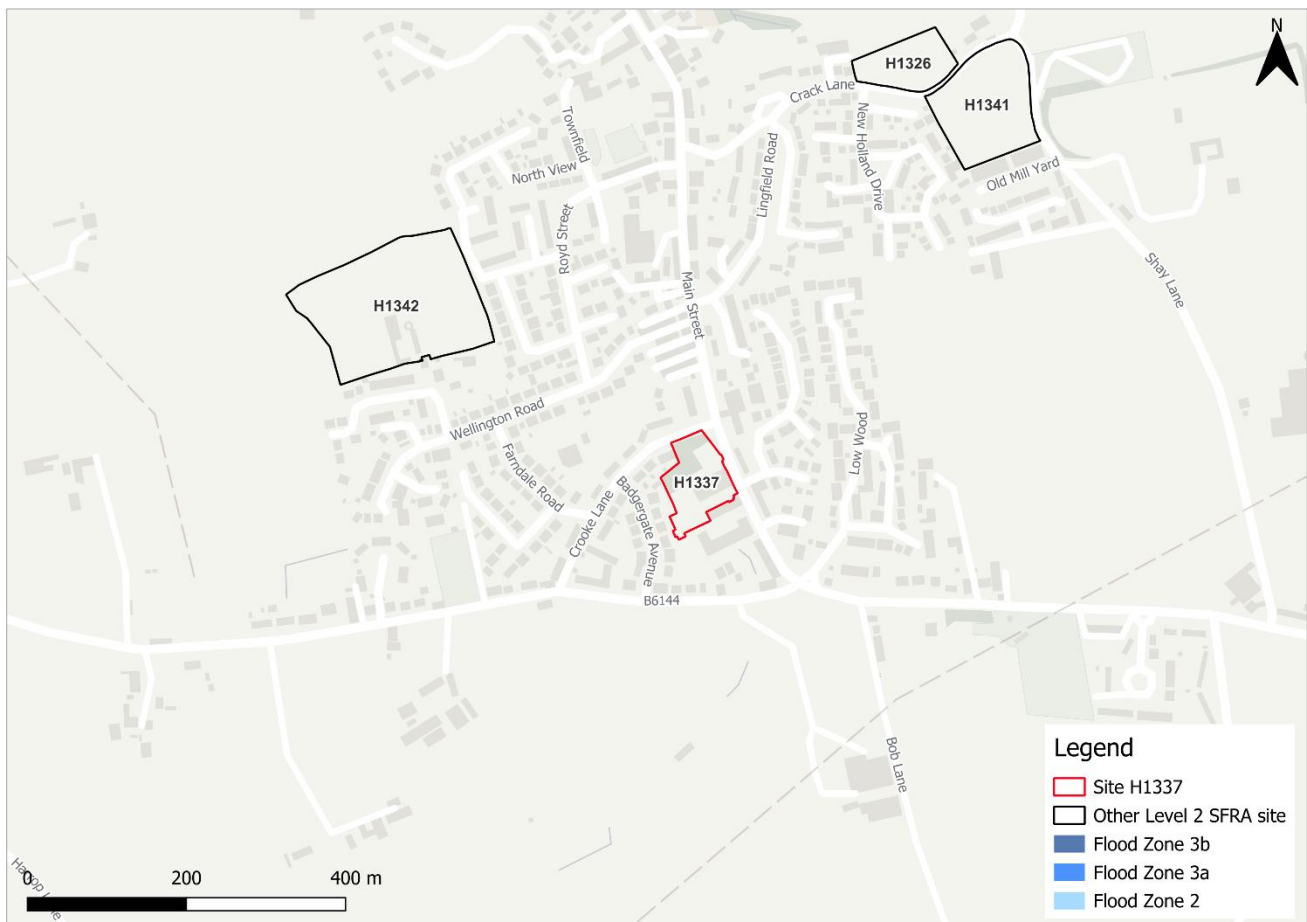


Figure 2-1: Existing risk from rivers to the site

2.2 Historic land-use mapping

Historic land-use mapping held by the LLFA indicates a watercourse along the eastern boundary of the site. This should be confirmed, and the exact location ascertained, through site investigation. Potential flood risk from this watercourse may need to be ascertained at the FRA stage. No development should take place over the top of a culvert nor within 8m either side of the culverted section of watercourse.

2.3 Flood risk management

2.3.1 Flood defences

The site does not benefit from any formal engineered flood defences, according to the EA's spatial flood defences dataset.

2.3.2 Working with Natural Processes

The EA's Working with Natural Processes (WwNP) dataset has been interrogated to identify opportunities for Natural Flood Management (NFM) to reduce flood risk to the site and surrounding areas. There are no applicable areas that could benefit the site.

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) and Recorded Flood Outlines (RFO) datasets have been considered. There are no recorded historic flood events within the vicinity of the site.

2.5 LLFA flood incidents

The LLFA have record of one flood incident northeast of the site, which occurred in 2020. Developers should contact the LLFA for further information at the FRA stage, to assess potential flood risk to the site associated with these incidents.

2.6 Flood warning and access and escape routes

The EA operates a Flood Warning Service for properties located within a Flood Warning Area (FWA) for when a flood event is expected to occur. The site is not located within a FWA.

Flood alerts may be issued before a flood warning for properties located within a Flood Alert Area (FAA) to provide advance notice of the possibility of flooding. A flood alert may be issued when there is less confidence that flooding will occur in a FWA. This site is not located within a FAA.

2.7 Observations, mitigation options and site suitability - fluvial

- The proposed development of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF.

- Given the change in use and therefore vulnerability of the site, the FRA must show that the development can be designed to be safe and that there is adequate emergency planning provision (para 014 FRCC-PPG).
- The site is wholly located within Flood Zone 1 and is therefore at low risk of flooding from rivers. Potential flood risk from the watercourse shown in historic land-use mapping to enter the site may need to be ascertained at the FRA stage. No development should take place over the top of a culvert nor within 8m either side of the culverted section of watercourse.
- If a watercourse is identified, it may need to be modelled to quantify the risk from any culverts.
- Assuming a culvert is located beneath the site, opportunities for opening up the culvert should be explored for inclusion in site design as a blue green corridor. This would remove any residual risk of flooding to the site as a result of culvert failure or blockage.

3 Flood risk from surface water

3.1 Existing risk

Based on the EA's national scale Risk of Flooding from Surface Water (RoFSW) map, surface water risk to the site is significant. Approximately 25% of the site is within the high risk surface water flood zone. 5% of the site is within the medium risk zone and a further 34% is at low surface water risk, as shown in Table 3-1.

In the high risk event, surface water ponding impacts the northern and southern halves of the site. The eastern site boundary is also impacted by a flow path along Main Street. In the medium risk event, ponding expands, a flow path forms between Crooke Lane and the ponding within the northern half of the site. Surface water is clearly constrained by existing buildings within the southern half of the site in the high and medium risk events. In the low risk event, surface water flooding impacts approximately 64% of the site. The flow path along Crooke Lane expands and joins the flooding within the site and along Main Street. Flooding within the southern half of the site also expands, interacting with the flow path which crosses Badgergate Avenue.

Greatest flood depths in the medium risk event are significant at > 1.2 m (Figure 3-1) with some areas of extreme hazard (Figure 3-2). Main Street is inundated during all events. Access and escape routes should be achievable via Crooke Lane where, though impacted by flooding, depths remain low during the extreme event.

Table 3-1: Existing surface water flood risk based on percentage area at risk using the RoFSW map

Very low risk (% area)	Low risk (% area)	Medium risk (% area)	High risk (% area)
36	34	5	25



Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

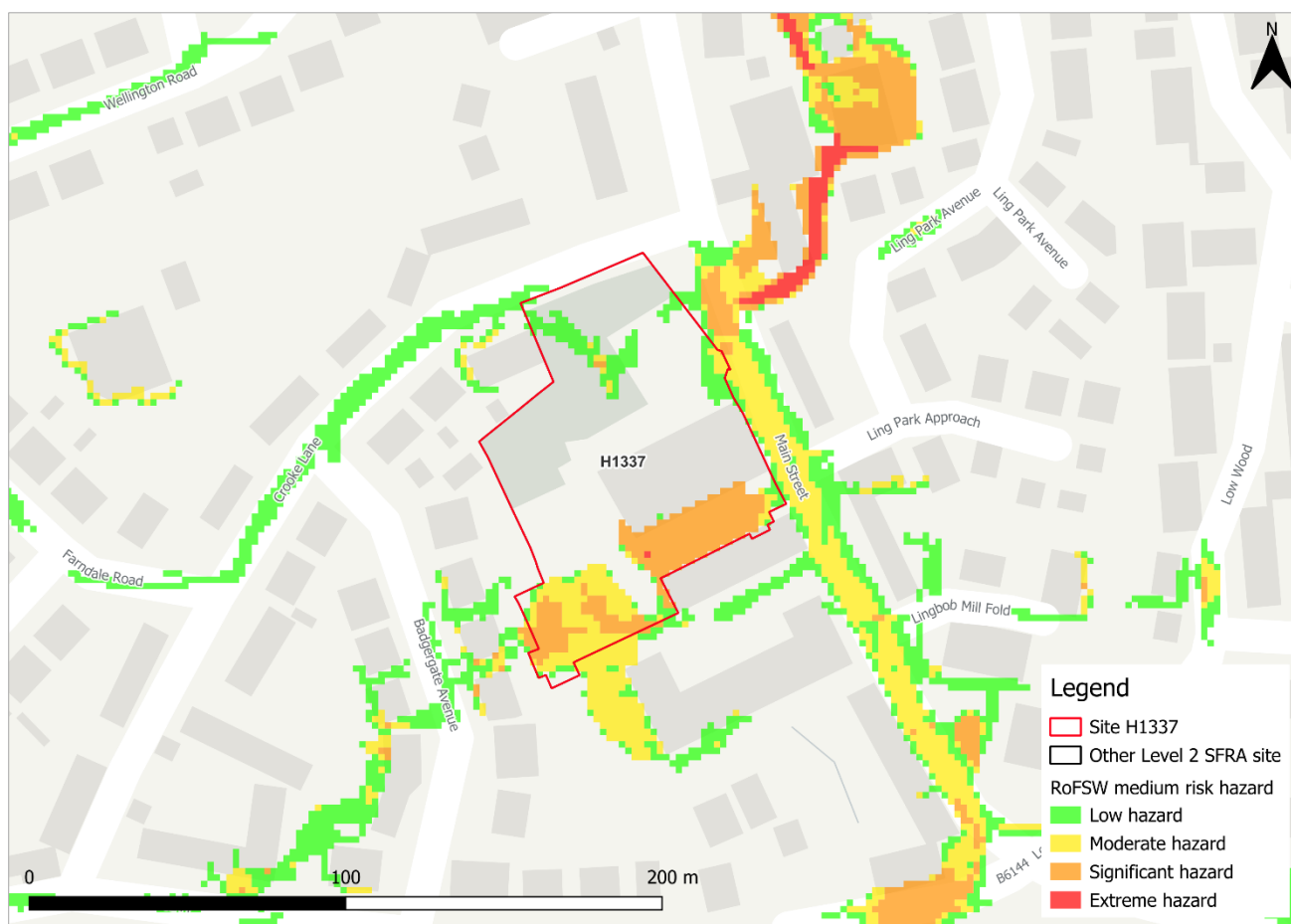


Figure 3-2: Medium risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

The impact of climate change on surface water flood risk has been modelled. This allows for direct comparison with the RoFSW map. With consideration of the EA's SFRA guidance, the latest climate change allowances have been modelled as shown in Table 3-2.

Table 3-2: Modelled climate change allowances for rainfall for the Aire and Calder management catchment

Return period	Central allowance 2070s (% increase)	Upper end allowance 2070s (% increase)
3.3% (high risk)	25%	40%
1% (medium risk)	30%	45%

Figure 3-3 shows the modelled surface water flood depths for the medium risk event +45% climate change. Risk is modelled to be significantly greater than for present day conditions,

¹ Based on Section 7.5 Hazard rating. What is the Risk of Flooding from Surface Water map? Report version 2.0. April 2019. Environment Agency

with the medium risk climate change event showing a greater level of risk than the low risk present day event. Ponding and flow path lengths increase to cover a large area of the site. Maximum depths remain > 1.2 m with some areas of extreme hazard.

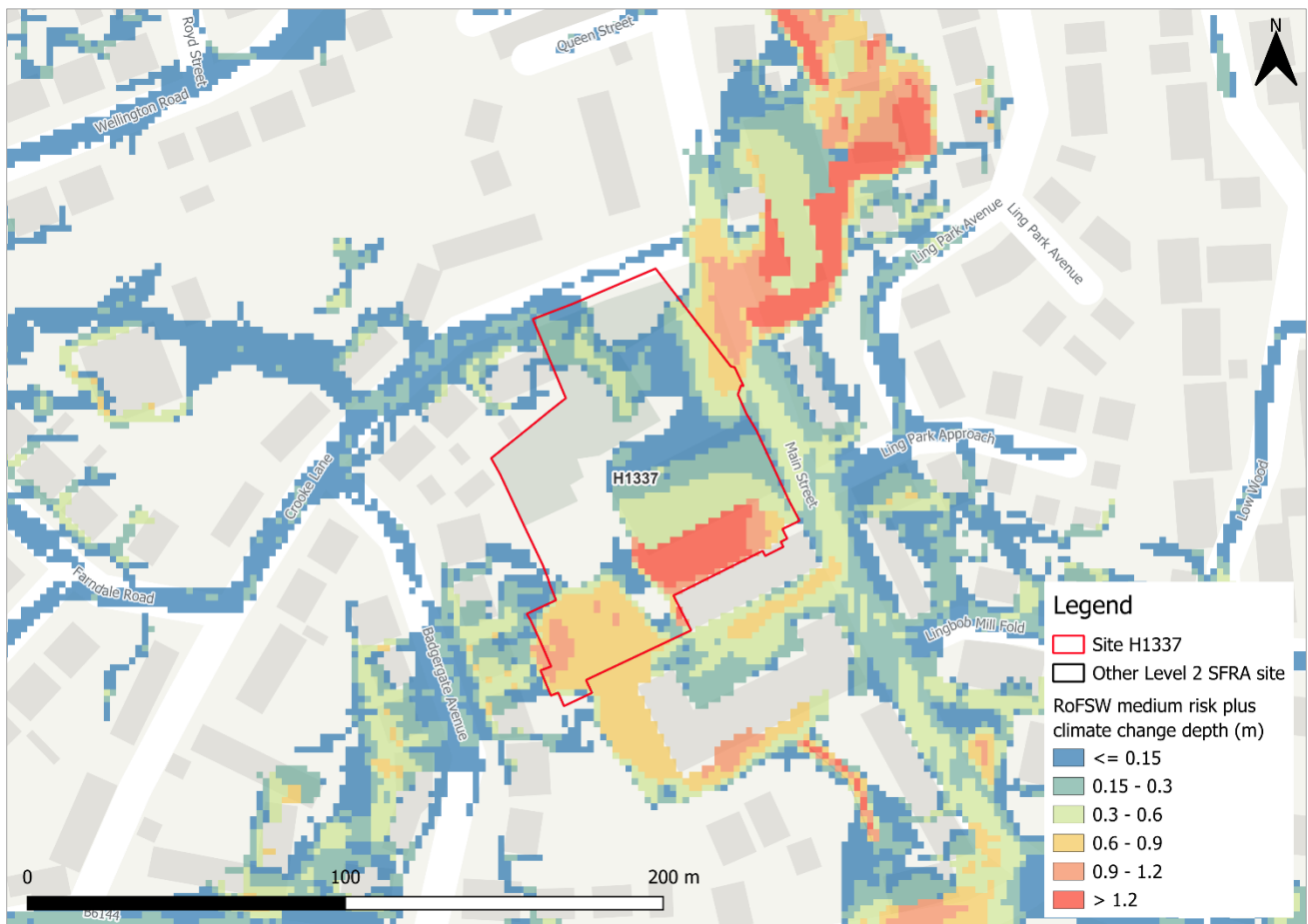


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)

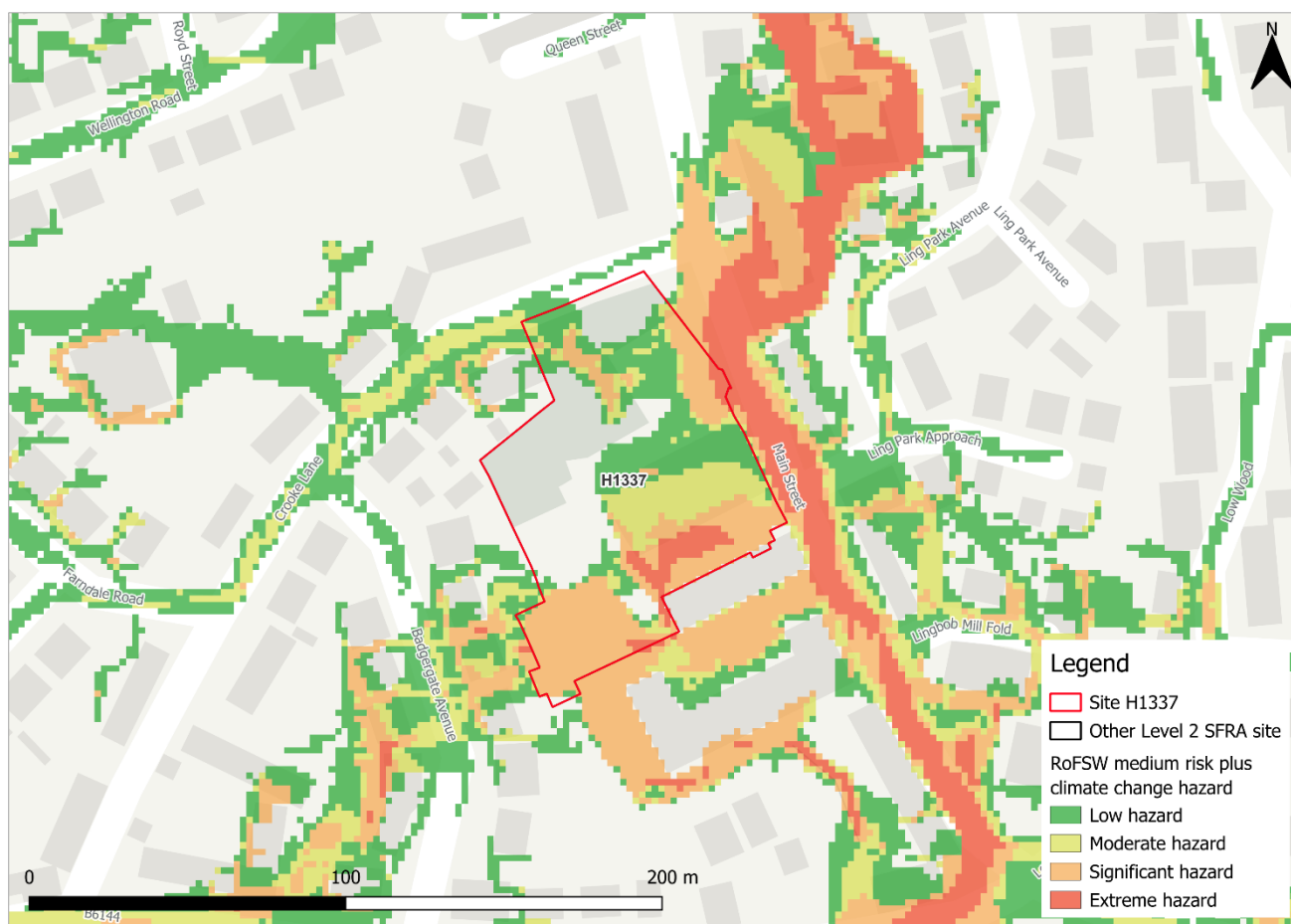


Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk and future risk are modelled to be significant, particularly in the south of the site that is currently constrained by the existing development present in the high and medium risk events. Any change in site layout where current buildings are to be demolished and changes to road layouts will require detailed surface water modelling.
- Given the onsite risk and the risk to surrounding areas, this site would ideally not be developed for more vulnerable uses or at least not redeveloped beyond its current footprint. The site is located in a topographic depression with higher land to the south, west and east causing runoff into the site and to surrounding areas.
- Were development at this site to proceed, an area-wide drainage strategy would be beneficial to ensure there is no increase in surface water flood risk elsewhere as a result of new development and surface water risk can be alleviated in the local area. This will require surface water modelling based on detailed design and full consultation with the LLFA and the council's highways department. Any regrading of land must include like for like volumes to ensure risk is contained safely onsite for the lifetime of development

- The Groundwater Emergence Map (Figure 4-1) indicates that ground conditions may not be suitable for infiltration SuDS across the site. This should be further explored through appropriate ground survey as part of the FRA and drainage strategy.
- Assessment of the current drainage system in place should be carried out to ascertain any current capacity issues and whether the current system could accommodate the proposed residential development or whether further capacity will be required.
- Note that the RoFSW map is not suitable for identifying whether an individual property will flood and is therefore indicative. The RoFSW map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

4 Risk from groundwater

Risk of groundwater emergence is assessed in this SFRA using JBA's 5m Groundwater Emergence Map. This dataset is recommended for use by the EA in the SFRA Good Practice Guide². Figure 4-1 shows the map covering this site and the surrounding areas and Table 4-1 explains the risk classifications.

There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.

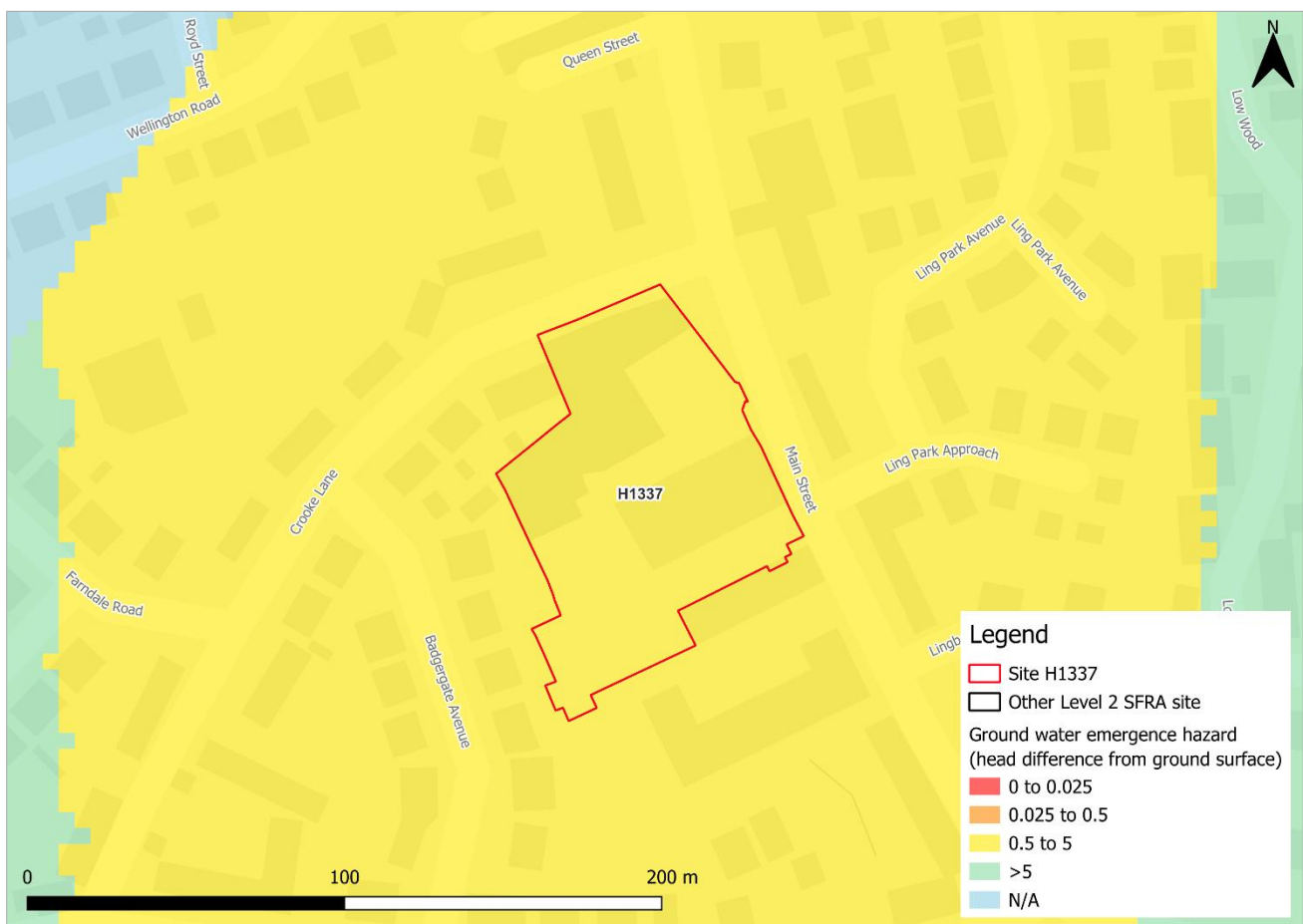


Figure 4-1: JBA 5m Groundwater Emergence Map

² [Strategic flood risk assessment good practice guide. ADEPT. December 2021.](#)

Table 4-1: Groundwater Hazard Classification

Groundwater head difference (m)*	Class label
0 to 0.025	Groundwater levels are either at very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event. There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
>5	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
*Difference is defined as ground surface in mAOD minus modelled groundwater table in mAOD.	

5 Residual risk

5.1 Potential culvert

Historic land-use mapping held by the LLFA, indicates that there may be a watercourse culverted along the eastern boundary of the site. If a watercourse is present, there will be a residual risk of flooding to the site were there to be a culvert failure or blockage. A model for this watercourse is not available. Therefore, residual risk could not be modelled for this Level 2 SFRA.

5.2 Flood risk from canals

The site is not likely to be at risk from a canal breach.

5.3 Flood risk from reservoirs

The EA's Reservoir Flood Maps (RFM) (2021) show where water may go in the unlikely event of a reservoir or dam failure. A 'dry day' scenario assumes that the water level in the reservoir is the same as the spillway level or the underside of the roof for a service reservoir and the watercourses upstream and downstream of the reservoir are at a normal level. A 'wet day' scenario assumes a worst-case scenario where a reservoir releases water held on a 'wet day' when local rivers have already overflowed their banks.

The site is not modelled to be at risk from reservoir flooding.

5.4 Flood risk from sewers

Flooding from the sewer network can occur when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes overloaded, blocked or it cannot discharge due to a high water level in the receiving watercourse.

According to Yorkshire Water's records, there have been no incidents of sewer flooding in the area over the last two years.

5.5 Observations, mitigation options and site suitability - residual risk

- There is no modelled residual risk to the site.
- Historic mapping indicates there may be a watercourse culverted along the eastern site boundary. If present, the culvert represents potential residual risk of flooding to the site through culvert failure or blockage. This may need to be further investigated and modelled at the FRA stage.

6 Overall site assessment

6.1 Can part b) of the exception test be passed?

This site is not required to pass part b) of the exception test³ as it is located within Flood Zone1, however it must still be proven that the development can be safe for its lifetime, which is 100 years for residential development.

6.2 Recommendations, FRA requirements, and further work

Based on the evidence presented in the Level 1 SFRA (2023) and this Level 2 SFRA:

- There is significant risk from surface water in all risk events, currently constrained by the existing development within the site during the high and medium events and with climate change. Given the topographic conditions in the area, development of this site for more vulnerable uses should be discouraged.
- Historic mapping indicates there may be a watercourse culverted along the eastern boundary of the site. If present, the culvert represents potential residual risk of flooding to the site through culvert failure or blockage. This may need to be further investigated and modelled at the FRA stage. Modelling should include for residual risk and options for culvert removal.
- No development should take place over the top of a culvert nor within 8m either side of the culverted section of watercourse.
- Assuming the culvert is located beneath the site, opportunities for opening up the culvert should be explored for inclusion in site design as a blue green corridor. This would remove any residual risk of flooding to the site as a result of culvert failure or blockage.
- Were development plans to proceed, a detailed area-wide drainage strategy would be necessary to confirm surface water risk in the local area and to the site, and to ascertain whether risk can be adequately managed on and offsite.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA online guidance; the CBMDC Local Plan and national and local SuDS policy and guidelines.
- Throughout the FRA process, consultation should be carried out with the following, where applicable, the local planning authority; the lead local flood authority; emergency planning officers; the Environment Agency; Yorkshire Water; the highways authorities; and the emergency services.

³ Para 178 National Planning Policy Framework 2024

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