

Bradford Level 2 Strategic Flood Risk Assessment - Site H781

Final Draft

July 2026

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

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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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The methodology adopted and the sources of information used by JBA in providing its services are outlined in this Report. The work described in this Report was undertaken between 18 November 2024 and 17 July 2026 and is based on the conditions encountered and the information available during the said period. The scope of this Report and the services are accordingly factually limited by these circumstances.

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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 H781. 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' (2026) and is therefore familiar with the terminology used in this report.

1.1 Site H781

- Location: Drummond Trading Estate, Lumb Lane
- Existing site use: General industry and brownfield land
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 3.3 hectares
- Proposed development impermeable area: 2.27 hectares
- Environment Agency (EA) river model: N/A
- Watercourse: Bradford Beck Diversion Tunnel
- 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.

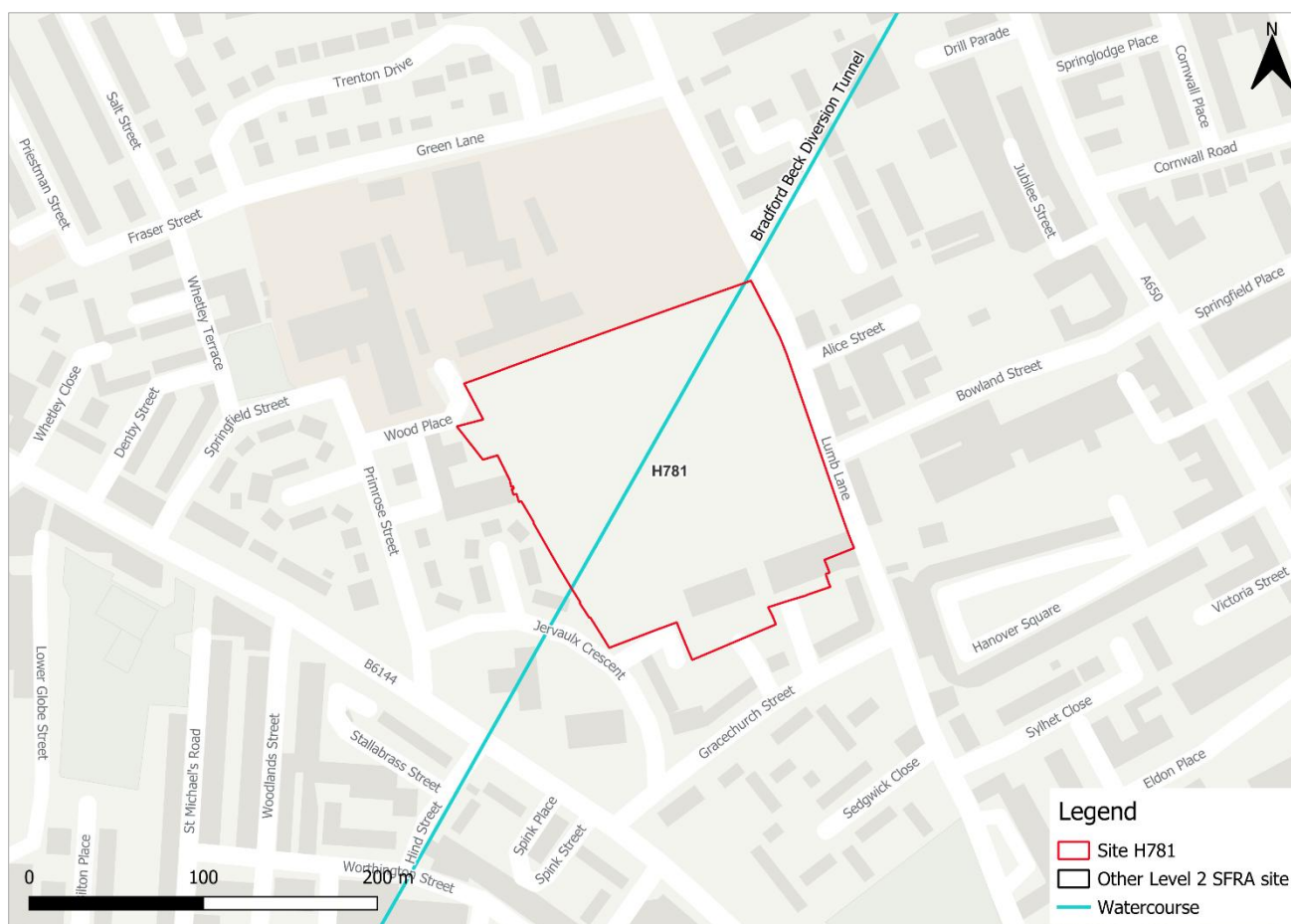


Figure 1-1: Existing site location boundary

The topography of the site is varied. There is an area of high elevation within the west of the site, with lower elevation areas to the east and south (Figure 1-2).

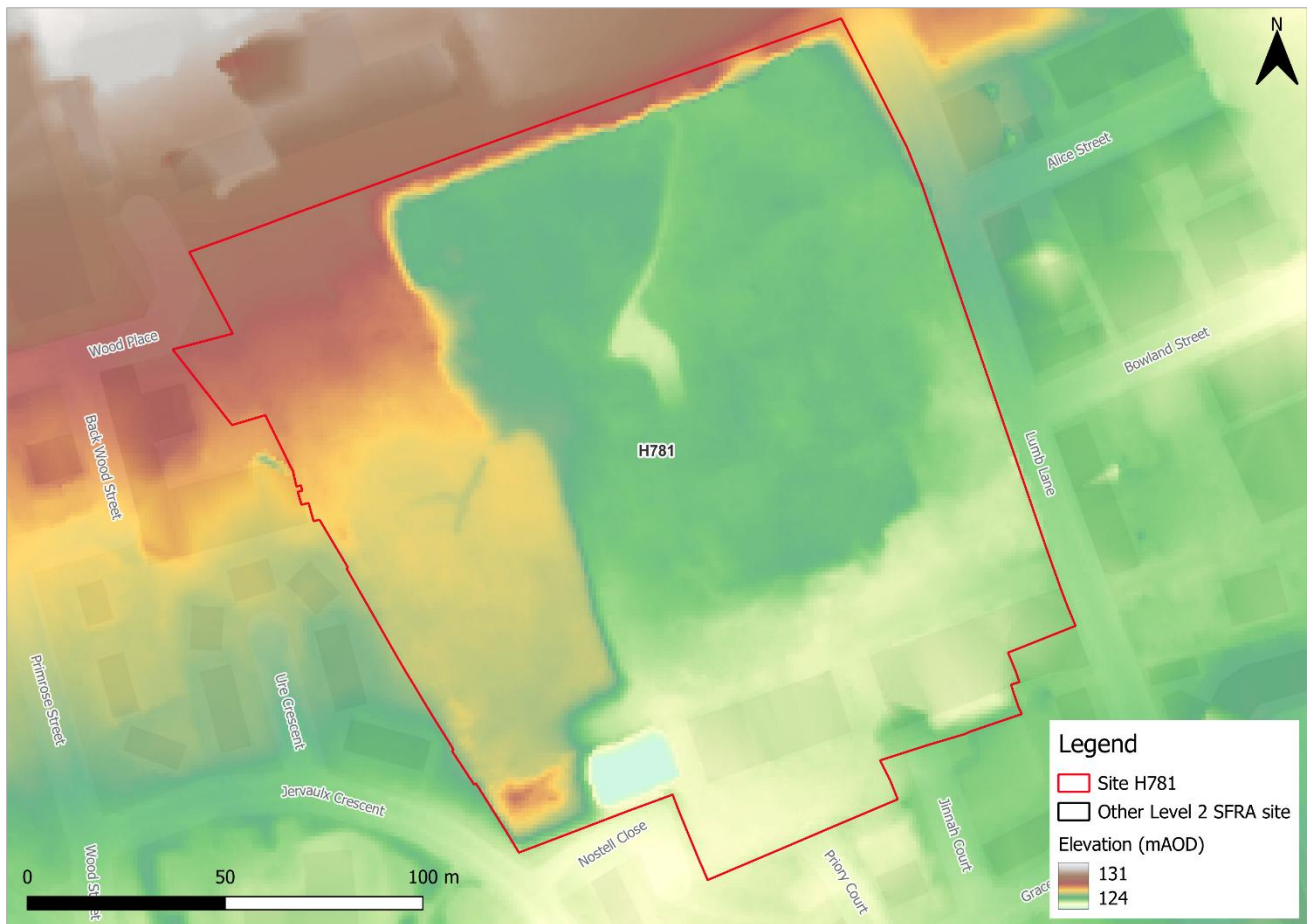


Figure 1-2: Topography

The underlying bedrock within the site is defined as 'Pennine Lower Coal Measures Formation', which comprises mudstone, siltstone, sandstone, coal, ironstone and ferricrete (Figure 1-3). This is overlain with superficial deposits of till. Mudstone, siltstone, coal, ironstone and ferricrete typically have low permeability, however this can be highly variable. Sandstone has a higher permeability.



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 (January 2026) 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).

The site is modelled to be within Flood Zone 1 indicating it is at low risk of flooding from rivers. Based on LLFA mapping, the Bradford Beck Diversion Tunnel flows beneath the site. There should be no development above the tunnel beneath the site. The path of the tunnel should be confirmed through a survey as part of the site-specific FRA and flood modelling may be required to robustly inform on risk to 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)
100	0	0	0

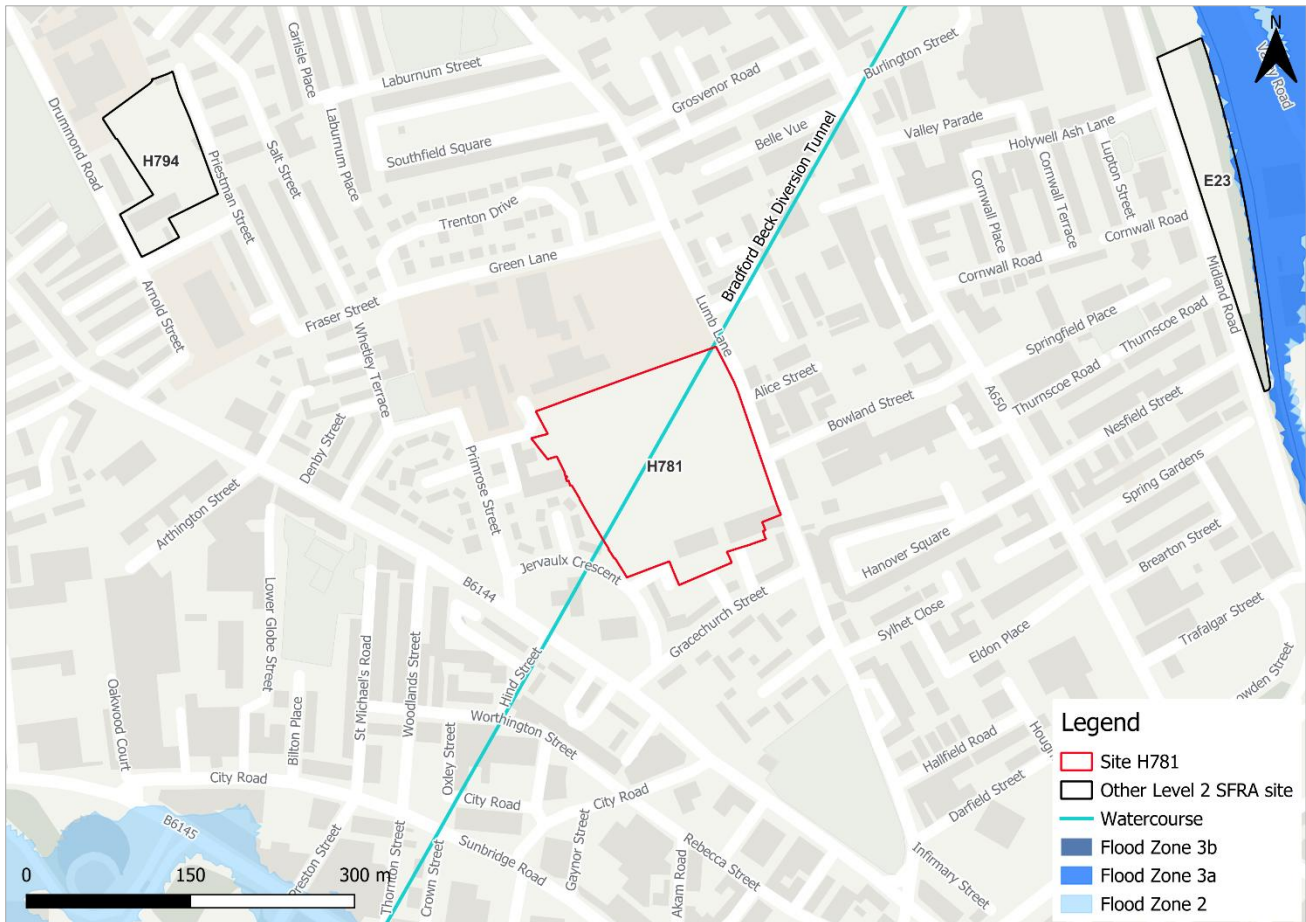


Figure 2-1: Existing risk from rivers to the site

2.1.2 Bradford Beck 2026 model outputs - present day

The Bradford Beck 2026 model does not cover the diversion tunnel present beneath the site. Therefore, flood depth, hazard and velocity data cannot be considered as part of this Level 2 SFRA. Depending on the outcomes of the tunnel survey, flood modelling may be required to inform on risk to the site.

2.2 Impacts from climate change

The EA's SFRA guidance states that SFRAs should assess the central allowance for less vulnerable, more vulnerable, highly vulnerable and water compatible development (Table 2-2). The impacts of climate change on flood risk from the Bradford Beck 2026 model have been modelled without flood defence infrastructure in place. As documented in Section 2.3.1, there are no formal engineered flood defences that would benefit the site.

Table 2-2: 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%

2.2.1 Bradford Beck 2026 model outputs - climate change

As documented in Section 2.1.2, there is no modelled risk to the site from the Bradford Beck 2026 model.

2.2.2 Flood Map for Planning - climate change

The EA's Flood Map for Planning plus Climate Change (2070-2125) dataset also does not cover the site (Figure 2-2).

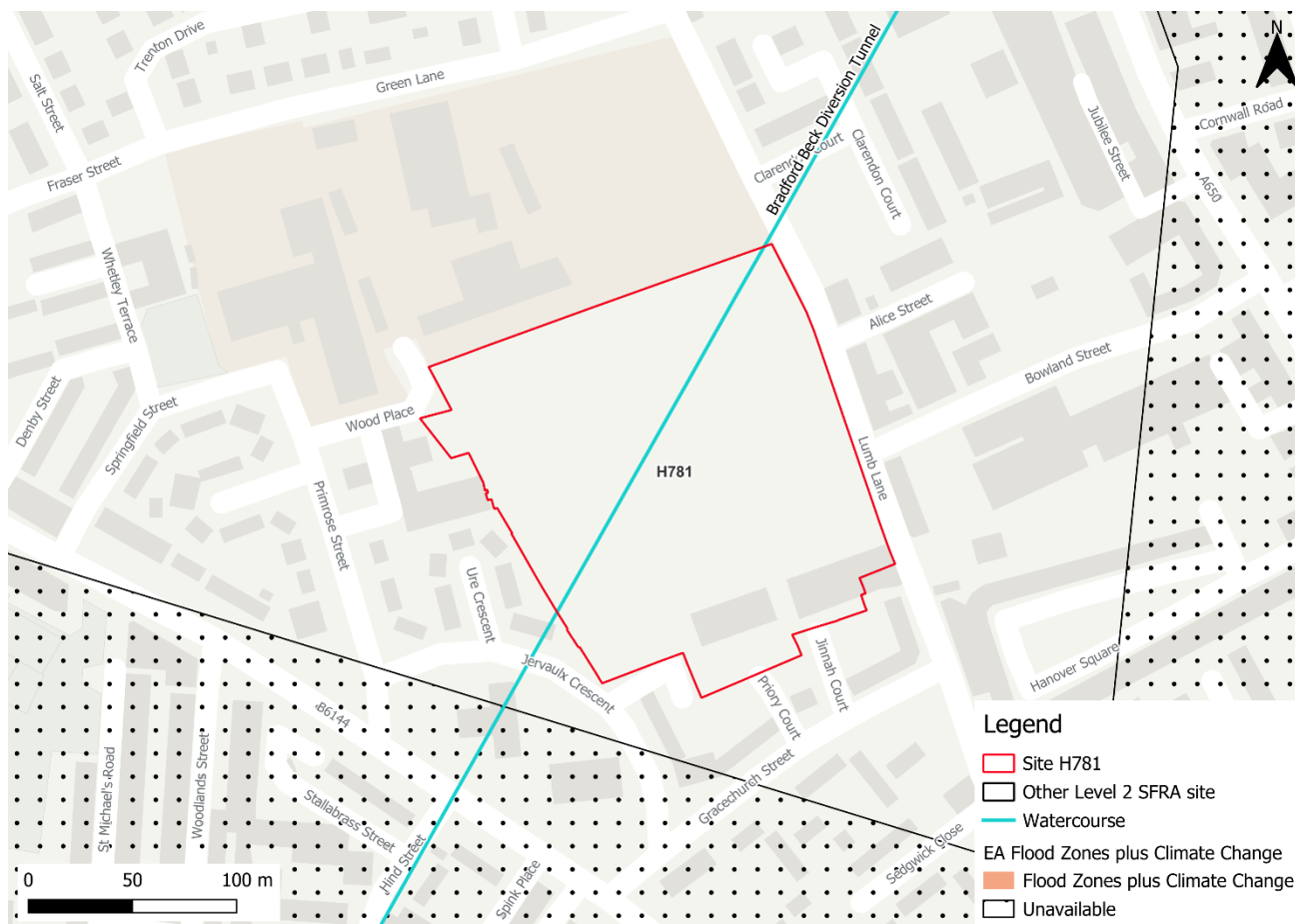


Figure 2-2: EA Flood Zones plus Climate Change dataset

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 within or in the vicinity of 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 incidents within the vicinity of the site.

2.5 Emergency planning

2.5.1 Flood warnings

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 an 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.

2.5.2 Access and escape routes

Based on available information, safe access and escape routes could likely be achieved during a flood event via multiple points surrounding the site (Figure 2-3).

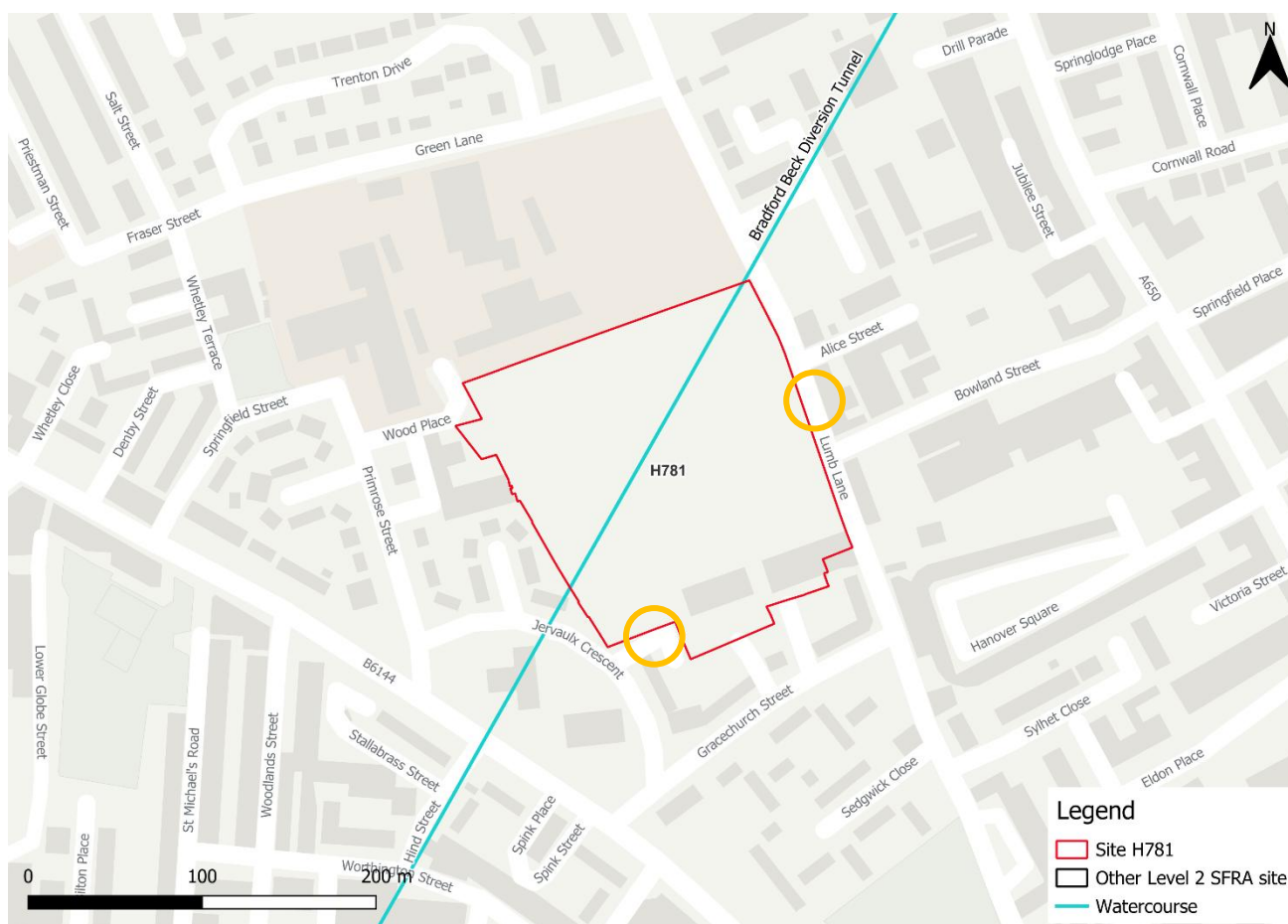


Figure 2-3: Potential access and escape routes

2.6 Observations, mitigation options, site suitability and sequential approach to development management - fluvial

- Observations:
 - 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 at low risk of flooding from rivers.
 - The Bradford Beck Diversion Tunnel is assumed to be located beneath the site, as shown in LLFA watercourse mapping. The location and course of the diversion tunnel should be confirmed through a survey.
 - Depending on the outcomes of the culvert survey, flood modelling may be required to inform on any risk to the site.
 - If works are proposed on or near to the diversion tunnel, a separate permission may be required. The type of permission needed from the Lead Local Flood Authority will depend on the activity and location proposed.
- Access and escape:

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

3 Flood risk from surface water

3.1 Existing risk

At the time of writing, the EA's latest national Risk of Flooding from Surface Water (RoFSW) does not include depth and hazard information suitable for planning purposes. Therefore, this Level 2 SFRA considers the third generation RoFSW depth and hazard mapping in addition to the NaFRA2 extents, as agreed with the EA. Surface water depth and hazard should be confirmed at the site-specific FRA stage.

3.1.1 Risk of Flooding from Surface Water - NaFRA2 extents

Based on the EA's national scale RoFSW map (January 2026, surface water flood risk to the site is predominantly very low, as shown in Table 3-1. Surface water risk is confined to areas of ponding within topographic low spots within the north and west of the site, with a flow path through the south (Figure 3-1)

Safe access and escape route should be achievable via multiple routes including Jinah Court and Lumb Lane.

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)
76	12	3	9

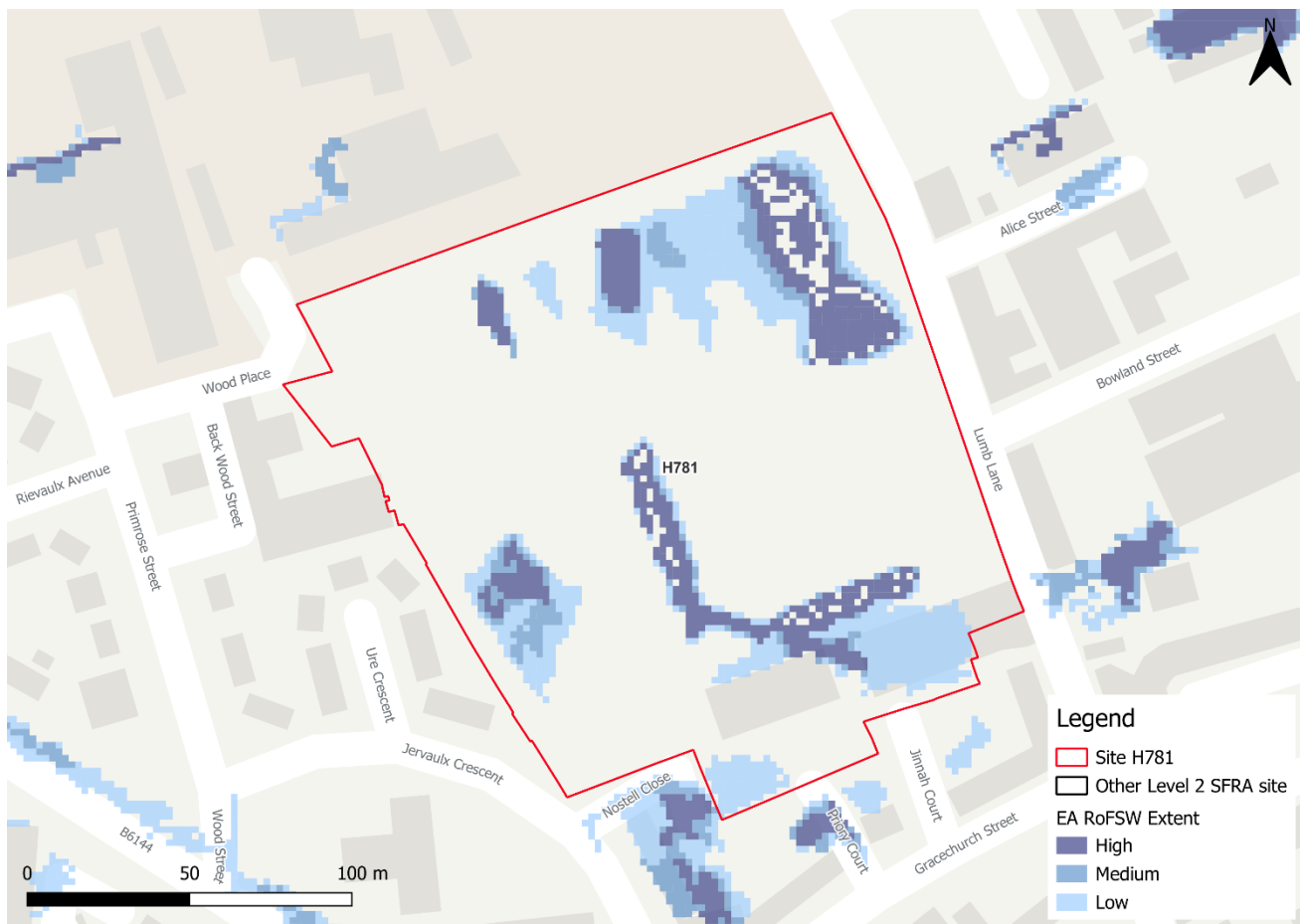


Figure 3-1: Surface water flood extents (NaFRA2 - Risk of Flooding from Surface Water map)

3.1.2 Risk of Flooding from Surface Water - third generation depths and hazards

Based on the EA's national scale third generation RoFSW map, the greatest flood depths within the site in the medium risk event are between 0.6 and 0.9 m (Figure 3-2), with hazard categorised as 'significant' (Figure 3-3).

The surface water modelling for the site shown in Figure 3-2 and Figure 3-3 was conducted based on LiDAR data that existed from when a previous development was present at the site, but which has since been demolished. This LiDAR data was flown prior to that shown in Figure 1-2. As such, existing flood risk from surface water to the site is unknown, and therefore detailed modelling based on a new topographic survey will be required to inform development plans within a planning application for this site.

There are some differences between the NaFRA2 RoFSW map and the third-generation depth and hazard mapping. The NaFRA2 RoFSW map does not map flooding less than 0.075m (7.5cm) in depth. Therefore, where the map may show no flooding, there may be shallow flooding up to a depth of 0.075m. In contrast, the third generation RoFSW does not map flooding with a hazard rating of less than 0.575. This could explain the differences observed between the NaFRA2 and third generation RoFSW. Assessment of surface water

should be carried out at the site-specific FRA stage to establish current and future surface water flood risk conditions.

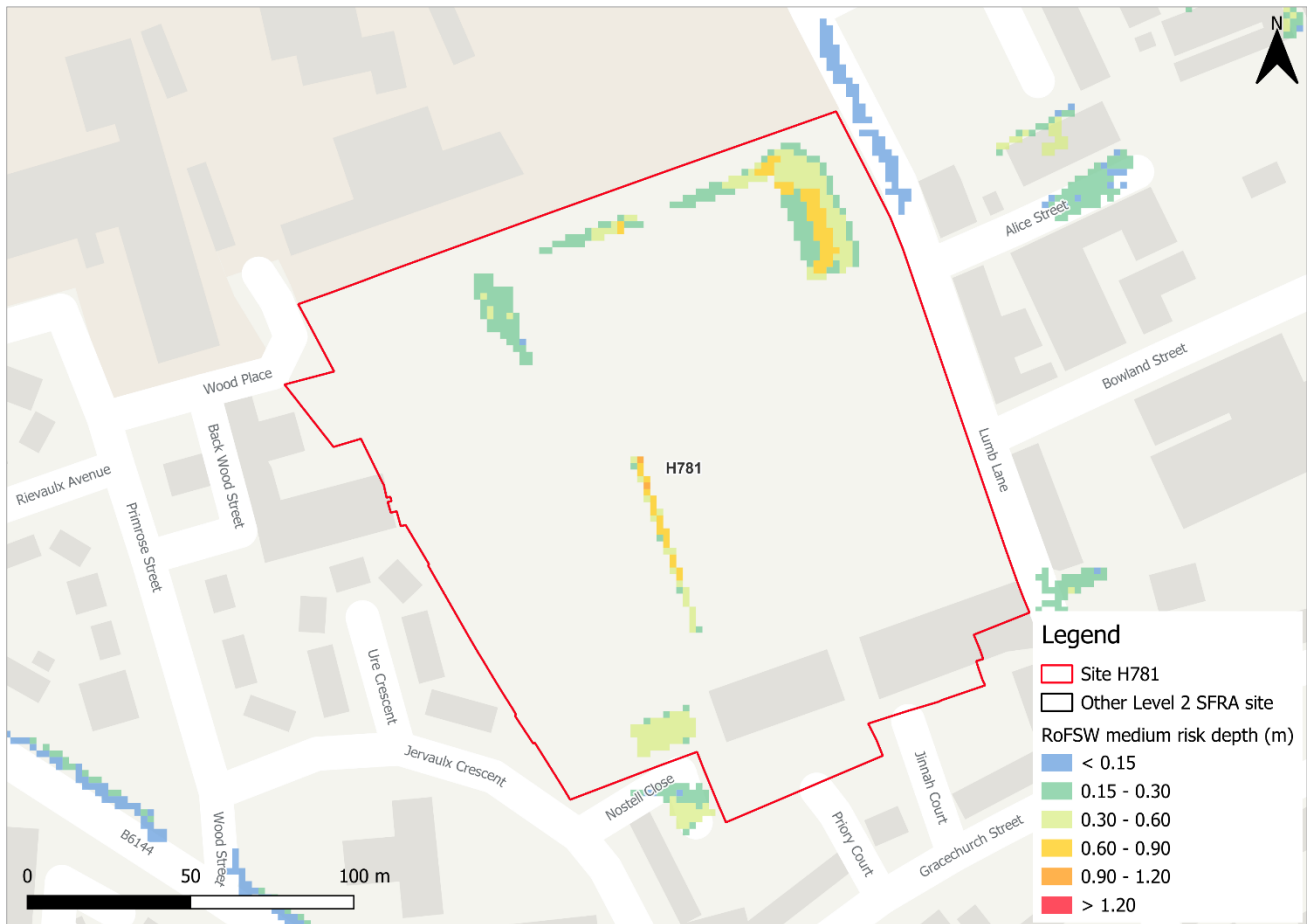


Figure 3-2: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

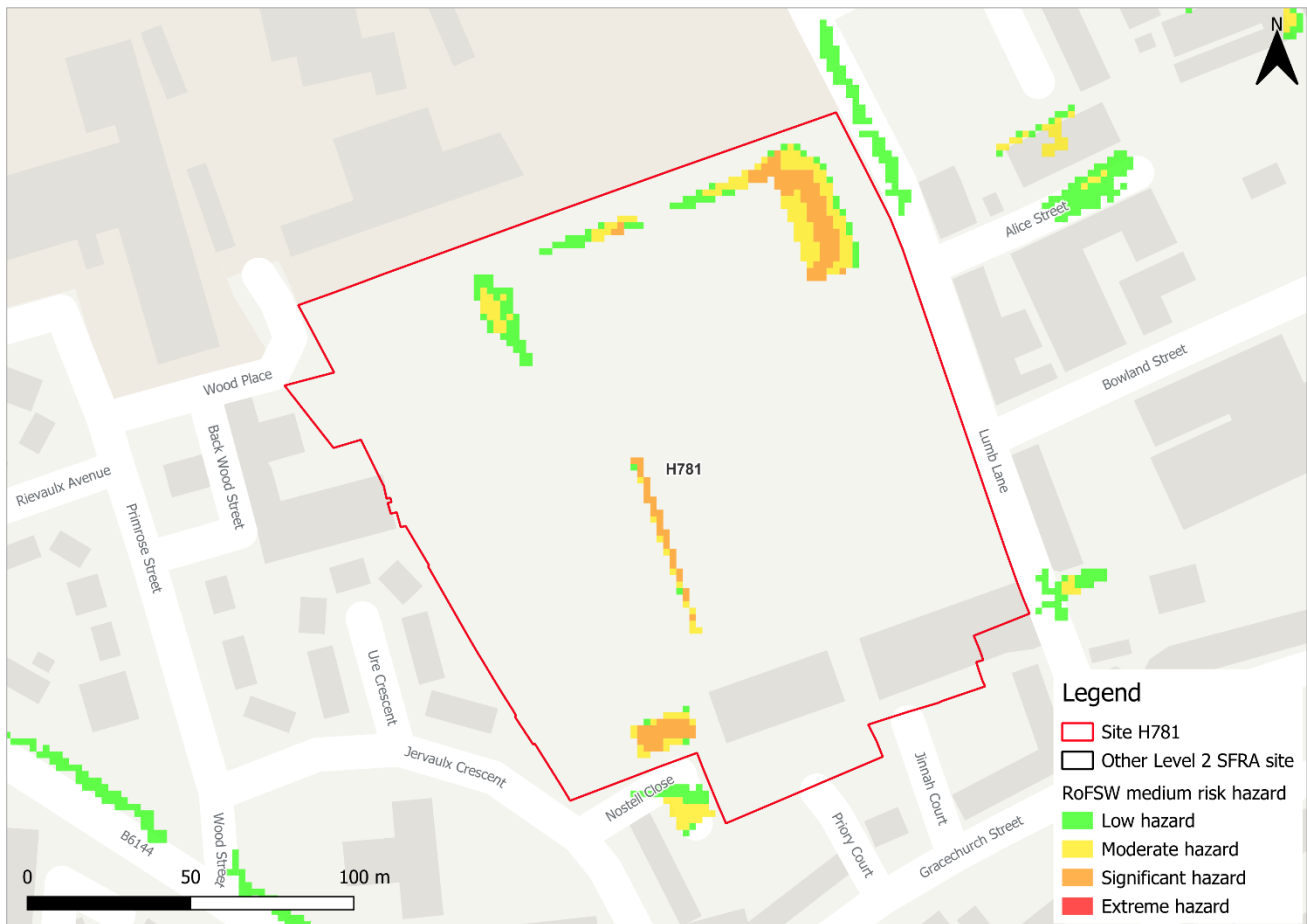


Figure 3-3: Medium risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

At the time of writing, the available national surface water climate change mapping is unsuitable for consideration in development planning. This Level 2 SFRA considers the low risk surface water event as a conservative proxy for the medium risk event plus climate change, as agreed with the EA. The impact of climate change on surface water flood risk should be considered at the site-specific FRA stage.

Using the low risk event as a proxy, surface water risk is likely to increase in extent across the site when accounting for climate change (Figure 3-4). Maximum flood depths are shown to increase to > 1.2 m (Figure 3-5), with areas of hazard categorised as 'significant' (Figure 3-6). Safe access and escape routes would likely remain achievable via Lumb Lane to the east of the site.

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

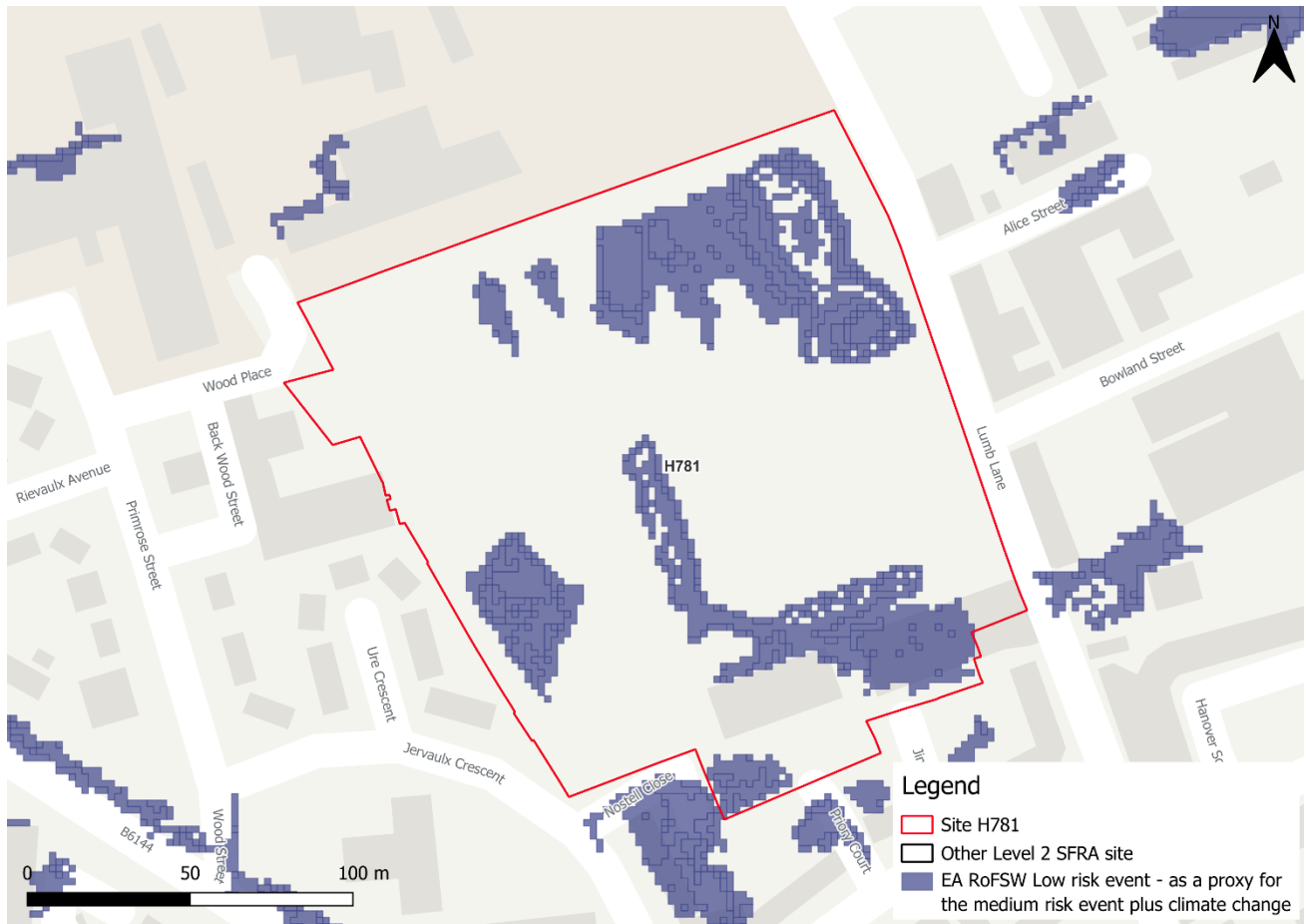


Figure 3-4: Low risk event surface water flood extent, as a proxy for the medium risk event plus climate change (NaFRA2 - Risk of Flooding from Surface Water map)

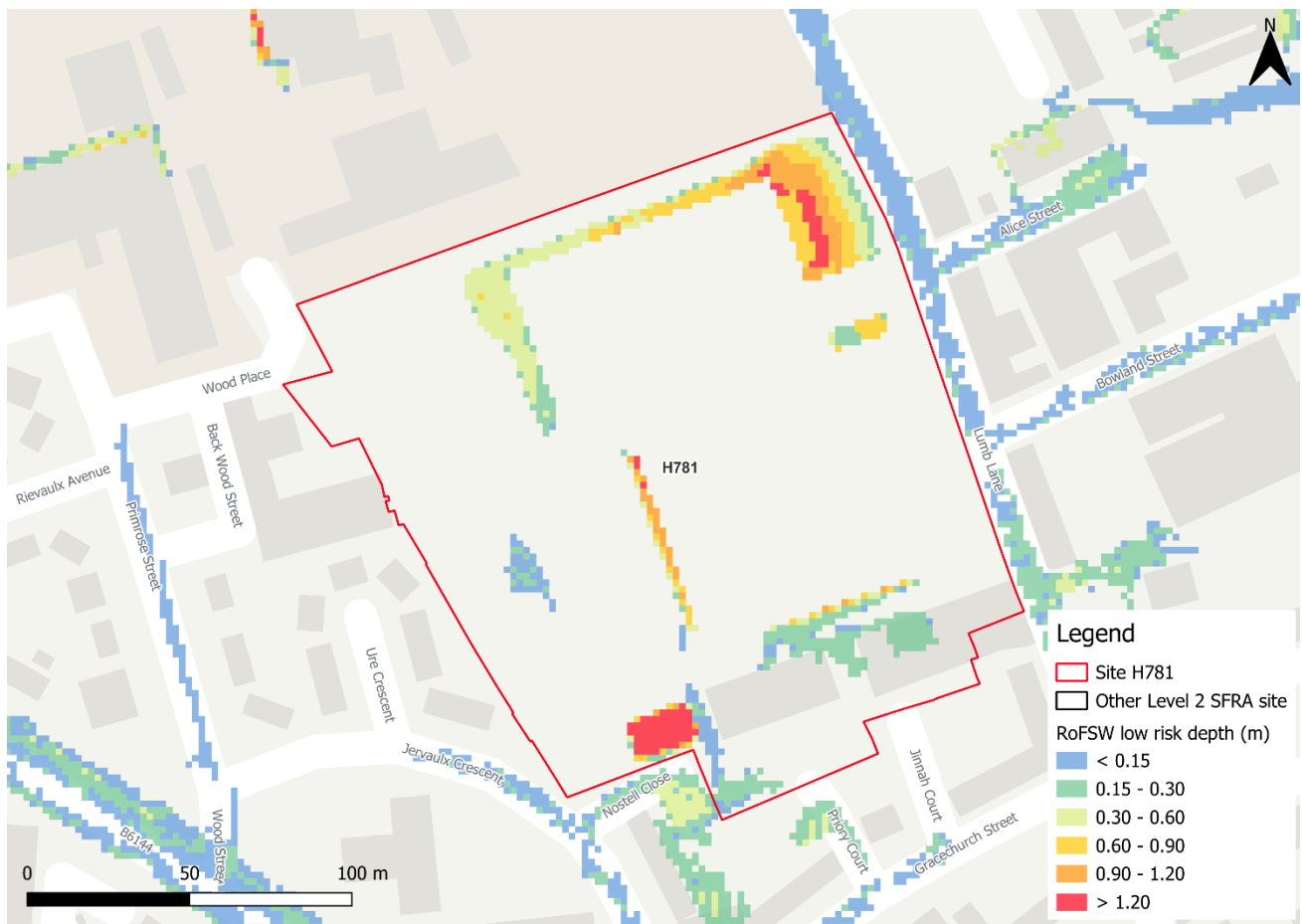


Figure 3-5: Low risk event surface water flood depths (Risk of Flooding from Surface Water map)

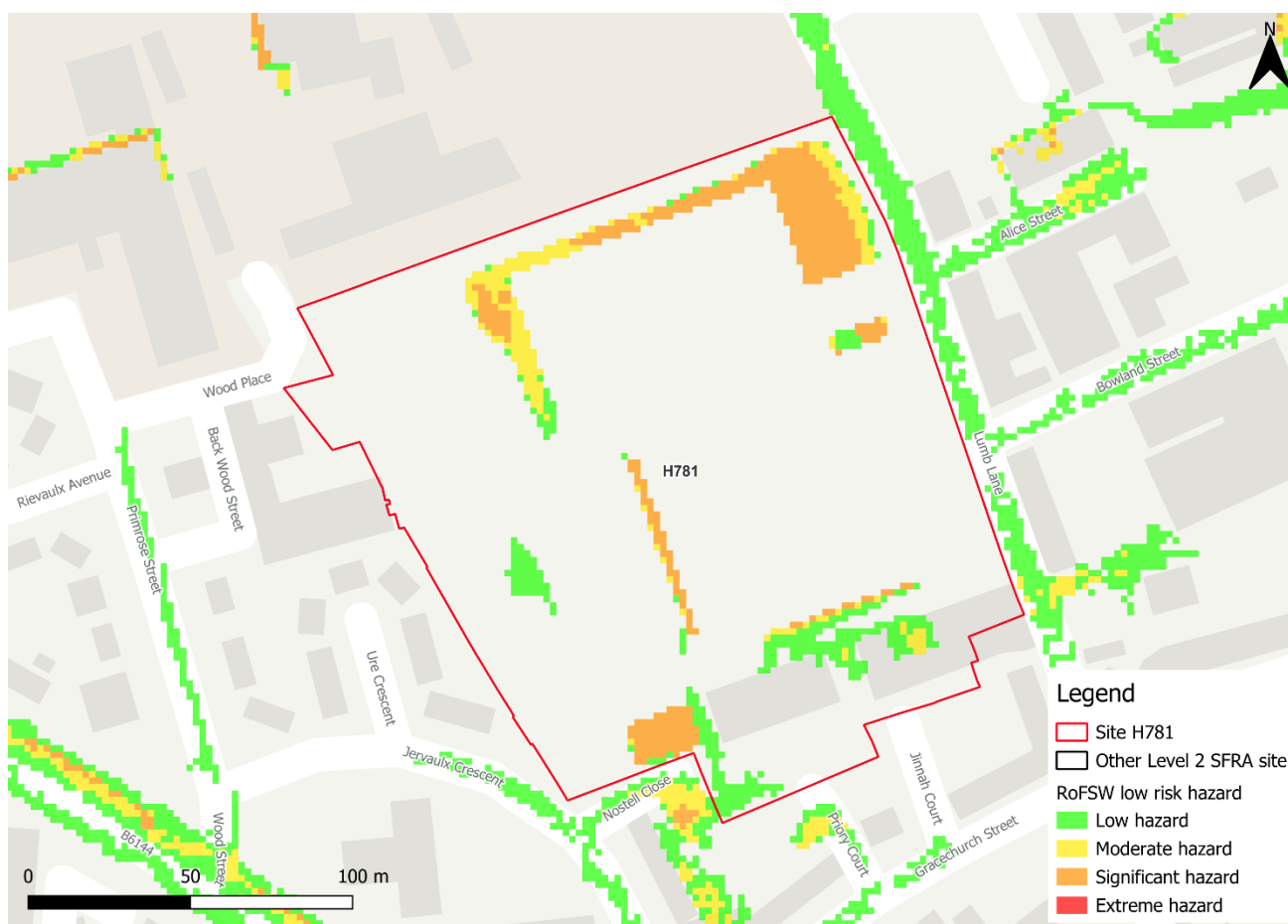


Figure 3-6: Low risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk based on existing surface water modelling is shown to be significant with surface water pooling occurring in pockets across the site. Areas of surface water pooling across the site are shown to be constrained by onsite structures.
- The third generation mapping of surface water flood risk to the site is based on LiDAR data flown at a time when a previous development existed on site which has since been demolished. Therefore, existing surface water flood risk to the site is currently unknown. Detailed pluvial modelling based on a new topographic survey will therefore be required to inform the level of flood risk to the site based on development layout plan considerations. Post development modelling must demonstrate that development will not result in offsite detriment.
- Topographic flow routes and depressions should be considered and included in site design and ideally left in place to flood naturally when required. Any regrading of land must include like for like volumes to ensure risk is contained safely onsite for the lifetime of development.
- The drainage strategy must ensure there is no increase in surface water flood risk elsewhere as a result of new development. Existing brownfield rates will likely

apply, though the developer should consult local LLFA guidance and the National SuDS guidance.

- 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. A Water Cycle Study would help to inform this.
- Based on available information, safe access and escape routes could likely be achieved during a flood event via Lumb Lane to the east of the site.
- 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 entirety of the site is in an area where there is no groundwater risk. Groundwater conditions may therefore be suited to infiltration SuDS, however this should be considered further through the drainage strategy given the likely low permeability of the underlying bedrock (Figure 1-3).



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. defence breaches, or blockages of culverts or drainage assets. Residual risk at this site may come from a structural failure of the diversion tunnel beneath the site.

5.1 Potential structural failure

A structural failure of the diversion tunnel beneath the site may cause flooding to the site, depending on the severity of the failure and the magnitude of the flood event. There is the potential for localised surcharge as a result of a backing-up of flows, contributing to rapid onset flooding. The exact tunnel course, capacity and condition are unknown. This will need to be established through a survey.

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 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 generally considered to be 100 years for residential development.

6.2 Recommendations summary

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

- It should be appropriate to develop this site for more vulnerable purposes given its location in Flood Zone 1.
- The location and path of the diversion tunnel should be confirmed through a survey as part of the site-specific FRA. There should be no development above the Bradford Beck Diversion Tunnel which is assumed to be located beneath the site.
- 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.
- The third generation surface water modelling for the site is based on outdated LiDAR data from when a previous development was present on site. This previous development has since been demolished and as such, existing flood risk from surface water to the site is unknown. Therefore, new detailed modelling based on an updated topographic survey will be required to inform on onsite surface water depths and hazards. Post development modelling must demonstrate that development at the site will not result in offsite detriment.
- A detailed drainage strategy will be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. Site runoff should be maintained at current rates (likely to be brownfield) and, where possible, betterment should be achieved. The use of infiltration SuDS should be investigated.

6.3 Site-specific FRA requirements and further work

- Further modelling to understand the impacts of climate change on surface water risk to the site.
- A condition and capacity assessment of the diversion tunnel beneath the site including a survey to identify tunnel course and location.

³ Para 178 National Planning Policy Framework 2024

- 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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Authorised by	Krista Keating BSc MSc CEnv CSci MCIWEM C.WEM Associate Director

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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 H789. 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 H789

- Location: Allerton Mills
- Existing site use: Commercial
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Residential
- Proposed site use vulnerability: More vulnerable
- Site area: 1.2 hectares
- Proposed development impermeable area: 1 hectare
- 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

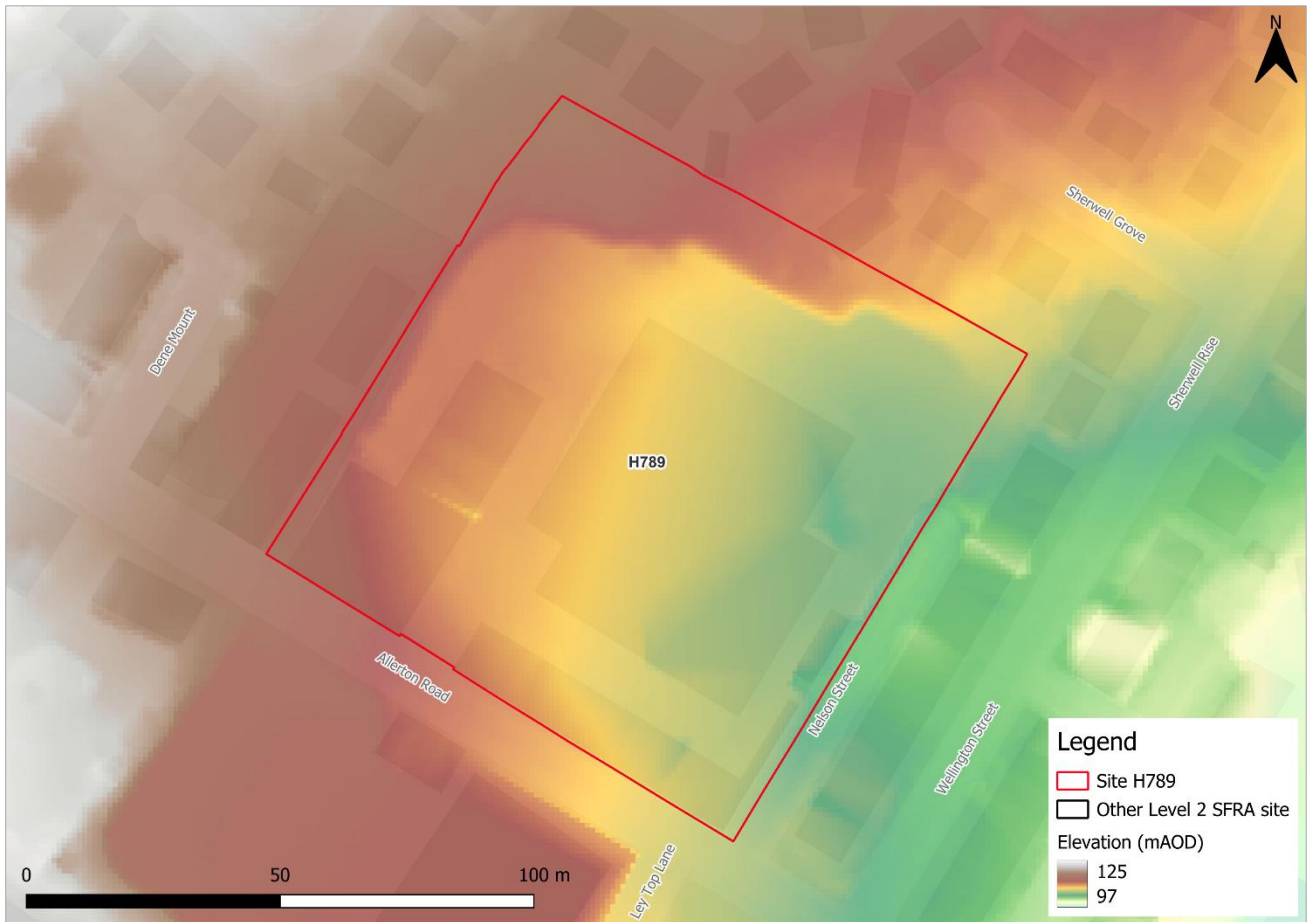


Figure 1-2: Topography



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, indicating it is 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 possible watercourse crossing the site. This should be confirmed, and the exact location ascertained, through site investigation. Potential flood risk from this watercourse may have 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 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.

2.6 Observations, mitigation options and site suitability - fluvial

- The site is wholly located within Flood Zone 1, indicating it is at low risk of flooding from rivers.
- However, potential flood risk from the watercourse shown in historic land-use mapping to cross 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 largely very low. Approximately 2% of the site is within the high risk surface water flood zone, 6% is within the medium risk zone and a further 18% is within the low risk zone.

In the high risk event flooding is confined to an area of ponding within the east of the site, confined by the existing buildings. In the medium risk event, this ponding expands into a small flow path across the north of the site, around the existing buildings. Another area of ponding forms within the west of the site, also confined by existing buildings. Ponding on Nelson Street slightly encroaches over the eastern site boundary. In the low risk event, all areas of ponding merge, forming part of a large flow path which flows through the north of the site.

Greatest flood depths within the site, during the medium risk event are between 0.6 and 0.9 m (Figure 3-1) with some areas of ponding with a significant flood hazard rating (Figure 3-2). There is a flow path present along Allerton Road during all events, however, safe access and escape may be achievable due to the low depths of flooding and low hazards to 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)
74	18	6	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 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 greater level of risk than the low risk present day event. The areas of ponding within the site merge to join the flow path which originates offsite to the east and flows through the site, north of the current onsite building. Maximum flood depths increase to between 0.9 and 1.2 m (Figure 3-3) with areas of significant hazard throughout the site (Figure 3-4).

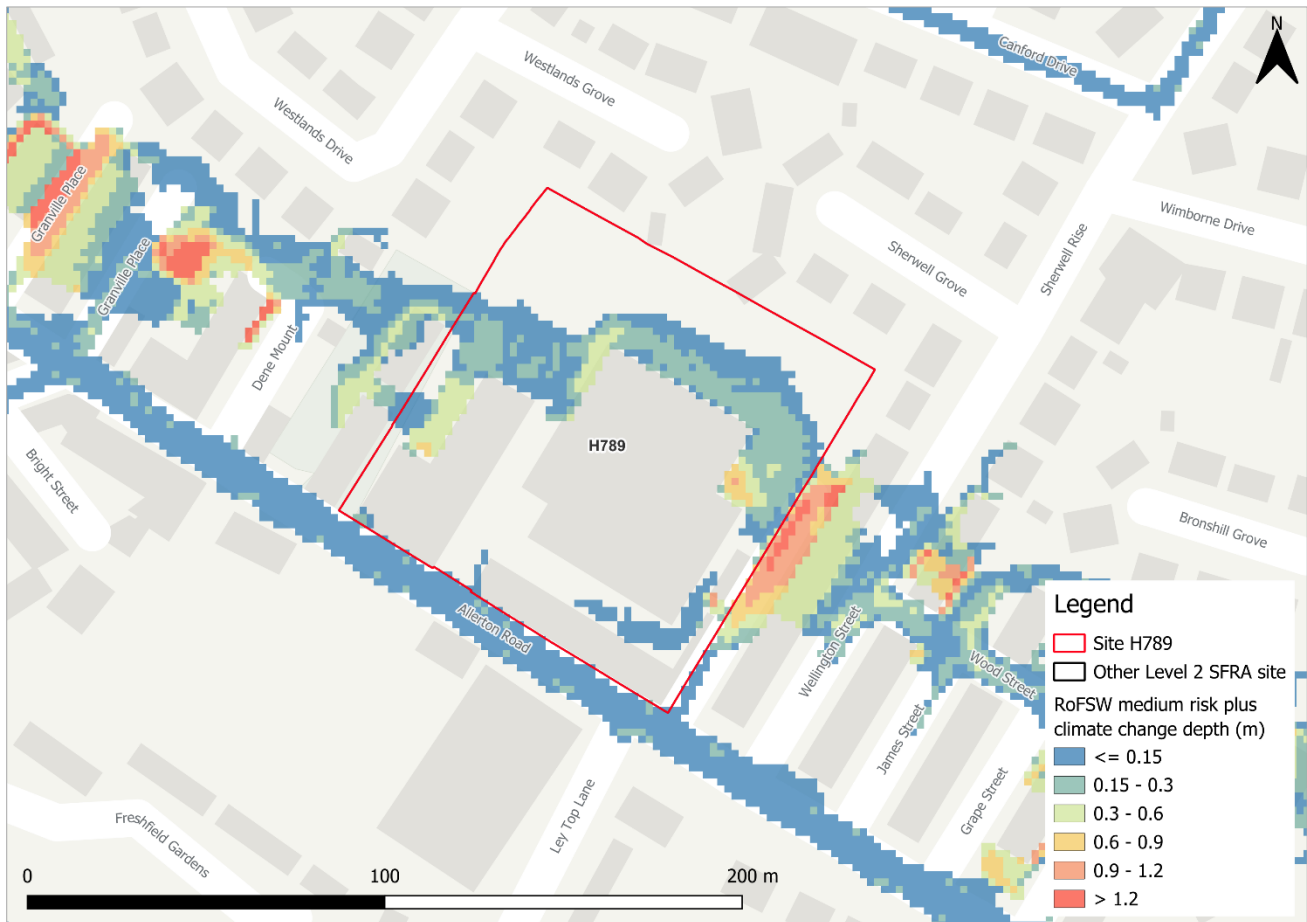


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)



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 largely very low, with a small amount of surface water ponding at the east of the site during the high risk event, a second area of ponding during the medium risk event and a large flow path through the site in the low risk event. Flooding is largely constrained by existing buildings within the site. Risk becomes significant with climate change.
- It is assumed the current buildings will be demolished for new residential units. Surface water modelling of the site and the wider area may be required to inform the level of risk once the site is cleared. 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. Runoff rates should be restricted to brownfield and betterment on existing rates should be applied if possible. This will require surface water modelling based on layout plans and detailed design and full consultation with the LLFA.
- The Groundwater Emergence Map (Figure 4-1) indicates that ground conditions may be unsuitable 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.

Within the majority of the site, there is a risk of groundwater flooding to surface and subsurface assets, as well as the possibility of groundwater emerging at the surface locally. In the northern and western corners of the site, there is no risk of groundwater emergence.

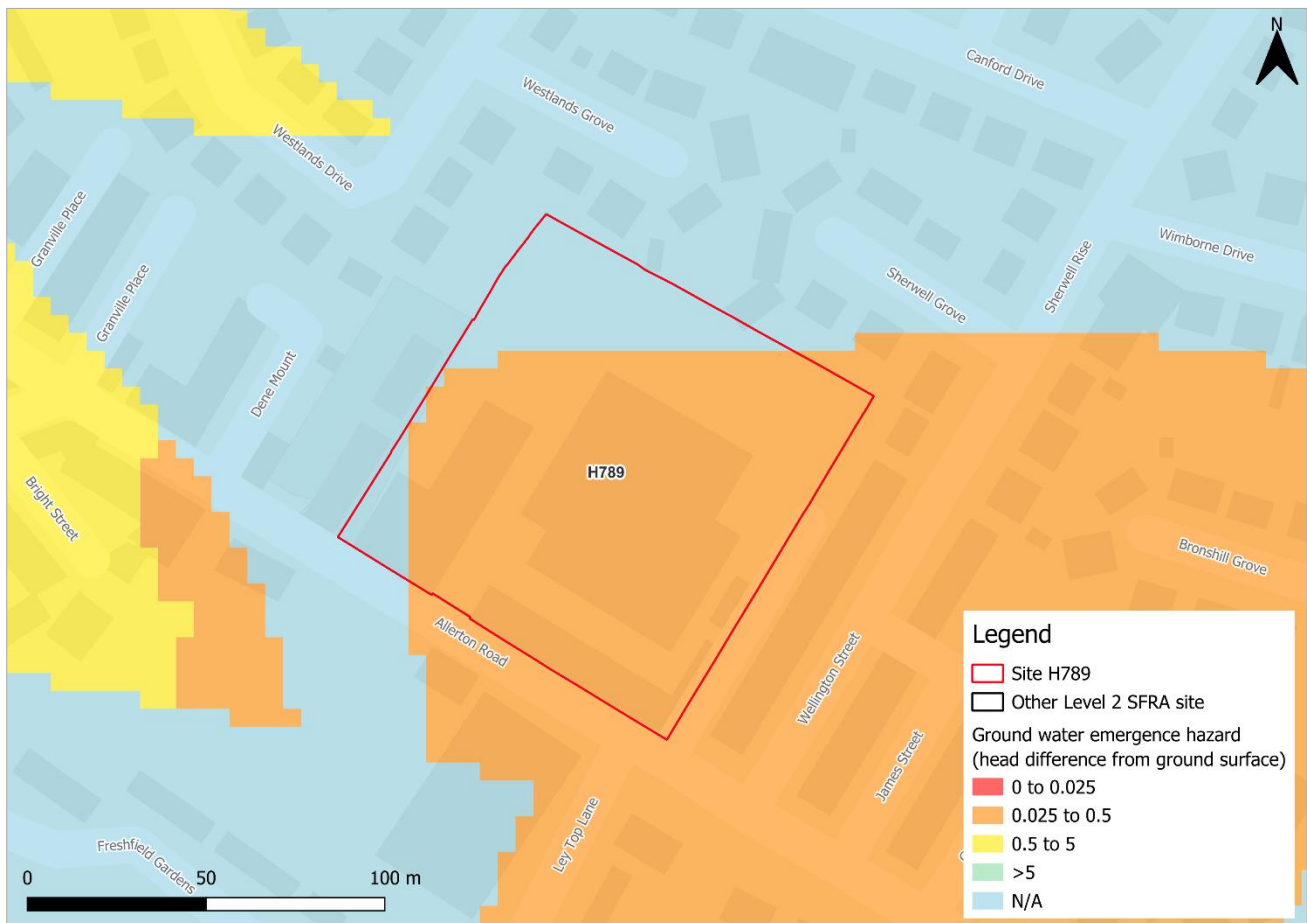


Figure 4-1: JBA 5m Groundwater Emergence Map

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 beneath 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 of 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 or blocked, or it cannot discharge due to high water levels 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.
- Historic mapping indicates there may be a watercourse culverted beneath 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.
- 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:

- It should be appropriate to develop this site for more vulnerable purposes given its location in Flood Zone 1. However, there is risk from surface water in the medium and low risk events, currently affecting the eastern and northern sides of the site which worsens with climate change. A detailed drainage strategy will be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. A wider strategy may be required given the clear flow route offsite which travels through the site.
- Historic mapping indicates there may be a watercourse culverted beneath 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.
- Surface water should be retained onsite which may reduce units. This will require detailed surface water modelling based on layout plans and detailed design and full consultation with the LLFA on required runoff rates, likely to be brownfield or betterment. The use of infiltration SuDS should be investigated for suitability across the majority of the site.
- Groundwater conditions must be investigated further through the site-specific FRA to ascertain groundwater levels and conditions.
- 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.

³ Para 178 National Planning Policy Framework 2024

- 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 H960

Final Draft

May 2025

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

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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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Acknowledgements

We would like to thank the Environment Agency and Yorkshire Water for their assistance with 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 H960. 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 H960

- Location: Copgrove Road
- Existing site use: Brownfield (former community and respite centre), and car parking
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Residential
- Proposed site use vulnerability: More vulnerable
- Site area: 0.64 hectares
- Proposed development impermeable area: 0.58 hectares
- Watercourse: N/A
- Environment Agency (EA) 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

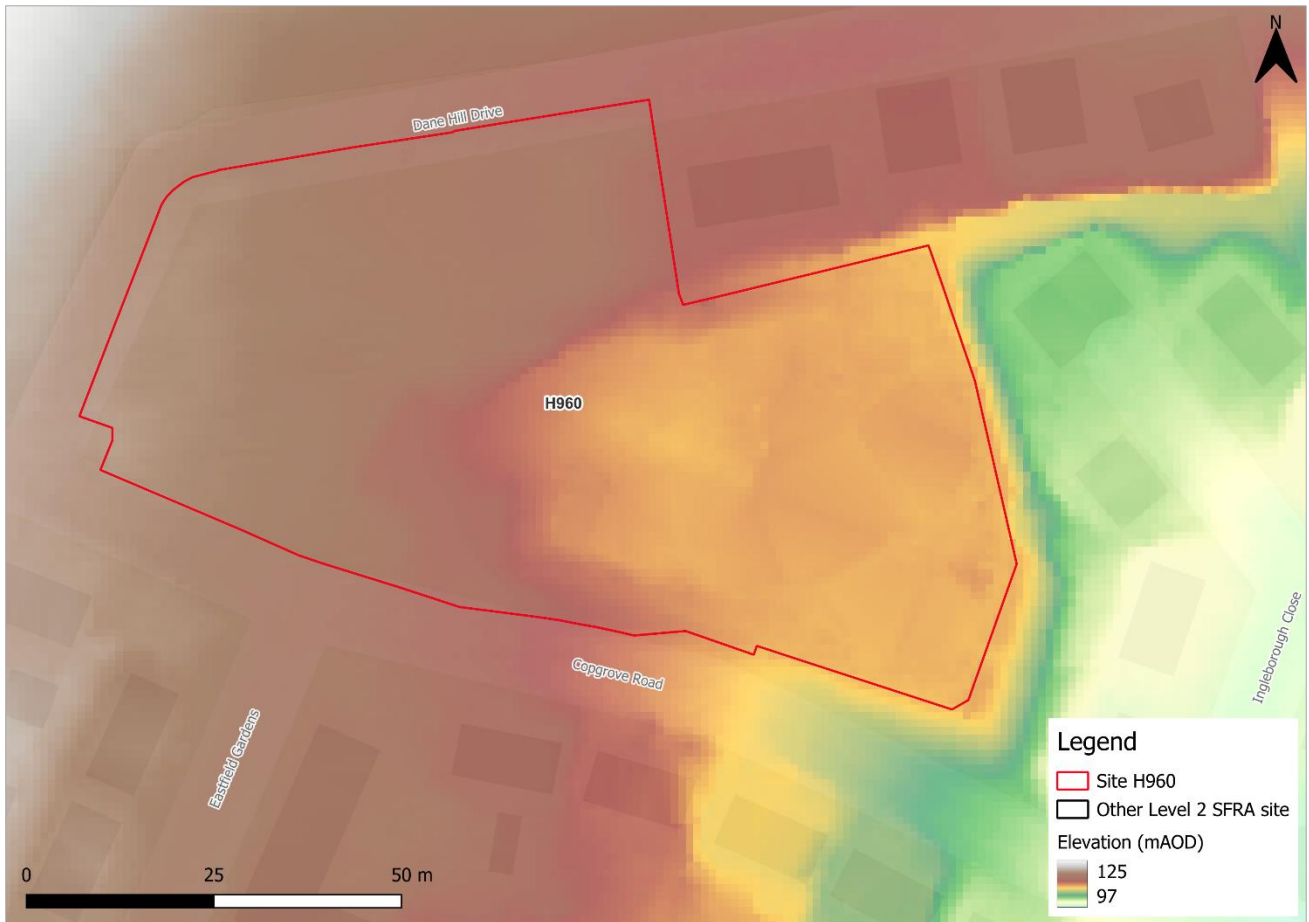


Figure 1-2: Topography



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 site is entirely located within Flood Zone 1 indicating it is 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 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, there is potential for wider catchment tree planting which can intercept, slow, store and filter water. There are also areas to the north where surface water runoff could be attenuated in the 3.3% AEP and 1% AEP event. 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.

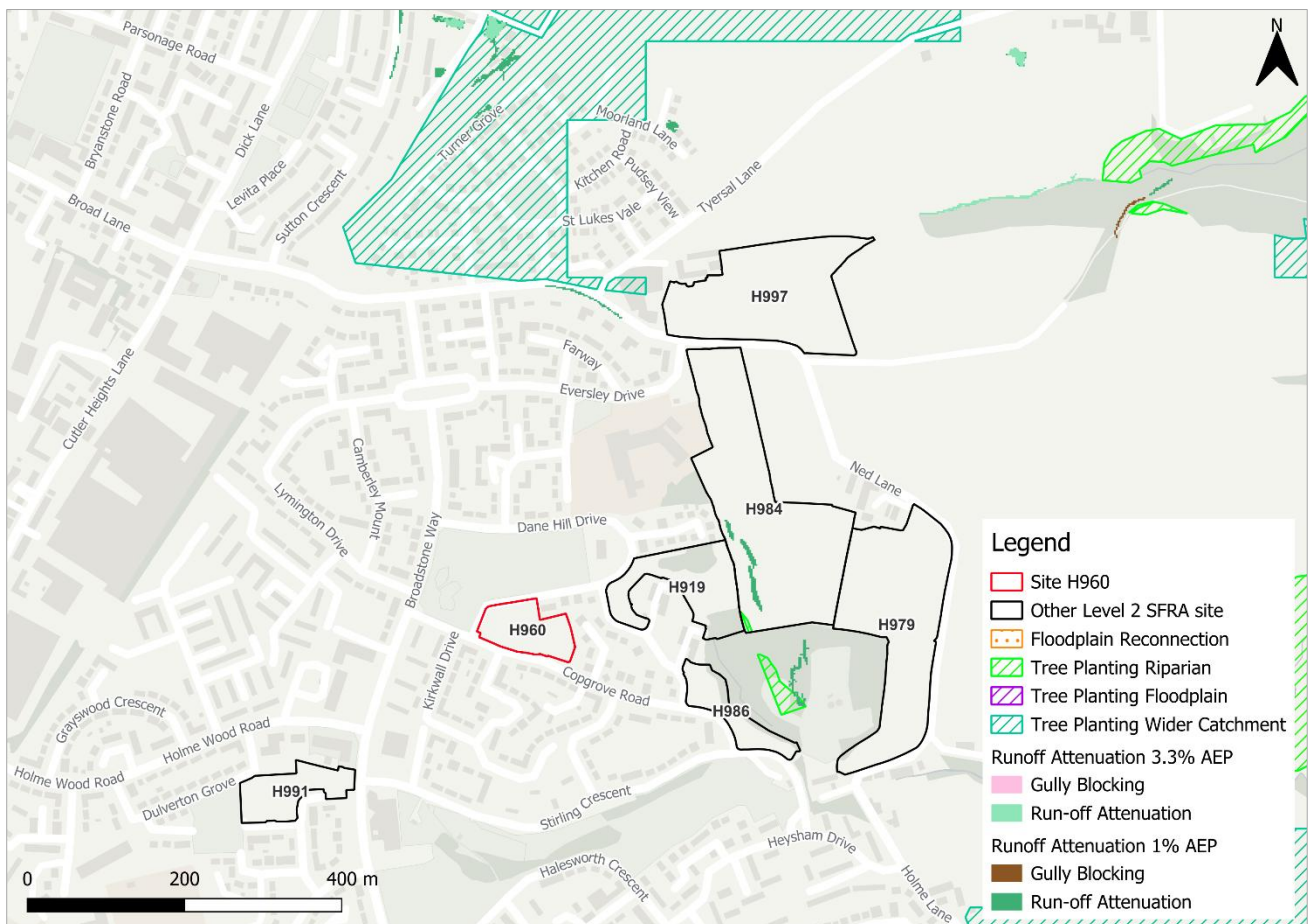


Figure 2-2: Natural Flood Management (NFM) potential mapping

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 incidents 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 Dane Hill Drive and Copgrove Road.

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 it is at low risk of flooding from rivers.

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 predominantly very low. Approximately 3% of the site is within the high risk surface water flood zone. A further 3% of the site is at medium surface water risk and a further 8% of the site is at low surface water risk, as shown in Table 3-1.

In the high-risk event, surface water is confined to a localised area of ponding in the centre of the site in an area of topographic depression within the site. In the medium risk event, this area of ponding can be seen to expand in size, and surface water flow paths along Dane Hill Drive as well as Copgrove Road can be seen to occur along the northern and southern site boundaries respectively. In the low-risk event, surface water flow paths along north, west and south of the site can be seen to expand in extent, and the area of surface water pooling is observed to be connected with the surface water flow route located to the northeast of the site.

Greatest flood depths in the medium risk event are between 0.30 m and 0.60 m (Figure 3-1), with areas of hazard classified as moderate (Figure 3-2).

In the low risk event, both Dane Hill Drive and Copgrove Road are shown to be inundated with hazard levels categorised in places as significant. Therefore, safe access and escape routes may be challenging to achieve in this event.

The surface water modelling for the site shown in Figure 3-1 and Figure 3-2 was conducted based on LiDAR data that existed from when a previous development was present at the site but which has since been demolished. This LiDAR data was flown prior to that shown in Figure 1-2. As such, existing flood risk from surface water to the site is unknown, and therefore detailed modelling based on a new topographic survey will be required to inform development plans within a planning application for this site.

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)
86	8	3	3



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 an increased level of risk when compared to the low-risk present day event. Maximum depths are approximately 0.80 m (Figure 3-3) with areas of hazard categorised as significant (Figure 3-4).

In the medium risk climate change event, both Dane Hill Drive and Copgrove Road are shown to be inundated with hazard levels categorised in places as significant. Therefore, safe access and escape routes may be challenging to achieve in this event.

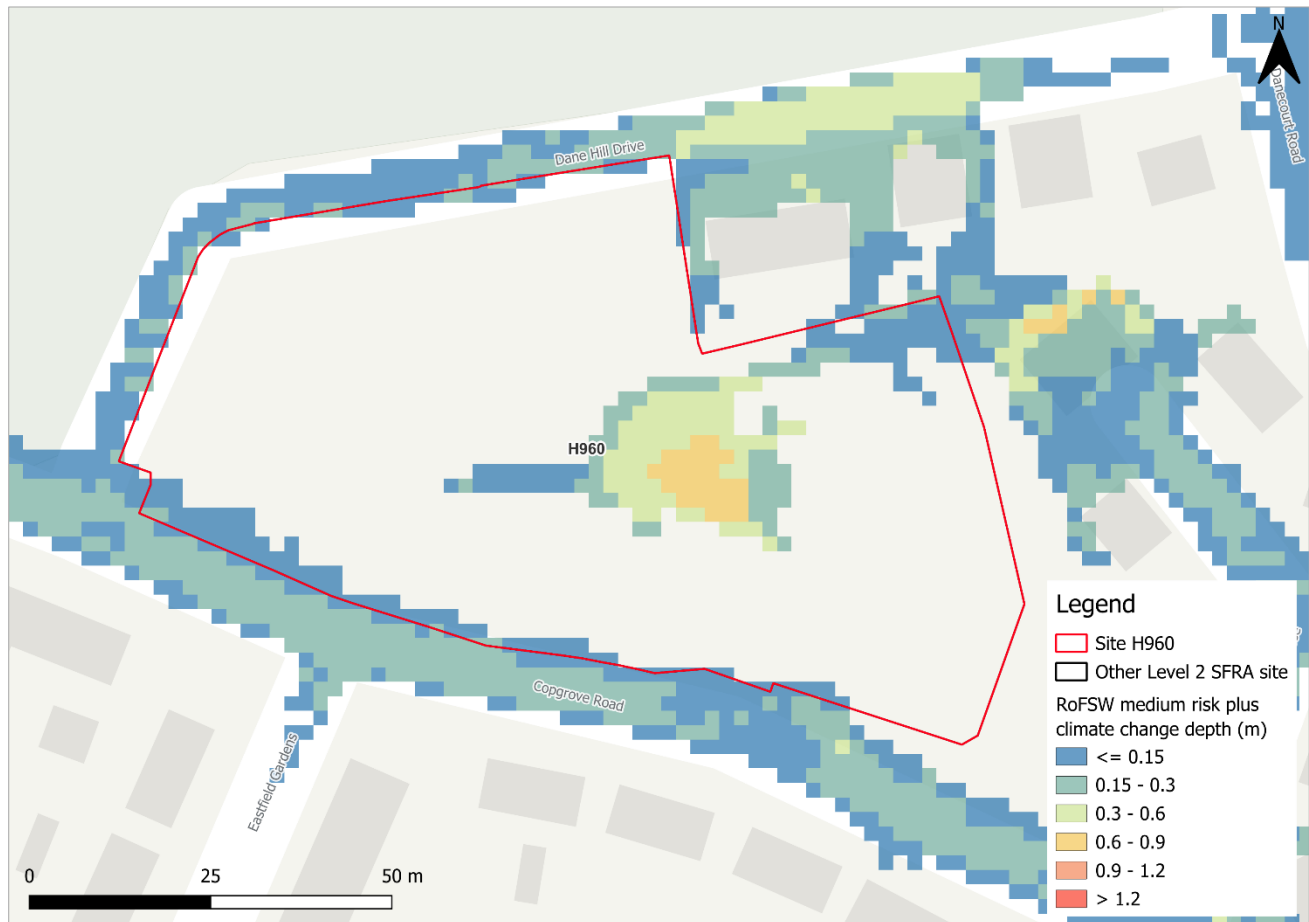


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)



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 is moderate in the centre of the site. Any change in site layout or changes to existing roads will require detailed surface water modelling to ascertain flow routes and low-lying areas.
- However, this modelling of surface water flood risk to the site is based on LiDAR data flown at a time when a previous development existed on site which has since been demolished. Therefore, existing surface water flood risk to the site is currently unknown. Detailed pluvial modelling based on a new topographic survey will therefore be required to inform of flood risk to the site development layout plan considerations. Post development modelling must demonstrate that development will not result in offsite detriment.
- Topographic flow routes and depressions should be considered and included in site design and ideally left in place to flood naturally when required. Any regrading of land must include like for like volumes to ensure risk is contained safely onsite for the lifetime of development.
- The use of appropriate SuDS should be investigated. The groundwater table is likely to be low in some areas of the site judging from the Groundwater Emergence Map in Figure 4-1, therefore infiltration SuDS may be an option in

suitable locations. This will require appropriate ground and infiltration survey, and surface water modelling based on layout plans and detailed design alongside full consultation with the LLFA.

- 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.
- 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.
- 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.

Parts of the north and south of the site are located in areas where there is no risk of groundwater emergence. Groundwater conditions in these areas may therefore be suited to infiltration SuDS. In the majority of the site however, there is a risk of flooding to subsurface assets, although surface manifestation of groundwater is unlikely. Ground investigations will be required at the site through the site-specific FRA to ascertain groundwater levels and conditions.

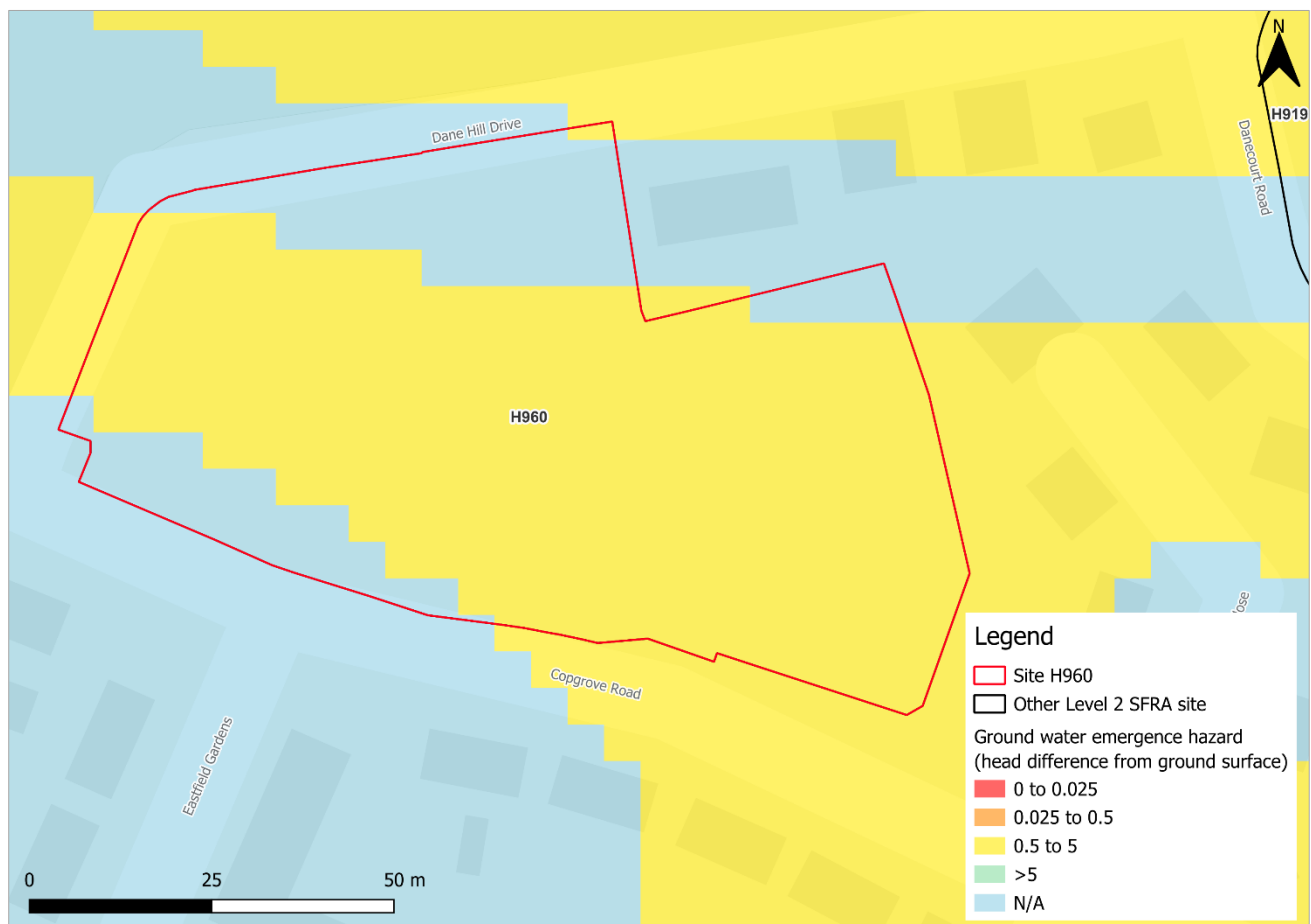


Figure 4-1: JBA 5m Groundwater Emergence Map

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 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. 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 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:

- It should be appropriate to develop this site for more vulnerable purposes given its location in Flood Zone 1. However, there is a moderate risk from surface water in the medium risk event. A detailed drainage strategy will be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development.
- The existing surface water modelling for the site is based on outdated LiDAR data from when a previous development was present on site. This previous development has since been demolished and as such, existing flood risk from surface water to the site is unknown. Therefore, new detailed modelling based on an updated topographic survey will be required to inform of flood risk to the site development layout plan considerations. Post development modelling must demonstrate that development at the site will not result in offsite detriment.
- A detailed drainage strategy will be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. Site runoff should be maintained at current rates (likely to be brownfield) and, where possible, betterment should be achieved. The use of infiltration SuDS should be investigated.
- Groundwater conditions in the site must be investigated further through the site-specific FRA to ascertain groundwater levels and conditions.
- 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 170 National Planning Policy Framework 2023

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Bradford Level 2 Strategic Flood Risk Assessment - Site H1034

Final Draft

July 2026

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

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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. Georgina Williams of JBA Consulting carried out this work.

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We would like to thank the Environment Agency for their assistance with 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 H1034. 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' (2026) and is therefore familiar with the terminology used in this report.

1.1 Site H1034

- Location: Land to rear of Aldi and McDonalds
- Existing site use: Industrial
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 0.75 hectares
- Proposed development impermeable area: 0.67 hectares
- Watercourse: Bradford Beck
- CBMDC river model: Bradford Beck 2026
- 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
 - Modelling of residual risk from Bradford Beck culvert

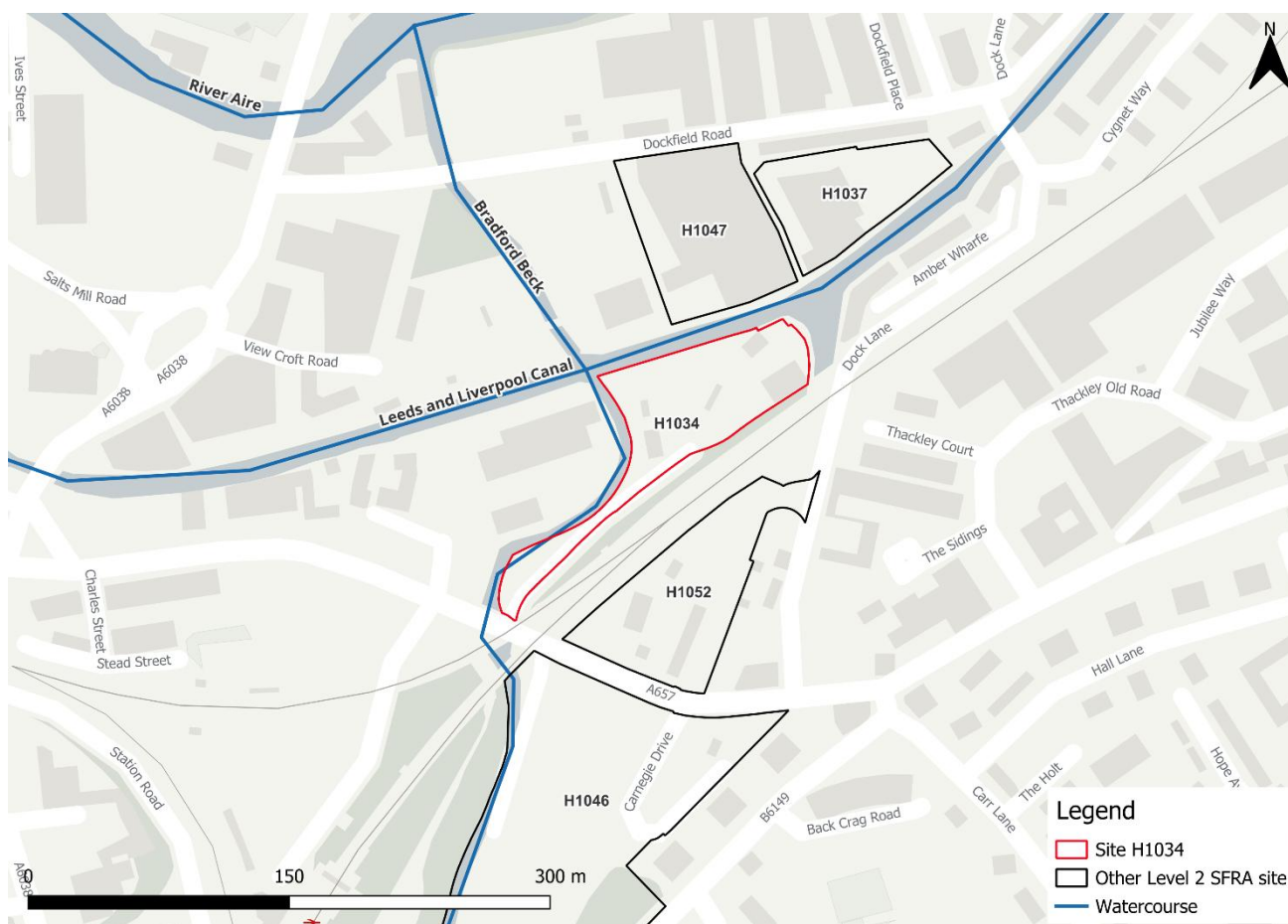


Figure 1-1: Existing site location boundary

The topography of the site is varied, with higher elevation in the east of the site, which slopes down towards Bradford Beck to the west (Figure 1-2). The floodplain adjacent to Bradford Beck in the west of the site is approximately 5m lower in elevation than the eastern areas of the site.

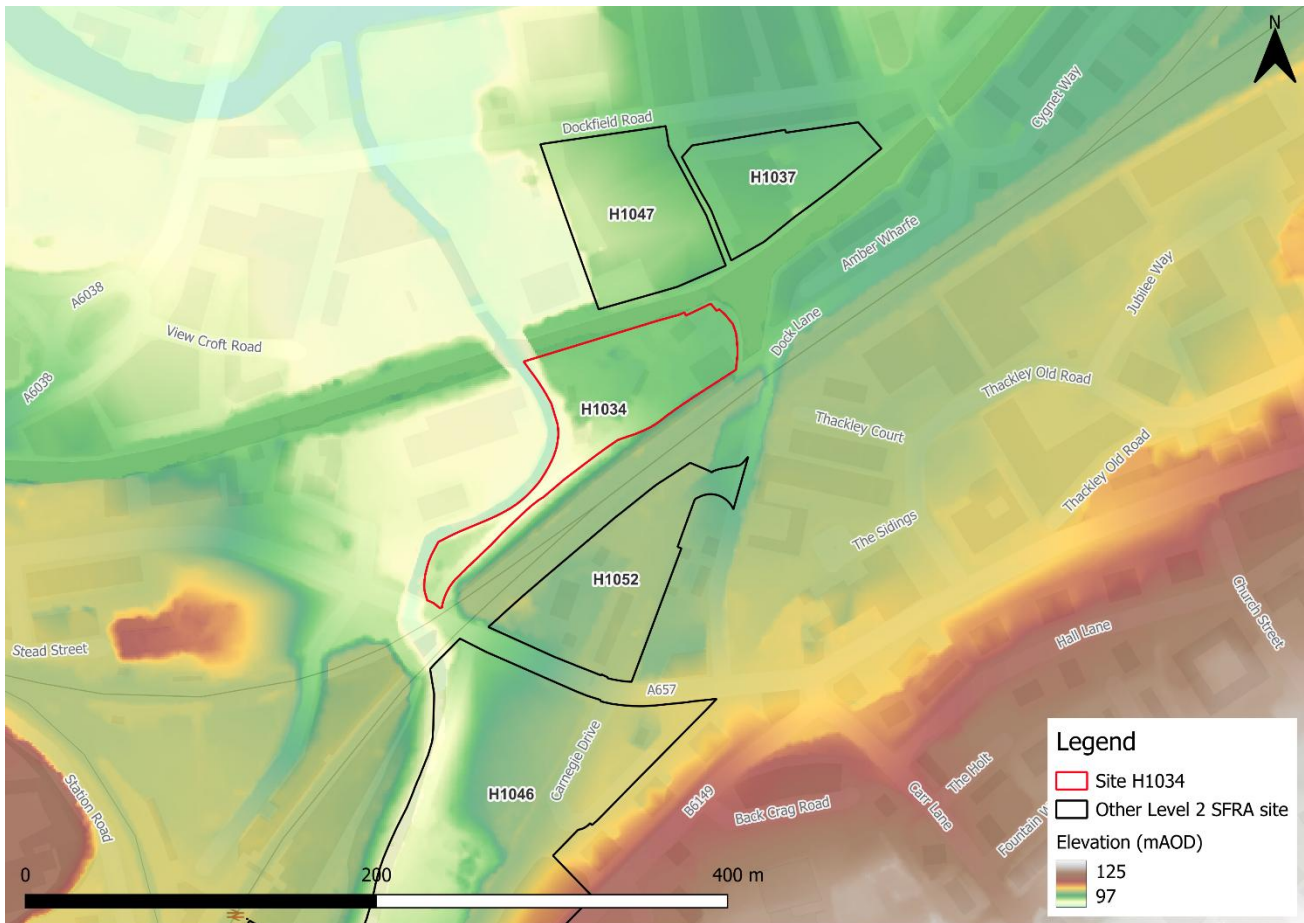


Figure 1-2: Topography

The underlying bedrock within the site is defined as 'Millstone Grit Group', which comprises mudstone, siltstone and sandstone (Figure 1-3). This is overlain with superficial deposits of till. Mudstone and siltstone typically have low permeability, whereas sandstone has a higher permeability.

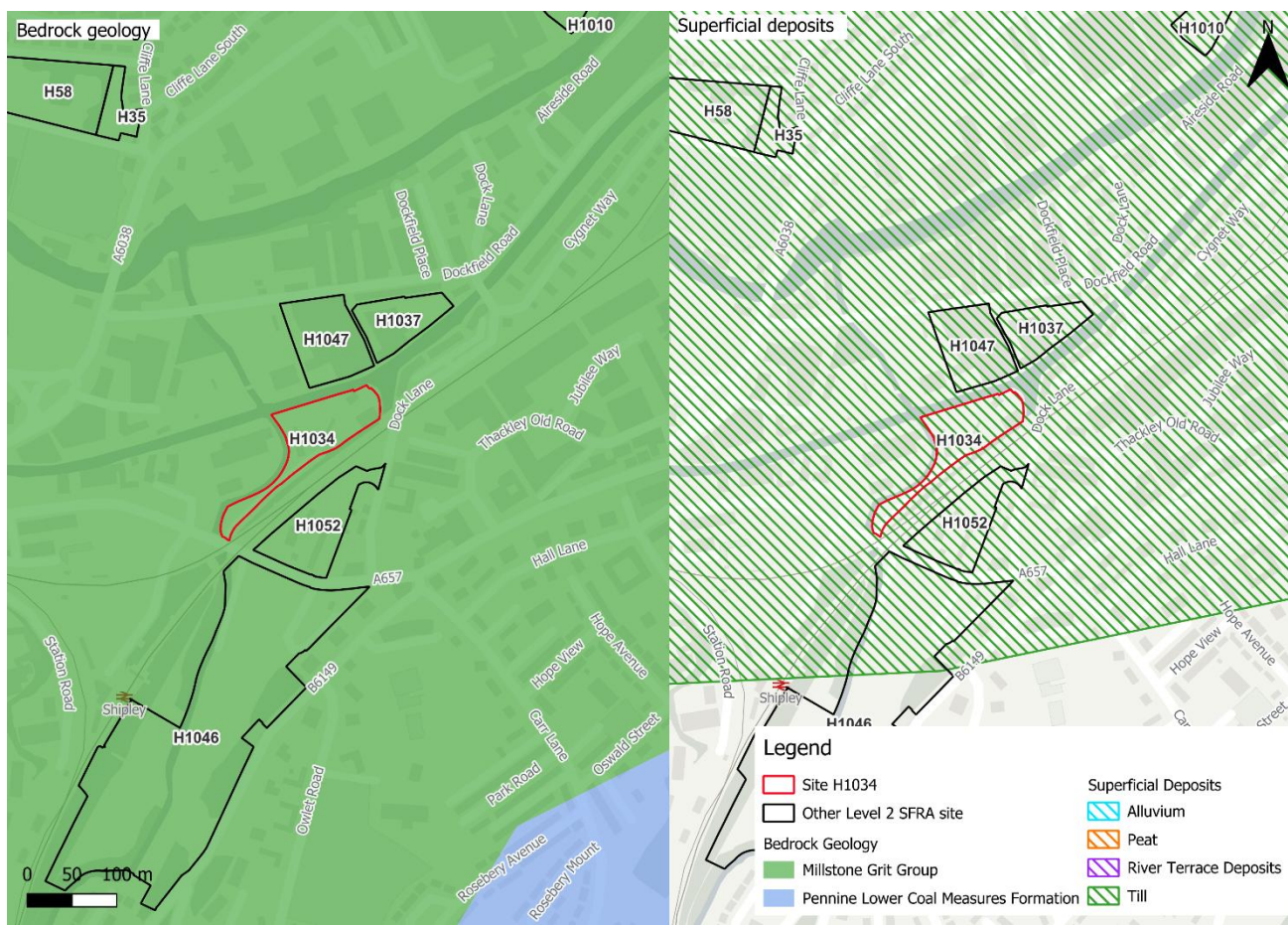


Figure 1-3: Soils and geology

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 (January 2026) 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).

Fluvial flood risk to the site comes from Bradford Beck which runs adjacent to the western boundary of the site. The area within the southwest of the site is situated within the functional floodplain. It appears this area would be the main access point for the site. There should be no development within the area of functional floodplain. There are some small additional areas of the site located within both Flood Zone 3a and Flood Zone 2, and therefore at high and medium risk of fluvial flooding respectively. The remaining area of the site is within Flood Zone 1 and is therefore at low risk of fluvial flooding.

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)
69	9	1	21

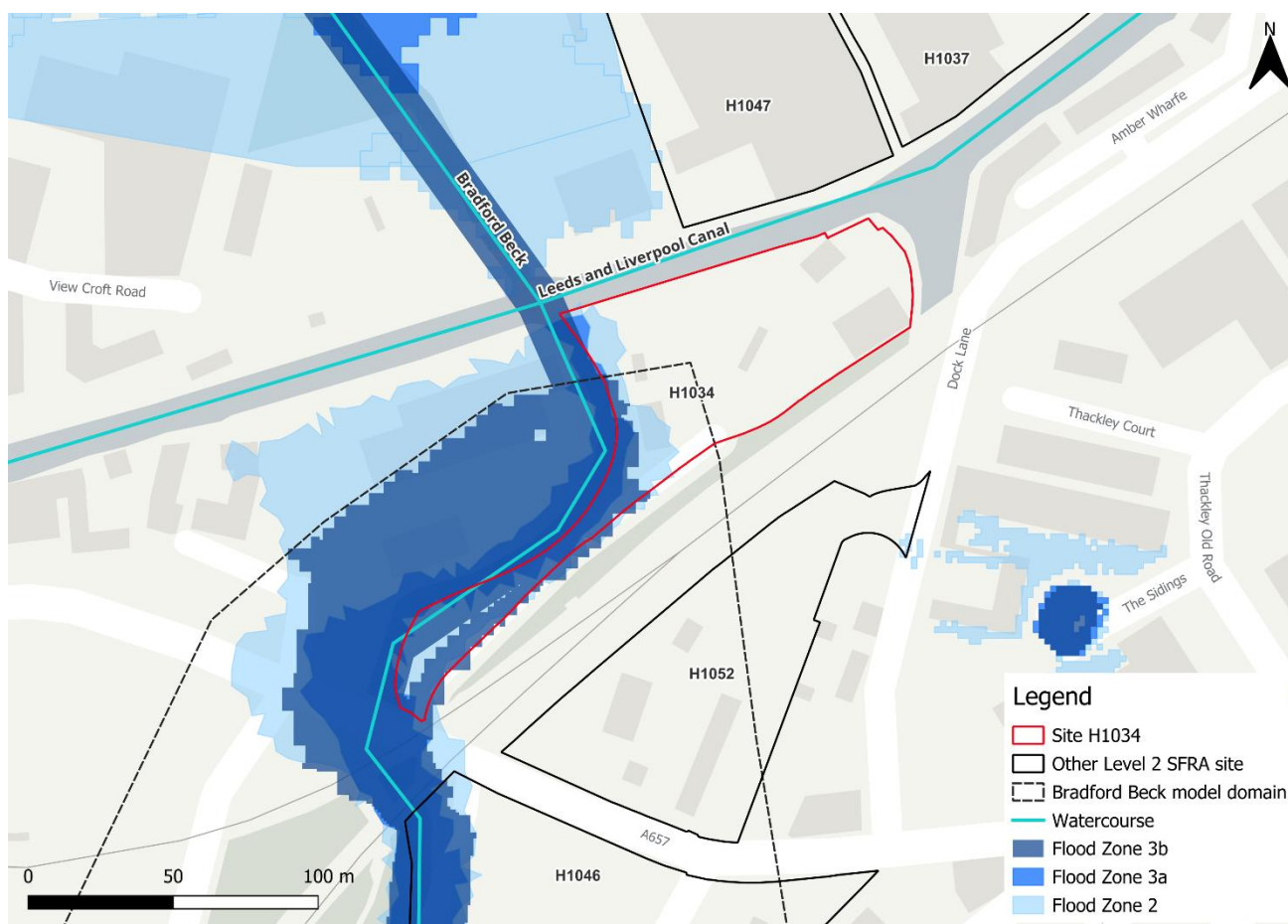


Figure 2-1: Existing risk from rivers to the site

2.1.2 Bradford Beck 2026 model outputs - present day

Figure 2-2 shows the modelled flood depths for the 1% AEP undefended event. Modelled risk to the site is greater than that shown by Flood Zone 3a, impacting the southwestern area of the site. However, it is noted that the current Flood Zone 3a does not yet account for the latest Bradford Beck model outputs. Maximum flood depths within the site are modelled to be between 0.6 and 0.9 m. Modelled flood velocities are between 1 and 2 m³/s (Figure 2-3). This indicates the floodwater within the site is likely to be fast moving, posing a greater risk to site users. There are some areas of hazard categorised as 'danger for most' and 'danger for all' (Figure 2-4).

The downstream extent of the Bradford Beck model is located at this site. Therefore, there may be some additional impacts that have not been modelled that cannot be considered based on the outputs available. Outside of the model domain, the functional floodplain is represented by a buffer of the Bradford Beck watercourse at this site. It is likely that the area of functional floodplain represented by the Bradford Beck model would continue along the western boundary of the site, were the model have been extended further.



Figure 2-2: Flood depths for 1% AEP undefended flood event

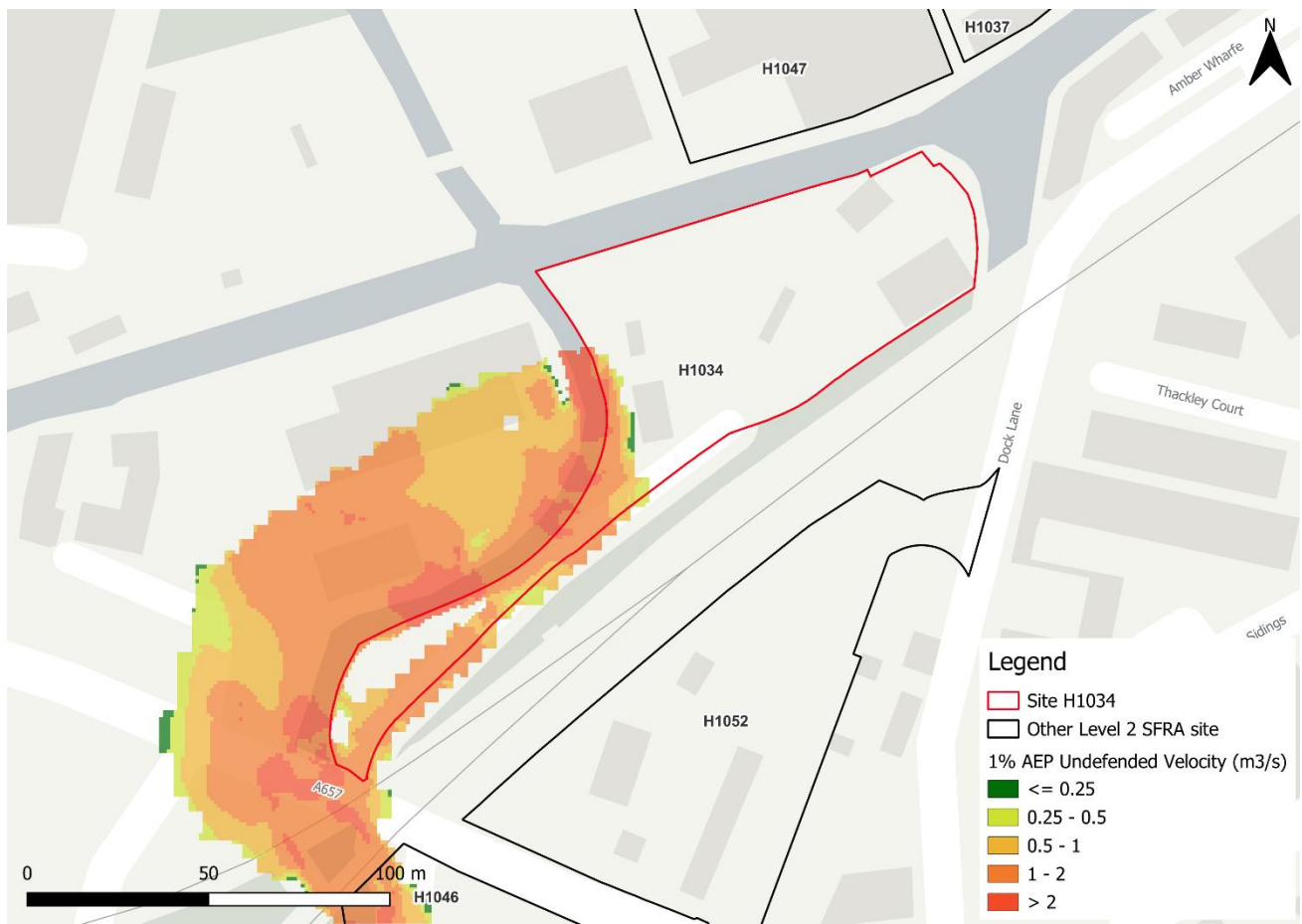


Figure 2-3: Flood velocities for 1% AEP undefended flood event

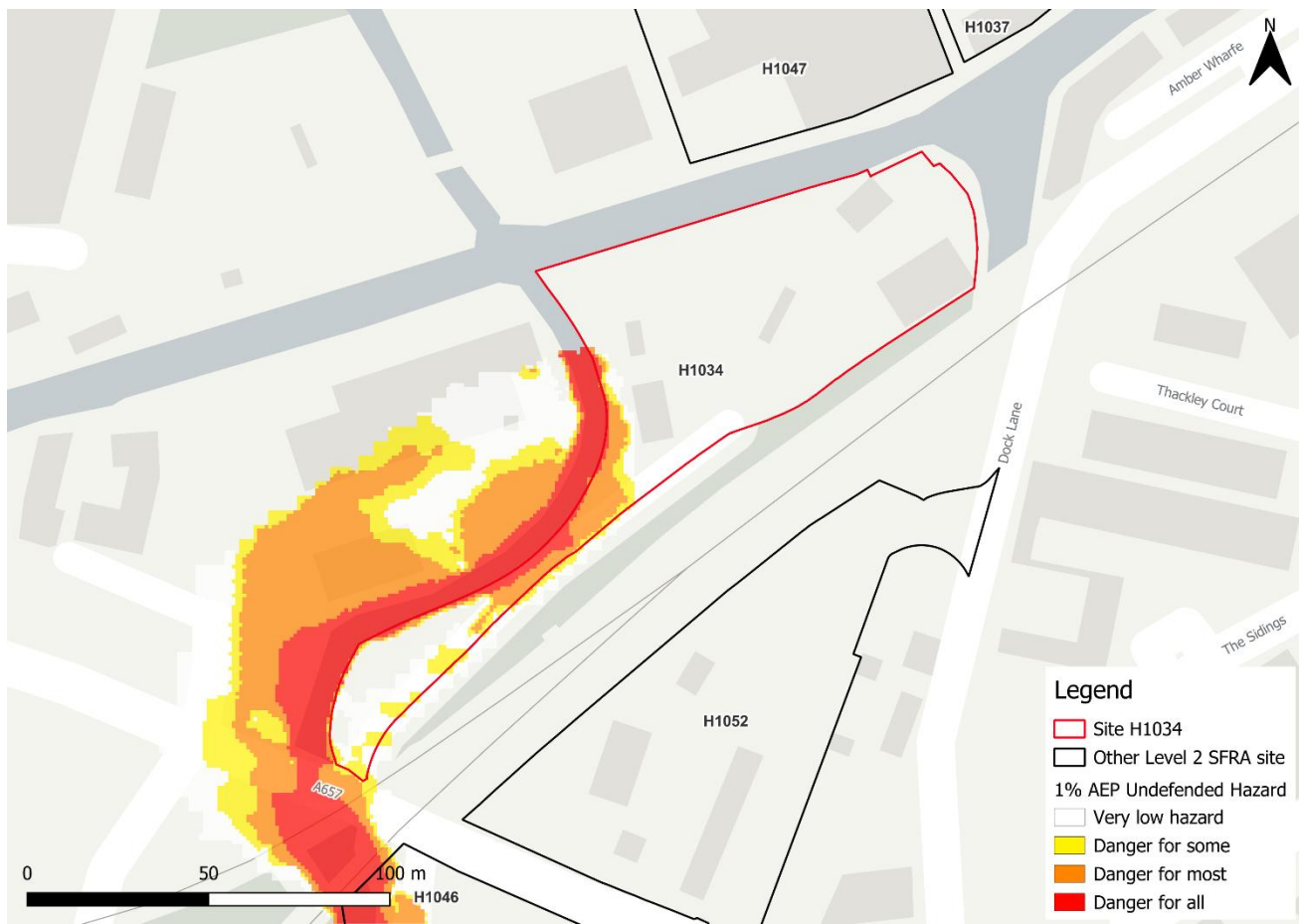


Figure 2-4: Flood hazard¹ for 1% AEP undefended flood event

2.2 Impacts from climate change

The EA's SFRA guidance states that SFRA should assess the central allowance for less vulnerable, more vulnerable, highly vulnerable and water compatible development (Table 2-2). The impacts of climate change on flood risk from the Bradford Beck 2026 model have been modelled without flood defence infrastructure in place. As documented in Section 2.3.1, there are no formal engineered flood defences that would benefit the site.

¹ Fluvial hazard ratings based on Table 4 of the SUPPLEMENTARY NOTE ON FLOOD HAZARD RATINGS AND THRESHOLDS FOR DEVELOPMENT PLANNING AND CONTROL PURPOSE – Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1. May 2008.

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%

2.2.1 Bradford Beck 2026 model outputs - climate change

Figure 2-5 shows the onsite modelled flood depths for the 1% AEP undefended event +23% for climate change. Risk is modelled to be similar in extent to present day conditions. Maximum flood depths are shown to remain at between 0.6 and 0.9 m, however there is a greater area of the site with these depths. Flood velocities are also modelled to remain at between 1 and 2 m³/s (Figure 2-6). The modelled flood hazard within the area at risk is largely categorised as either 'danger for most' or 'danger for all' (Figure 2-7).

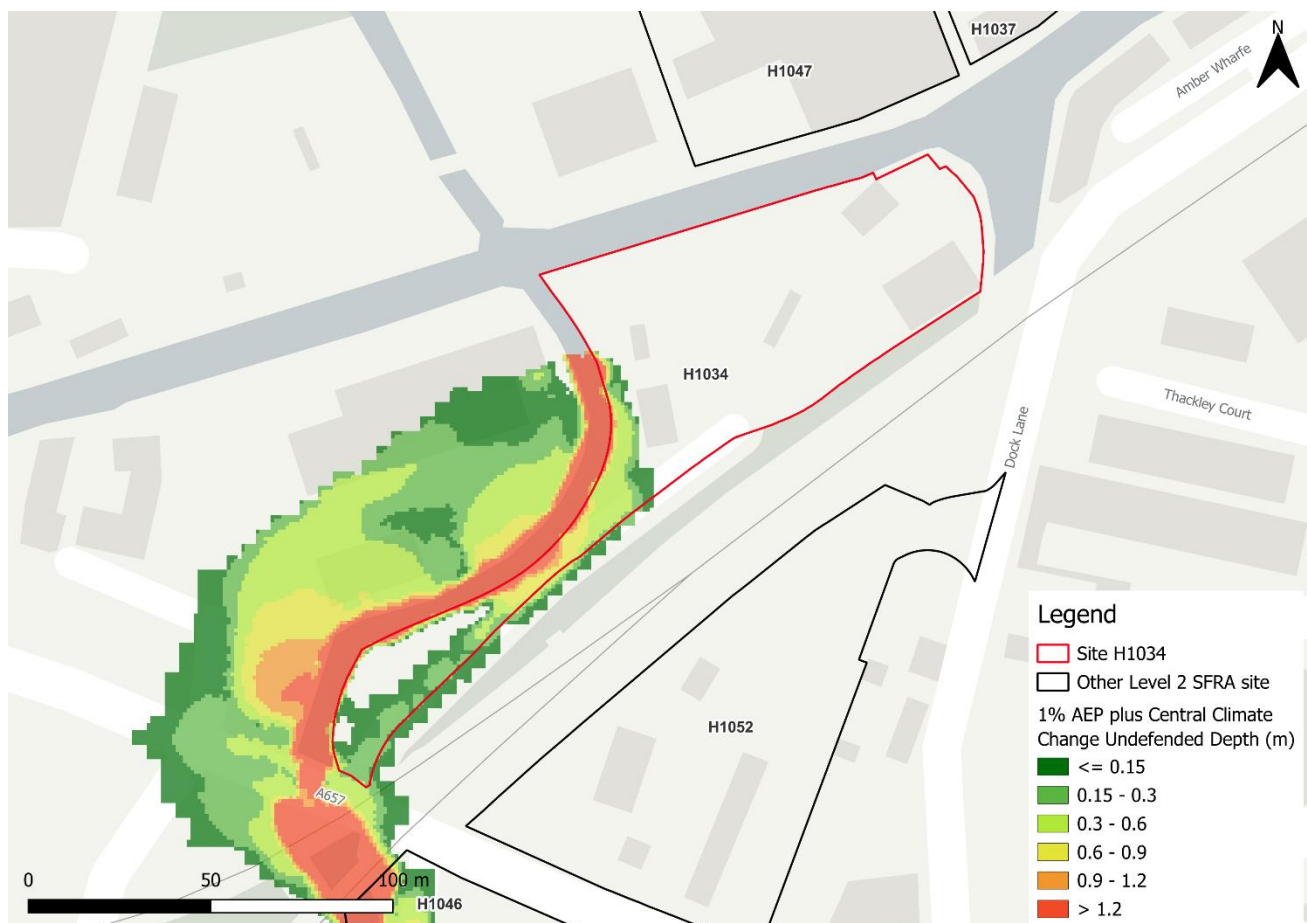


Figure 2-5: Flood depths for 1% AEP undefended flood event +23% (central climate change allowance)

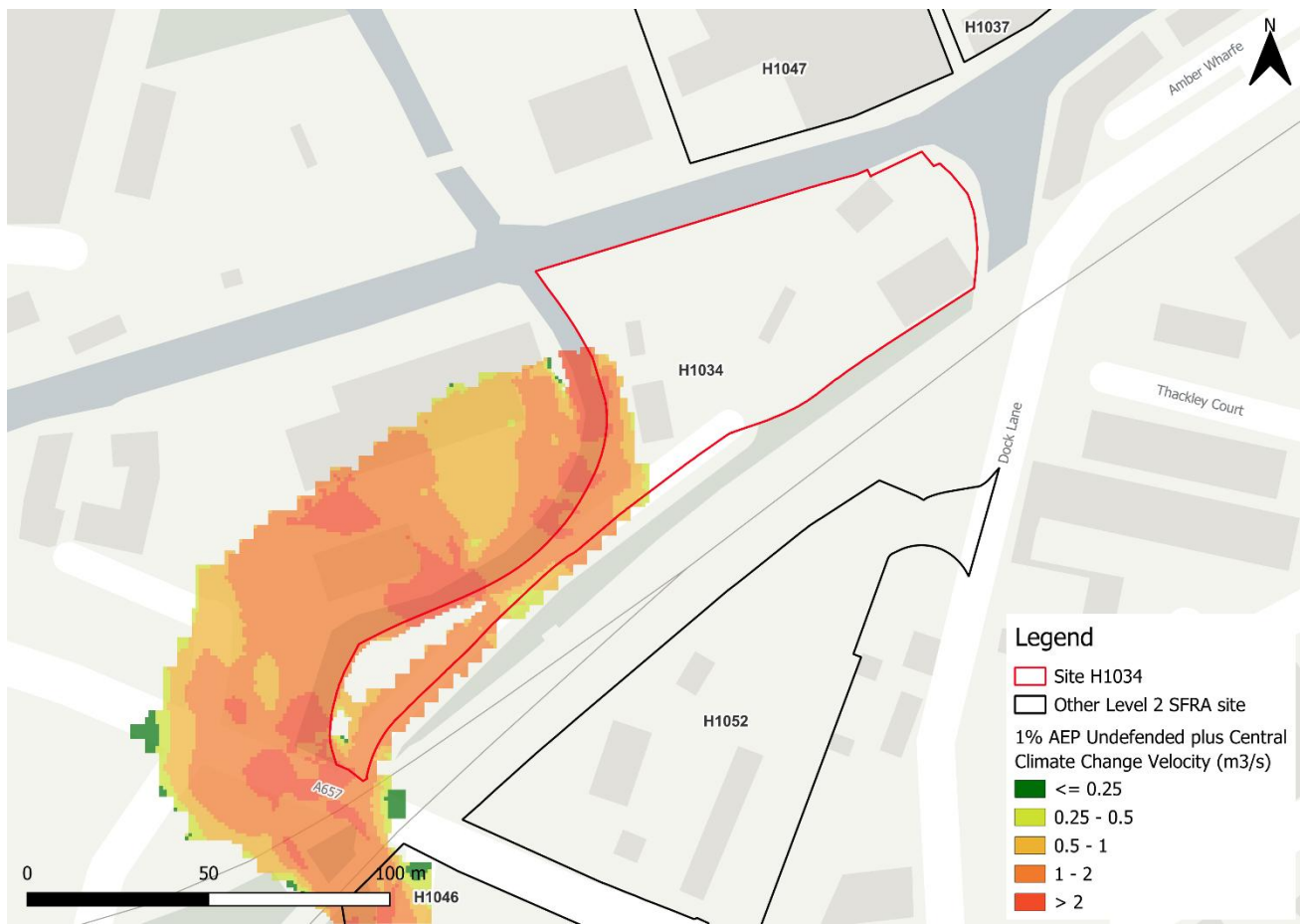


Figure 2-6: Flood velocities for 1% AEP undefended flood event +23% (central climate change allowance)

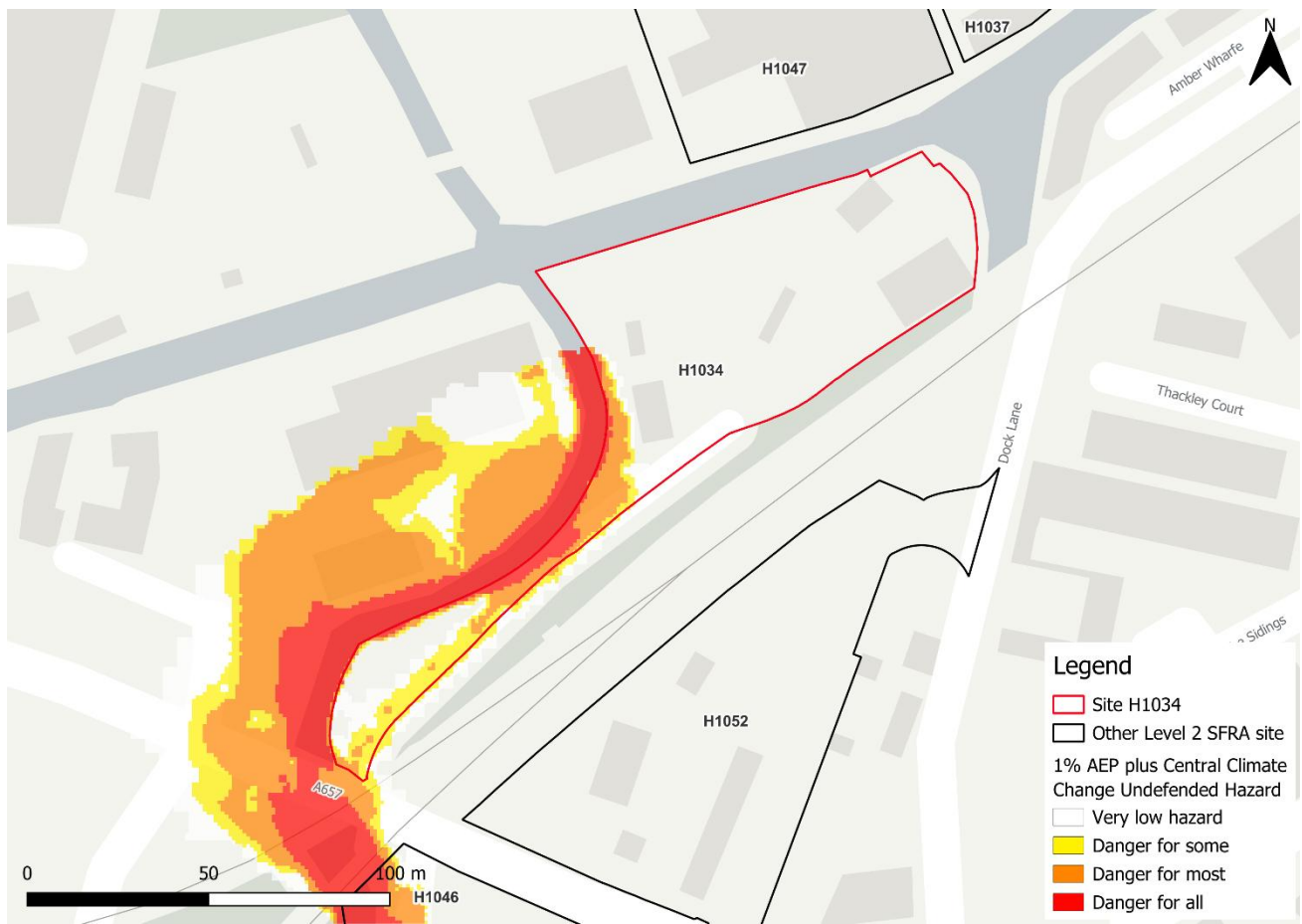


Figure 2-7: Flood hazard for 1% AEP undefended flood event +23% (central climate change allowance)

2.2.2 Flood Map for Planning - Climate Change

Climate change data in this area is unavailable from the EA's Flood Map for Planning plus Climate Change (2070-2125) dataset, as shown in Figure 2-8.

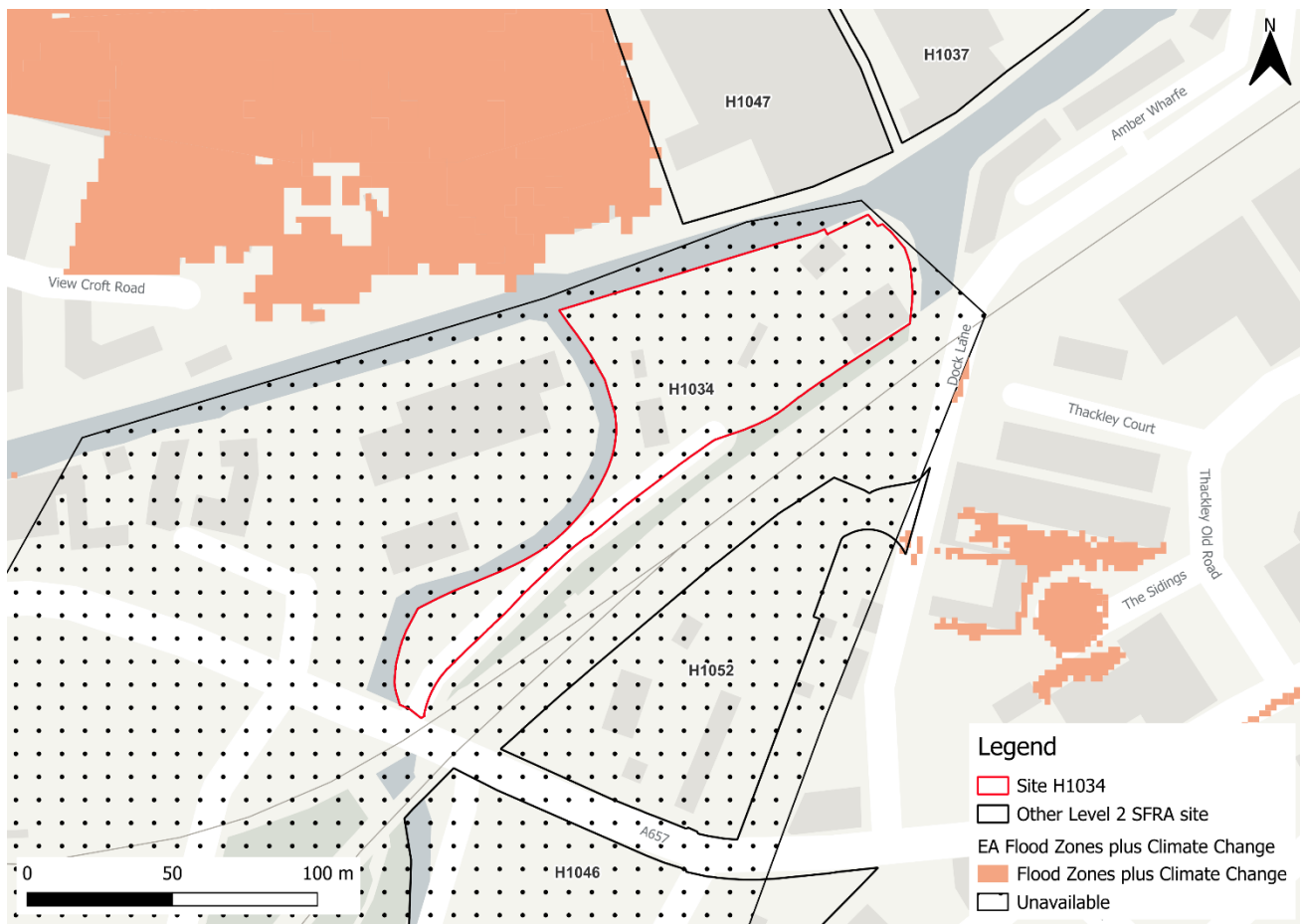


Figure 2-8: EA Flood Zones plus Climate Change

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. Within a small area in the west of the site, there may be opportunities for floodplain reconnection, which can decrease the magnitude of the flood peak and reduce downstream flood depths especially for high frequency, low return period floods. This area is shown in Figure 2-9. The WwNP mapping is broadscale and indicative. Further investigation is required for any land shown to have potential for WwNP.

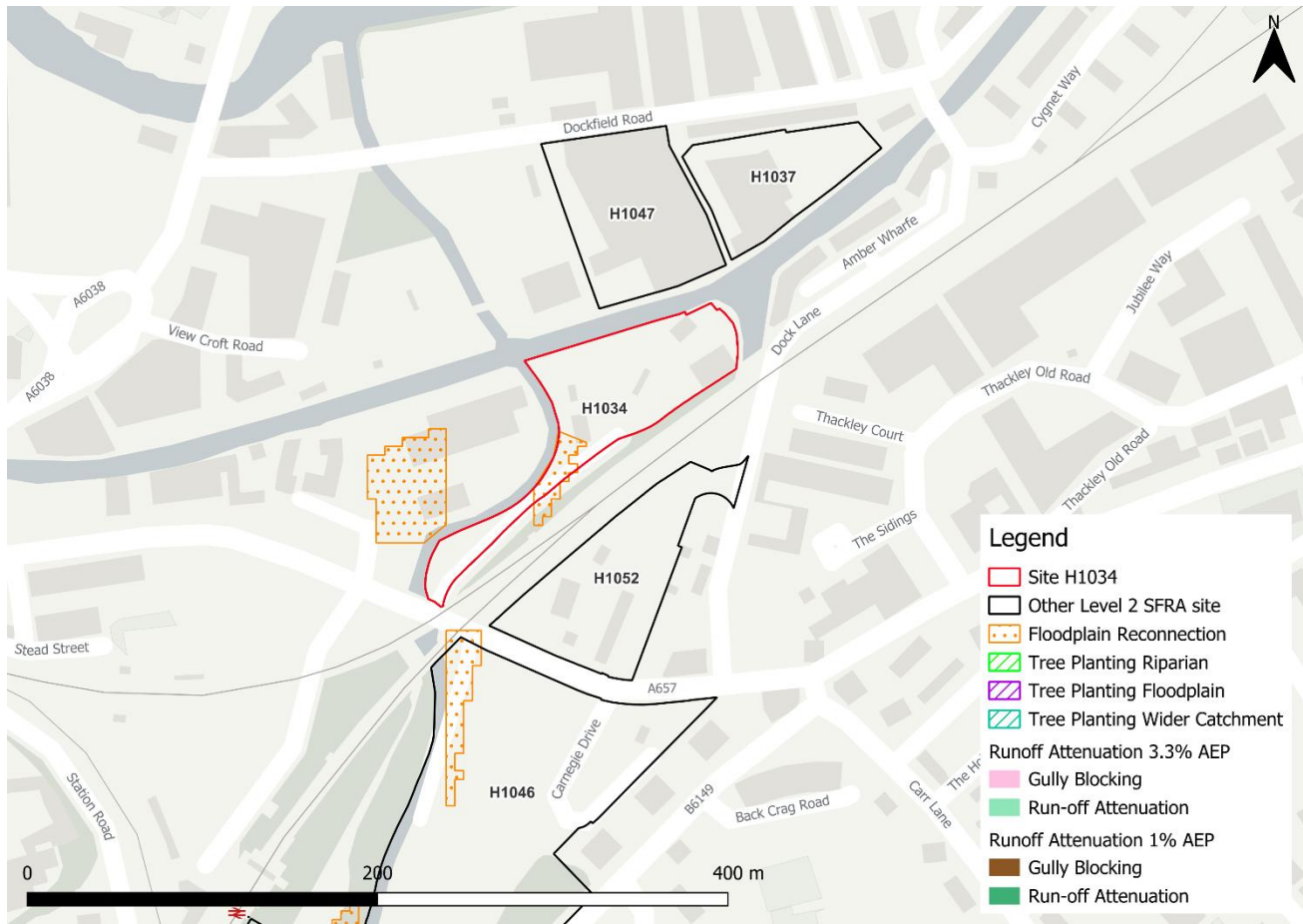


Figure 2-9: Natural Flood Management (NFM) potential mapping

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 events at the site.

2.5 LLFA flood incidents

The LLFA have records of one flood incident occurring adjacent to the site, which occurred in 2007 due to overtopping from Bradford Beck. Developers should contact the LLFA for further information at the FRA stage, to assess potential flood risk to the site associated with this incident.

2.6 Emergency planning

2.6.1 Flood warnings

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, though a FWA, namely 123FWF119 - River Aire at Shipley, is located adjacent to the northwest boundary of the site.

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 west of the site is located within a FAA, namely 123WAF961 - Middle River Aire catchment.

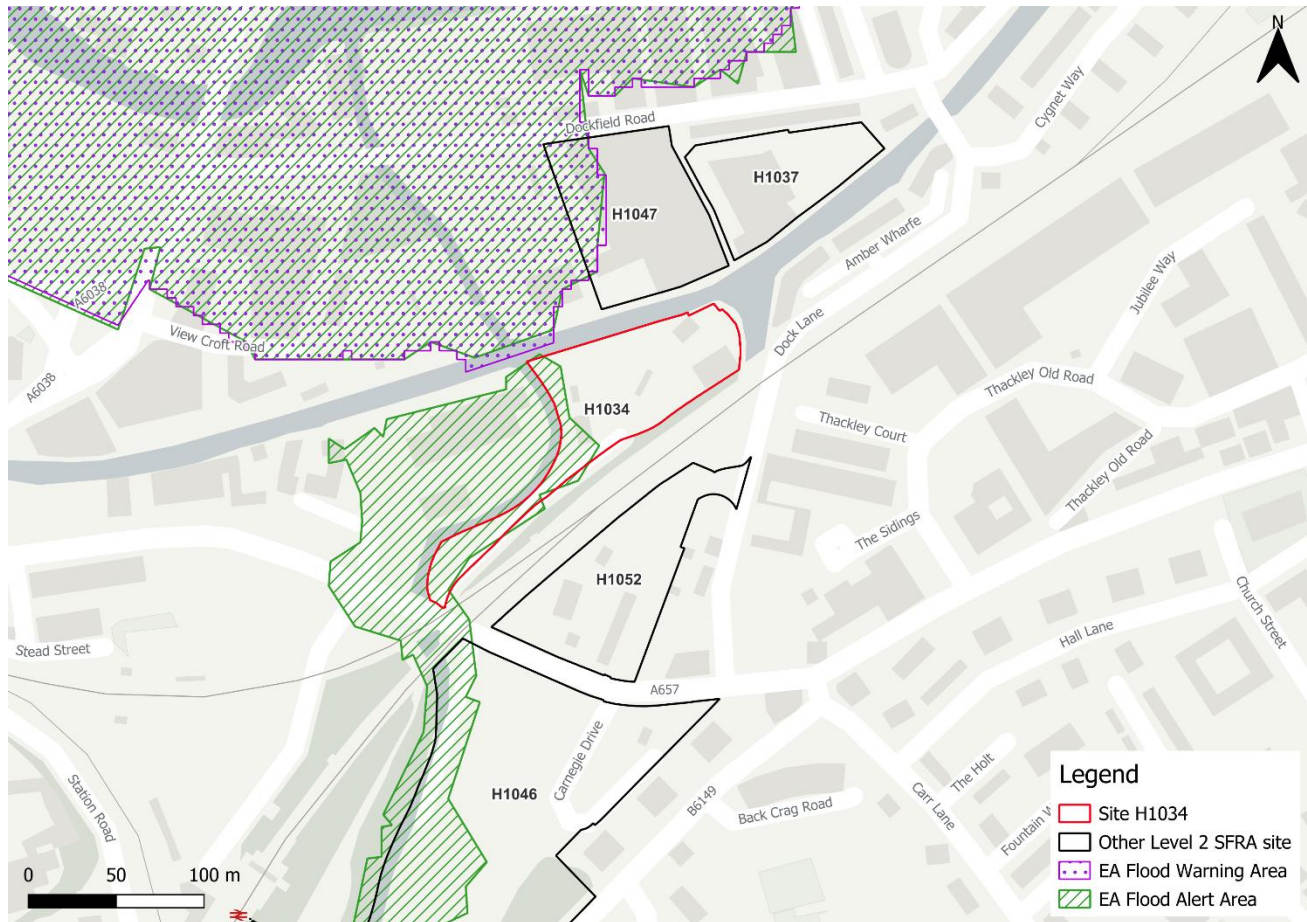


Figure 2-10: EA Flood Warning Areas and Flood Alert Areas

2.6.2 Access and escape routes

Based on available information, safe access and escape routes may be challenging to achieve from the south of the site, given the extent of flooding shown in the 1% AEP undefended event and when accounting for climate change. Safe access and escape routes may need to be considered via Dock Lane to the east of the site, if possible (Figure 2-11).

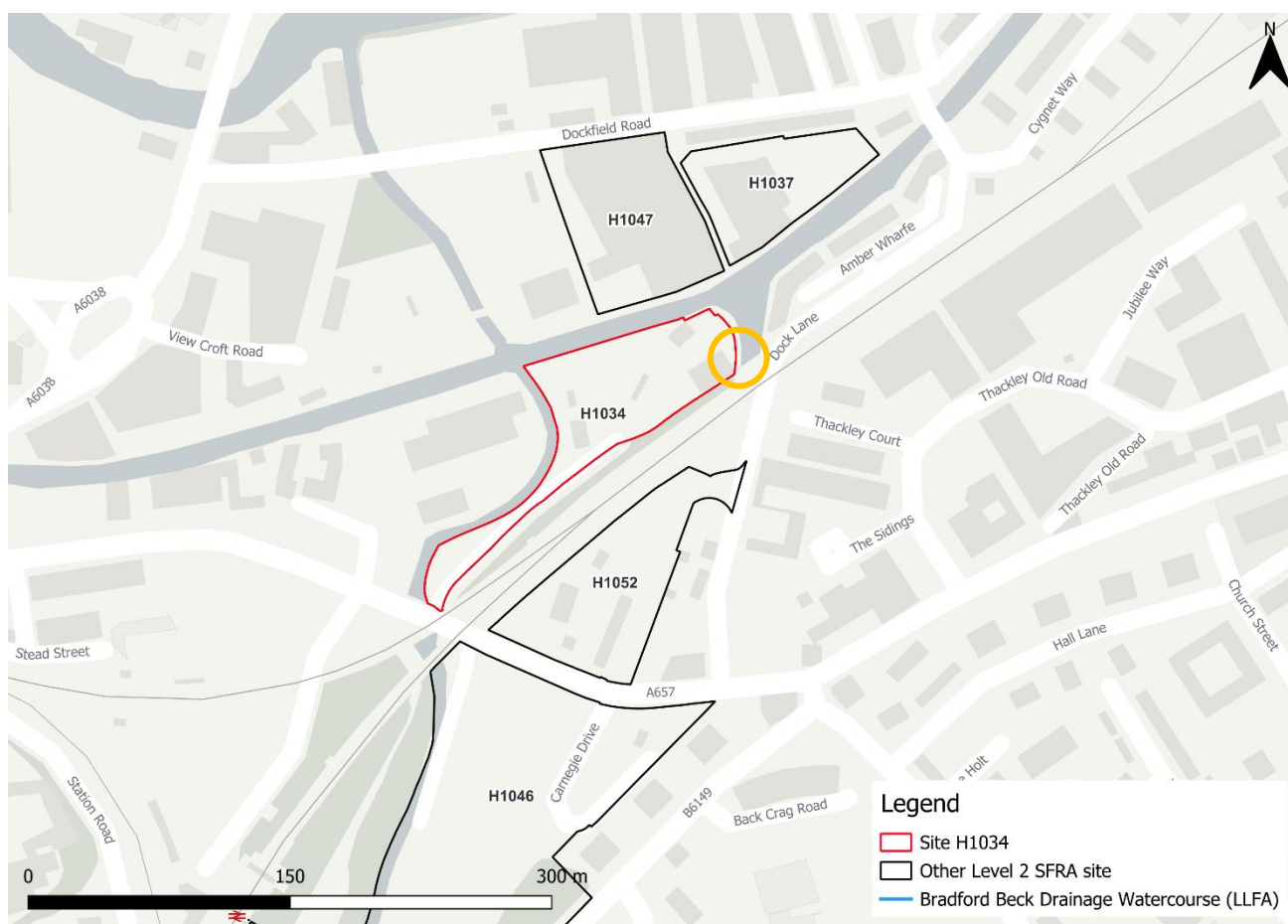


Figure 2-11: Potential access and escape routes

2.7 Observations, mitigation options, site suitability and sequential approach to development management - fluvial

- Observations:
 - 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 LPA must consider whether the change of use is acceptable and whether the development can be designed to be safe, including for adequate emergency planning provision, accounting for the information provided in this Level 2 SFRA (para 014 FRCC-PPG).
 - The site is modelled to be within the functional floodplain within the southwest of the site, adjacent to Bradford Beck. Development is not permitted within the functional floodplain. If feasible, this area would be included as a green / blue corridor in site design offering multifunctional benefits alongside flood risk mitigation including Biodiversity Net Gain (BNG) contributions, and social and amenity benefits.
 - If works are proposed on or near a river or flood defence, a separate permission may be required. The type of permission needed from the Lead Local Flood Authority will depend on the activity and location proposed.

- For non-tidal main rivers, a flood risk activity permit may be required if the development of the site is within 8 metres of Bradford Beck, the Leeds and Liverpool Canal, or the Leeds Road culvert (see Section 5.1). A flood risk activity permit may also be required for activity (e.g. land raising) in the floodplain if it could affect flood flow or storage, and potential impacts are not controlled by a planning permission.
- The southwest of the site is modelled to be at risk from fluvial sources (according to the Bradford Beck 2026 model) in the 1% AEP undefended scenario, to a larger extent than Flood Zone 3a. The east of the site is modelled to be within Flood Zone 1.
- Given the site is more vulnerable and within Flood Zone 3a, and also within the 1% AEP undefended event modelled flood outline, the site must be subject to and must pass the exception test.
- Given the site is at high and medium risk from Bradford Beck, it is recommended that southwestern area of the site is not redeveloped for more vulnerable uses. More vulnerable development should be directed to the east of the site, within Flood Zone 1.
- The 1% AEP event with an allowance for climate change is what the EA considers to be the design event for a development to mitigate fluvial flood risk. The extent of flooding in the 1% AEP undefended +23% climate change event is shown to be similar to that of the present day event.
- Were any plans for development to proceed, the site-specific FRA must show that development will be safe for its lifetime taking account of the vulnerability of its users, including for appropriate evacuation procedures and flood response infrastructure are in place to manage the fluvial risk associated with the extreme flood event.
- Mitigation:
 - EA flood alerts should continue to be in place to ensure early evacuation of site users before an extreme flood event occurs.
- Access and escape:
 - Based on available information, safe access and escape routes may be challenging to achieve. If possible, these routes should be explored via Dock Lane to the east of the site.

3 Flood risk from surface water

3.1 Existing risk

At the time of writing, the EA's latest national Risk of Flooding from Surface Water (RoFSW) does not include depth and hazard information suitable for planning purposes. Therefore, this Level 2 SFRA considers the third generation RoFSW depth and hazard mapping in addition to the NaFRA2 extents, as agreed with the EA. Surface water depth and hazard should be confirmed at the site-specific FRA stage.

3.1.1 Risk of Flooding from Surface Water - NaFRA2 extents

Based on the EA's national scale RoFSW map (January 2026), surface water risk to the site is predominantly very low, as shown in Table 3-1.

Surface water risk in the medium risk event is confined to a very small area along the northern boundary of the site, adjacent to the Leeds and Liverpool Canal (Figure 3-1). In the low risk event, there is an area of ponding within the northeast of the site. Safe access and escape routes via Dock Lane may be challenging to achieve based on surface water depths and hazards along this route.

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)
93	6	1	0

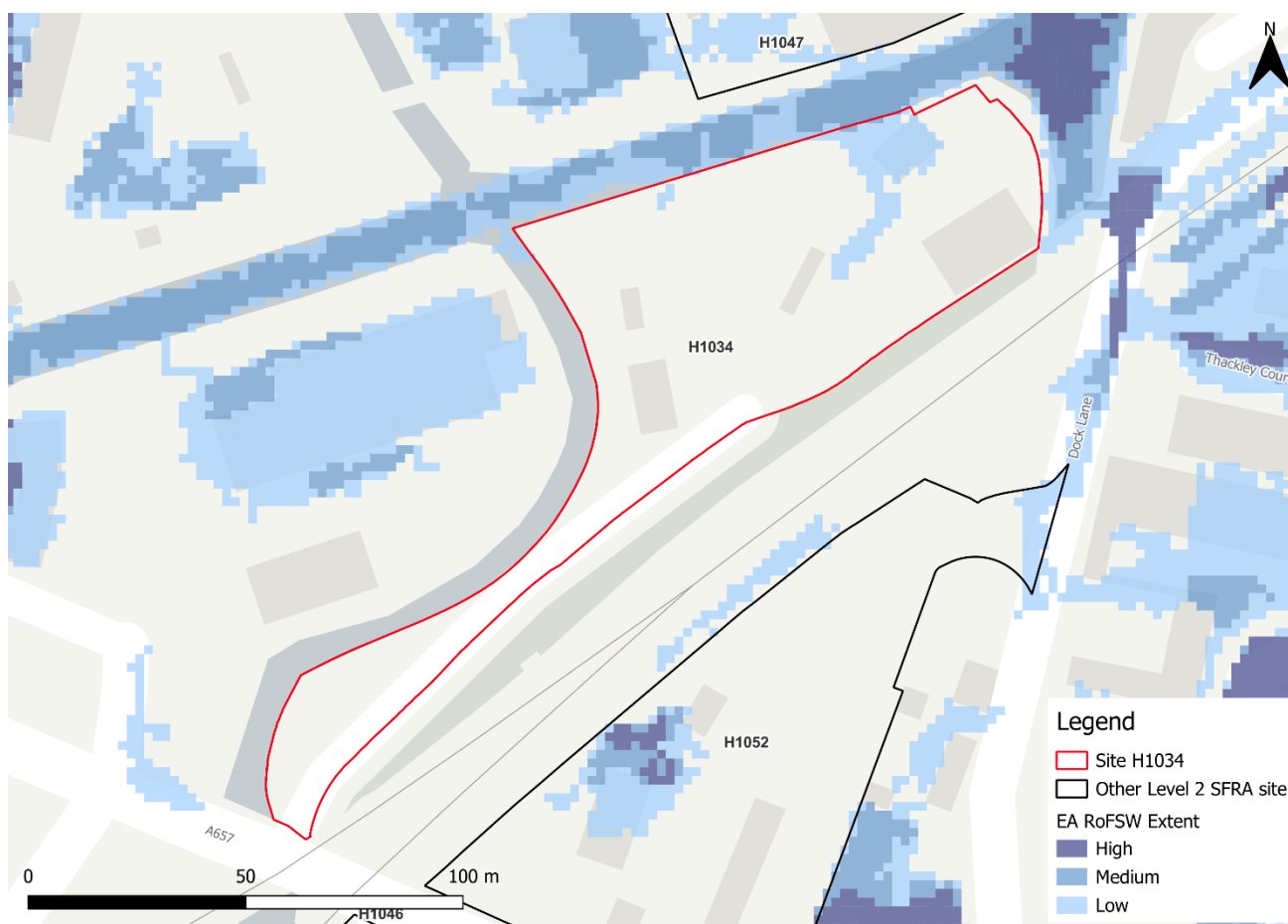


Figure 3-1: Surface water flood extents (NaFRA2 - Risk of Flooding from Surface Water map)

3.1.2 Risk of Flooding from Surface Water - third generation depths and hazards

Based on the EA's national scale third generation RoFSW map, the greatest flood depths within the site in the medium risk event are between 0.15 and 0.3 m within the north of the site (Figure 3-2), with hazard categorised as 'low' (Figure 3-3).

Safe access and escape routes may be challenging to achieve via Dock Lane to the east of the site, given modelled flood depths of up to 0.6 m along this route, based on the third generation mapping. Safe access and escape routes should be confirmed based on a drainage strategy through the FRA.

There are differences between the NaFRA2 RoFSW map and the third-generation depth and hazard mapping. The NaFRA2 RoFSW map does not map flooding less than 0.075m (7.5cm) in depth. Therefore, where the map may show no flooding, there may be shallow flooding up to a depth of 0.075m. In contrast, the third generation RoFSW does not map flooding with a hazard rating of less than 0.575. This could explain the differences observed between the NaFRA2 and third generation RoFSW. Assessment of surface water should be carried out at the site-specific FRA stage to robustly establish current and future surface water flood risk conditions.



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

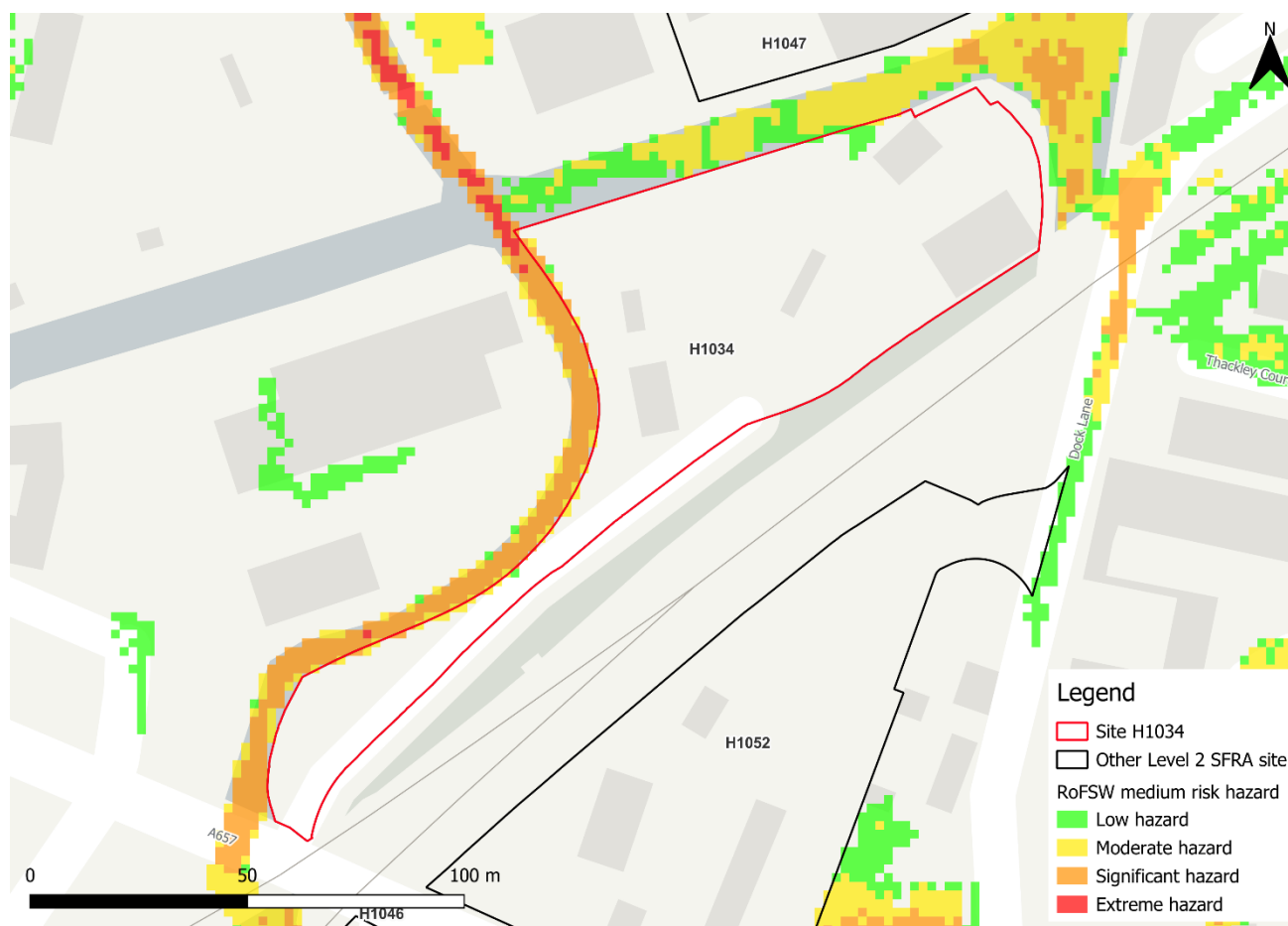


Figure 3-3: Medium risk event surface water flood hazard² (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

At the time of writing, the available national surface water climate change mapping is unsuitable for consideration in development planning. This Level 2 SFRA considers the low risk surface water event as a conservative proxy for the medium risk event plus climate change, as agreed with the EA. The impact of climate change on surface water flood risk should be considered at the site-specific FRA stage.

Using the low risk event as a proxy, the medium risk surface water event is likely to increase in extent within the site when accounting for climate change (Figure 3-4). The third generation map indicates maximum flood depths are likely to increase to > 1.2 m (Figure 3-5), however these are confined to the area adjacent to Bradford Beck that is also within the functional floodplain. Within the rest of the site, flood depths are shown to increase to between 0.3 and 0.6 m, with areas of hazard categorised as 'moderate' (Figure 3-6). Along Dock Lane, modelled flood depths are shown to be between 0.6 and 0.9 m, therefore safe

² 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

access and escape routes may be challenging to achieve. This should be confirmed through the site-specific FRA.

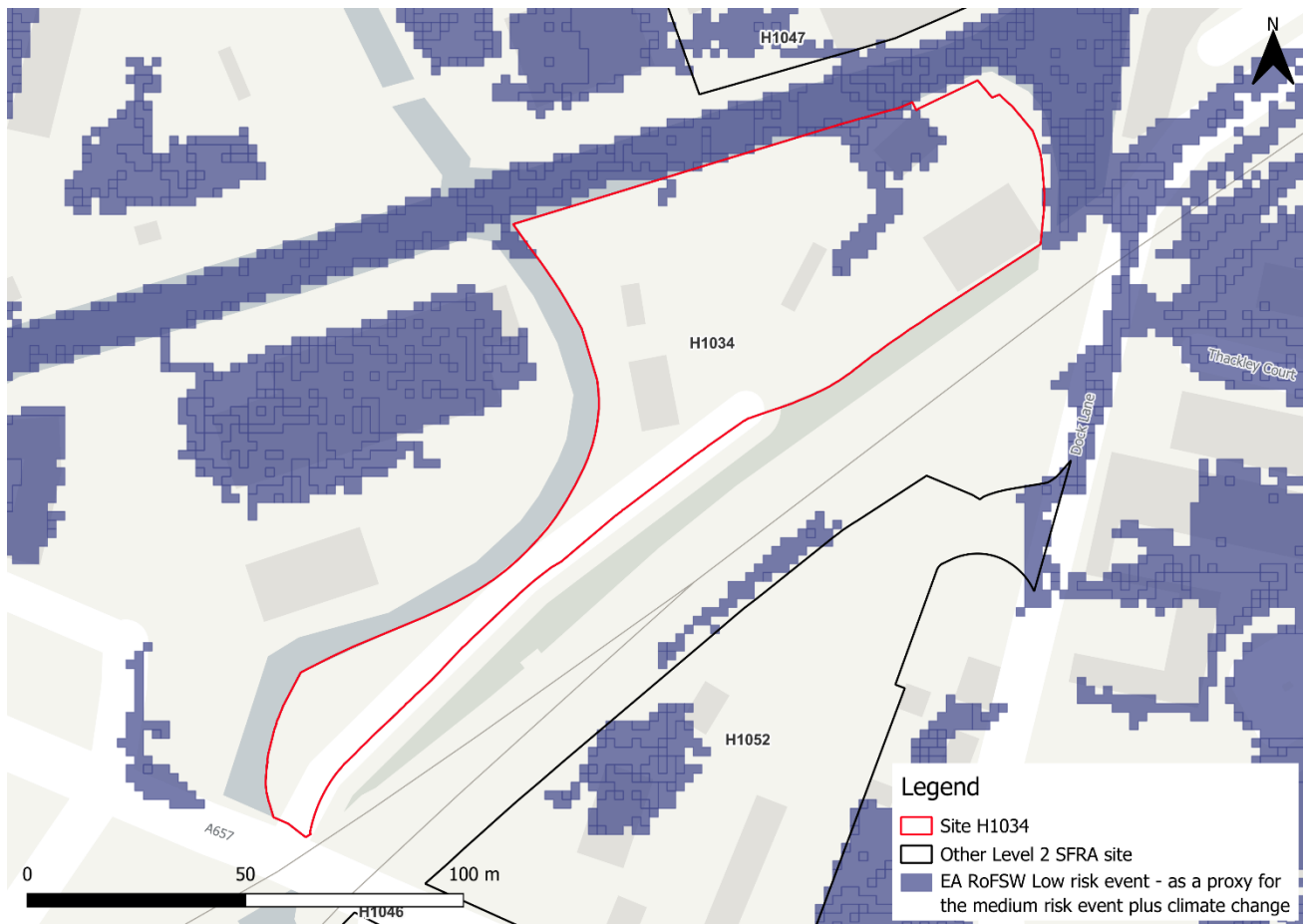


Figure 3-4: Low risk event surface water flood extent, as a proxy for the medium risk event plus climate change (NaFRA2 - Risk of Flooding from Surface Water map)

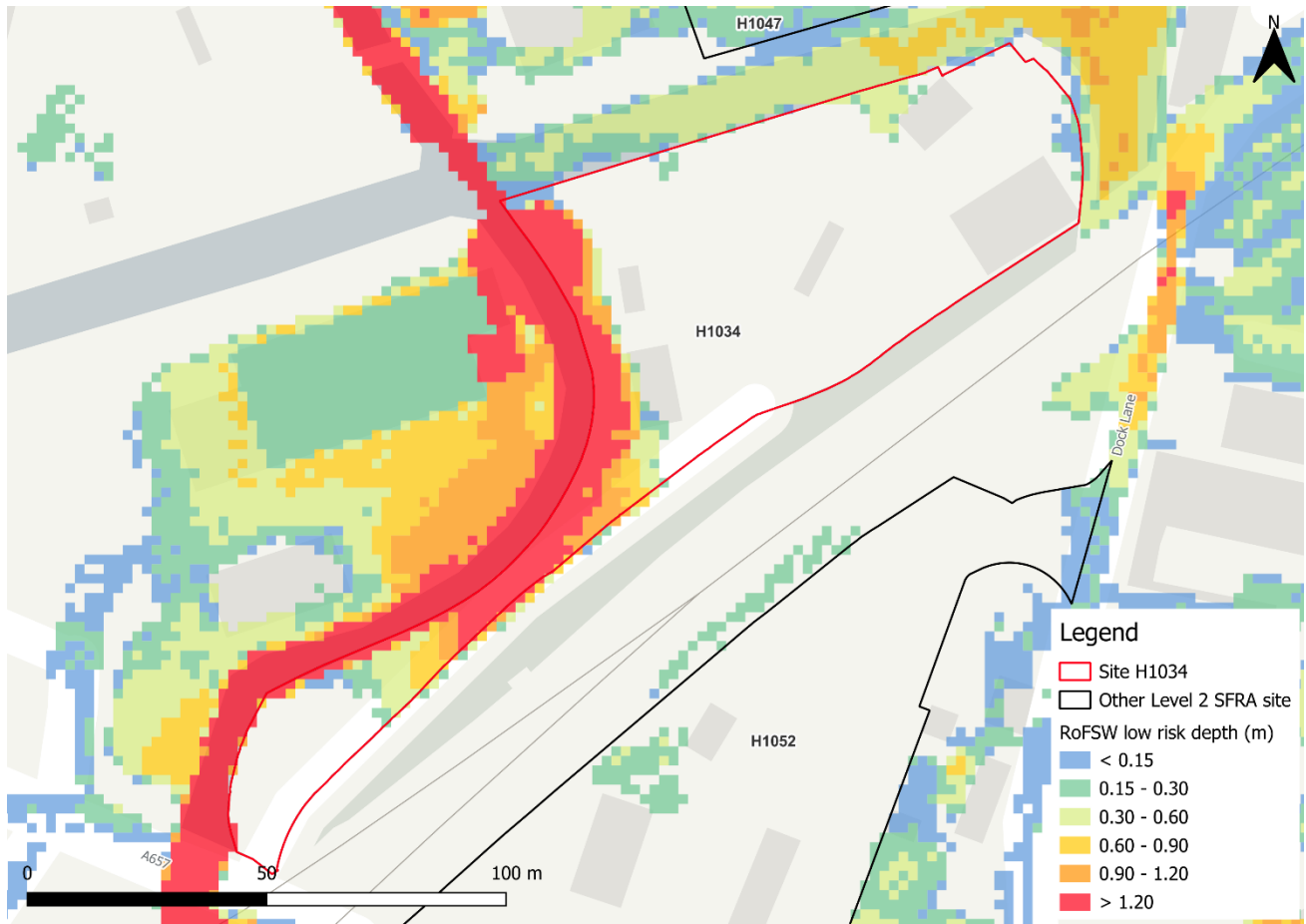


Figure 3-5: Low risk event surface water flood depths, as a proxy for the medium risk event plus climate change (Third generation - Risk of Flooding from Surface Water map)



Figure 3-6: Low risk event surface water flood hazard, as a proxy for the medium risk event plus climate change (Third generation - 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 93% of the site being at very low surface water flood risk. Surface water risk in the medium risk event is primarily confined to the northern boundary of the site, adjacent to the Leeds and Liverpool Canal.
- The effects of climate change on surface water have not been modelled for this SFRA, however the low risk surface water event has been used as a proxy for the medium risk event plus climate change. In this event, there is an area of ponding within the northeast of the site.
- Topographic low spots should be considered and included in site design and ideally left in place to flood naturally when required.
- The areas at surface water flood risk are within the fluvial risk areas and should therefore be included within any mitigation solutions for fluvial risk.
- Safe access and escape routes would likely be challenging to achieve in the low risk and medium risk plus climate change events based on the modelled surface water flood depths and hazards along Dock Lane. However, this is based on the third generation mapping and therefore safe access and escape routes should be confirmed based on site-specific surface water modelling through the FRA.

- The drainage strategy must ensure there is no increase in surface water flood risk elsewhere as a result of new development. Existing brownfield rates will likely apply, though the developer should consult local LLFA guidance and the National SuDS guidance.
- 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.
- 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 Guide³. Figure 4-1 shows the map covering this site and the surrounding areas and Table 4-1 explains the risk classifications.

The entire site is located within an area where there is no risk of groundwater emergence. This is reflected in the geology of the area being a combination of mudstone, siltstone and sandstone (Figure 1-3), contributing to potentially reduced rates of infiltration and low water tables. Infiltration SuDS may therefore be an appropriate option at this site as there is a lower risk of groundwater emergence. However, the underlying bedrock geology being less permeable means that the type of infiltration SuDS needs to be considered further through the drainage strategy.

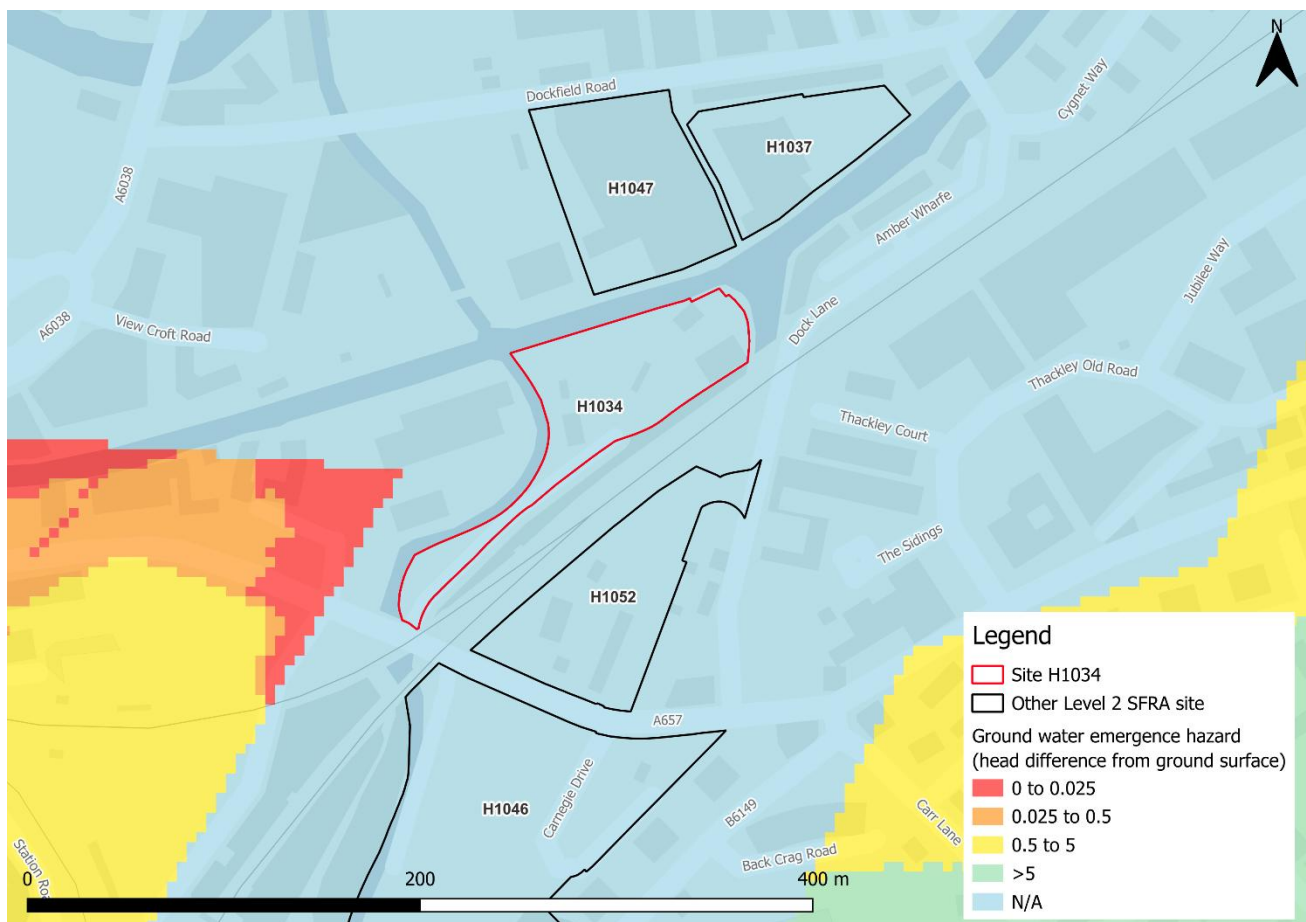


Figure 4-1: JBA 5m Groundwater Emergence Map

³ [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. defence breaches, or blockages of culverts or drainage assets. Residual risk at this site comes from the potential blockage or structural failure of the culvert beneath Leeds Road (A657) to the south of the site.

5.1 Potential blockage

A blockage or failure of the structure beneath Leeds Road (A657) may cause water in the channel to back up and cause flooding to the site, depending on the severity of the blockage and the magnitude of the flood event. Culvert course and condition surveys may be required, including for consultation with the culvert owner.

The Bradford Beck 2026 model includes for a scenario in which all culverts within the model are blocked by 50%. Figure 5-1 shows the modelled flood depths for this scenario. There is a very minor increase in the extent of flooding caused by a 50% blockage to the culvert beneath Leeds Road. There are some areas of greater flood depths.

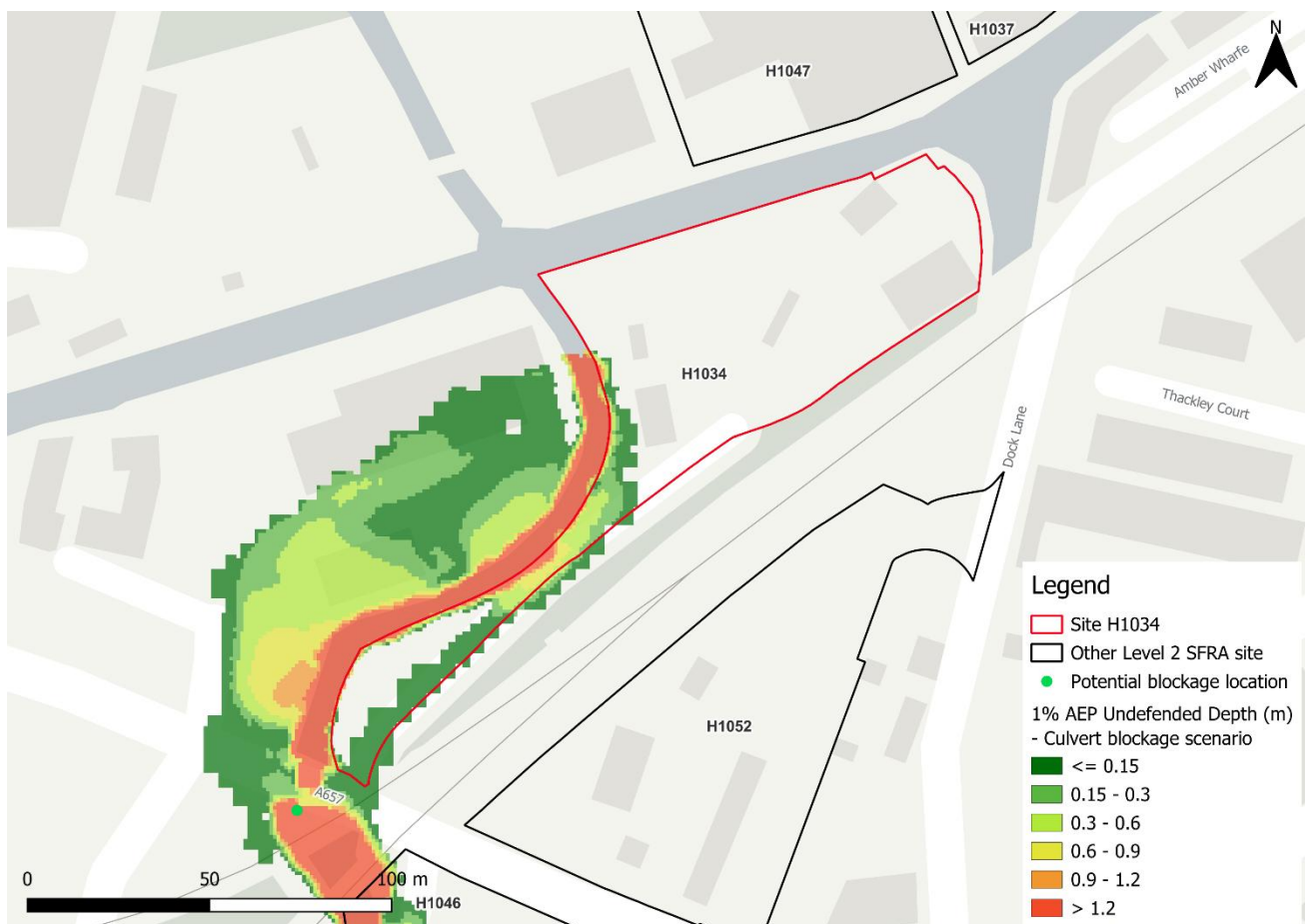


Figure 5-1: Flood depths for 1% AEP undefended flood event 50% culvert blockage scenario - structure beneath Leeds Road (A657)

5.2 Flood risk from canals

The Leeds and Liverpool Canal runs along the northern boundary of the site. There is no known existing flood model of the canal therefore any residual risk from the canal is unknown at this stage. However, the canal is not significantly raised compared to the site therefore the site is less 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. 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 17 reservoirs. Of these 17 reservoirs, 14 are located within Bradford, two located within North Yorkshire and one located within Lancashire. These are operated by either Yorkshire Water Services Ltd, the National Trust or the City of Bradford Metropolitan District Council.

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 relevant reservoir undertaker 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.

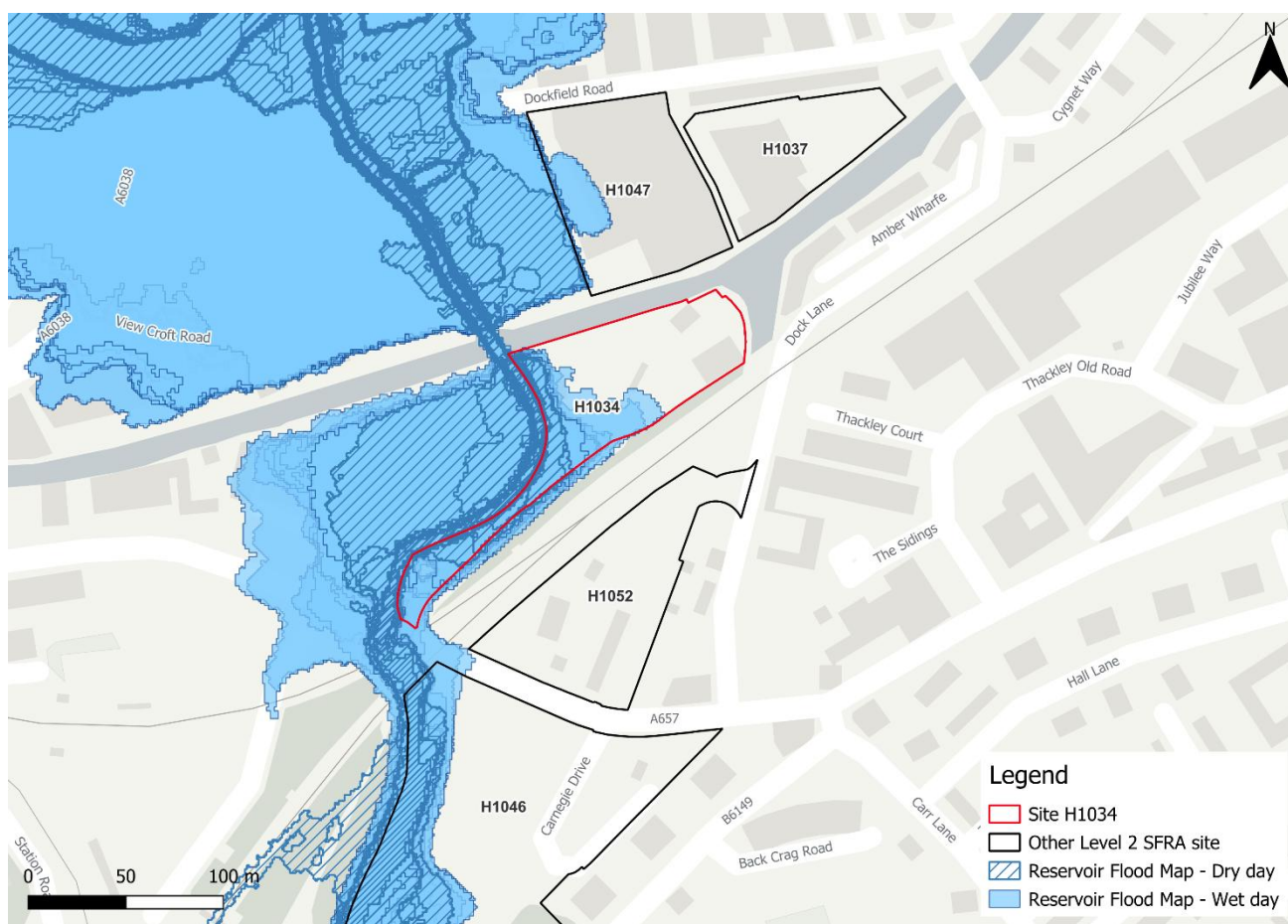


Figure 5-2: Flood risk from reservoirs

5.4 Observations, mitigation options and site suitability - residual risk

- The site is at potential residual risk from a blockage of the culvert beneath Leeds Road to the south of the site. The modelled 50% culvert blockage scenario indicates that there is unlikely to be significant additional impacts to the site. The site-specific FRA could consider modelling a higher blockage proportion to understand whether there would be any additional risk to the site.
- 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 escape routes must be in place for the lifetime of development. Resistance and resilience measures may also need to 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).
- The site is also at potential residual risk from a breach of 17 reservoirs. However, only two reservoirs impact the site in the 'dry day' flood extent, namely Chellow

Heights East and Chellow Heights West reservoirs, both located within Bradford. This indicates that the remaining 15 reservoirs are all modelled to impact the site based on the 'wet day' flood extent, which represents a prediction of the credible worst case scenario, therefore it is unlikely that such an extreme flood event would occur.

- Given the potential reservoir risk to the site, developers should consider⁴:
 - 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
 - Using this Level 2 SFRA to understand whether any proposed development will be safe throughout its lifetime.

⁴ [Reservoir flood maps: when and how to use them | Environment Agency | 2021](#)

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 test⁵, given it is proposed for more vulnerable uses and is located within Flood Zone 3a. It must be proven that the development can be safe for its lifetime, which is generally considered to be 100 years for residential development. Based on the available information documented within this Level 2 SFRA, this site cannot pass the exception test given both the 1% AEP event modelled present day and future fluvial risk, unless all development can be directed to Flood Zone 1 and 2.

6.2 Recommendations summary

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

- There should be no development within the existing area of functional floodplain present on site.
- It is recommended that the area of the site within both the functional floodplain and the modelled 1% AEP undefended event plus climate change is converted to open space offering multifunctional benefits alongside flood risk mitigation including Biodiversity Net Gain (BNG) contributions, and social and amenity benefits.
- Development should be directed to the east of the site, to the areas of the site within Flood Zone 1.
- Safe access and escape routes must be considered further at the site-specific FRA stage through a drainage strategy which should assess flood depths and hazards, both in the present day and climate change scenarios.
- Were any plans for development to proceed, the site-specific FRA must show that development will be safe for its lifetime taking account of the vulnerability of its users, including for appropriate evacuation procedures and flood response infrastructure.

6.3 Site-specific FRA requirements and further work

At the planning application stage, the following should be considered:

- Further modelling to understand the impacts of climate change on surface water flood risk to the site.
- Further consideration of safe access and escape routes given the modelled fluvial and surface water risk to current routes.
- A condition assessment of the culvert beneath Leeds Road (A657) to the south of the site.

⁵ Para 178 National Planning Policy Framework 2024

- Consultation with the relevant reservoir owners to understand the impact of development on reservoir risk designation.
- FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA 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 H1044

Final Draft

May 2025

Prepared for:



City of
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METROPOLITAN DISTRICT COUNCIL

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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. Kaylyn Carroll 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 H1044. 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 H1044

- Location: West Victoria Street
- Existing site use: Commercial, Leeds and Liverpool Canal within the site boundary
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Residential
- Proposed site use vulnerability: More vulnerable
- Site area: 0.36 hectares
- Proposed development impermeable area: 0.36 hectares
- Environment Agency (EA) river model: N/A
- Watercourse: Leeds and Liverpool Canal
- 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

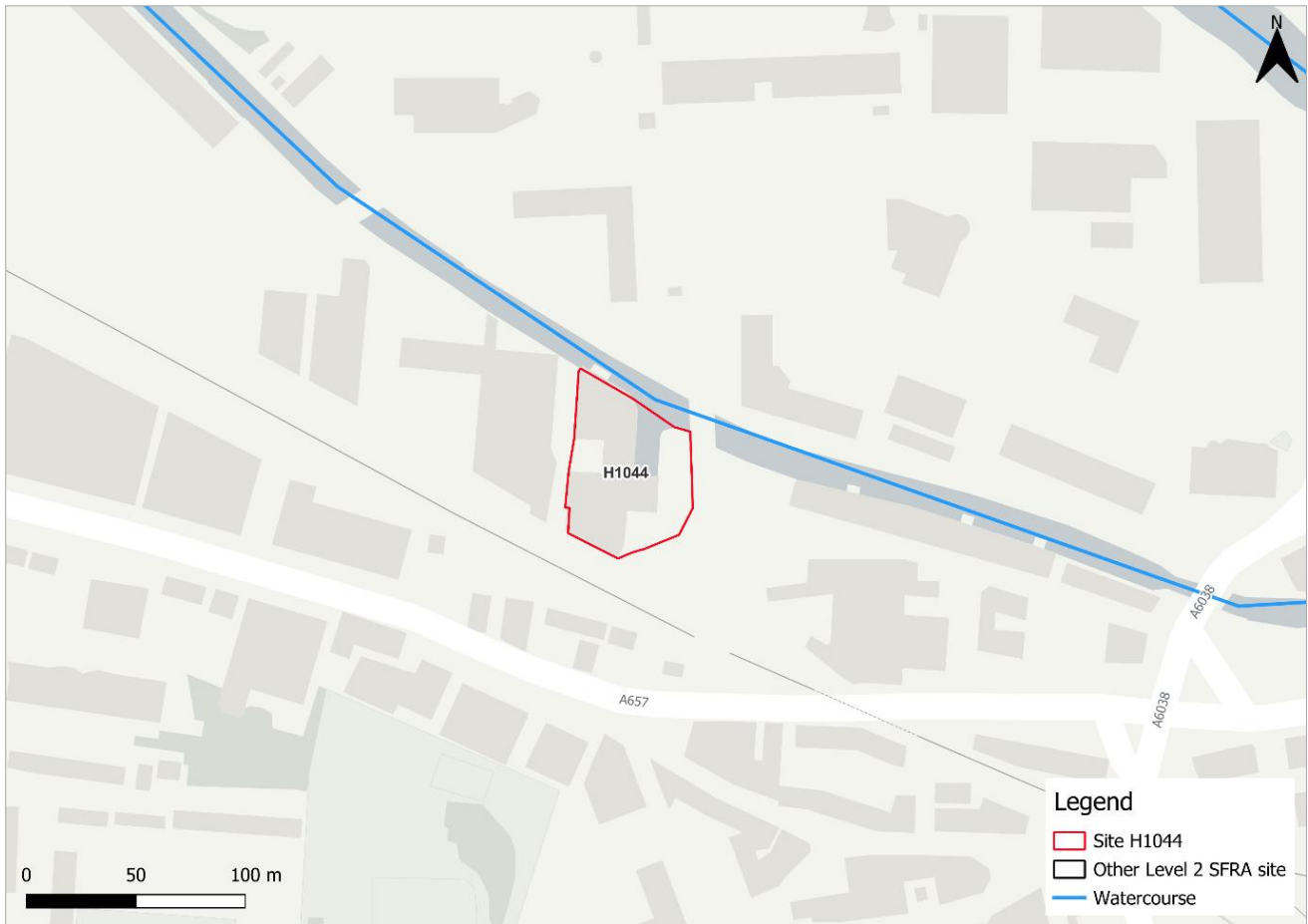


Figure 1-1: Existing site location boundary



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 whole site is modelled to be within Flood Zone 1 indicating it is at low risk of flooding from rivers. However, part of the Leeds and Liverpool Canal is within the site boundary. The existing area of the Leeds and Liverpool Canal on site should be left free of development.

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

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

2.2.1 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, there is potential for floodplain reconnection to establish a connection between the River Aire watercourse and floodplain during high flows. 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.

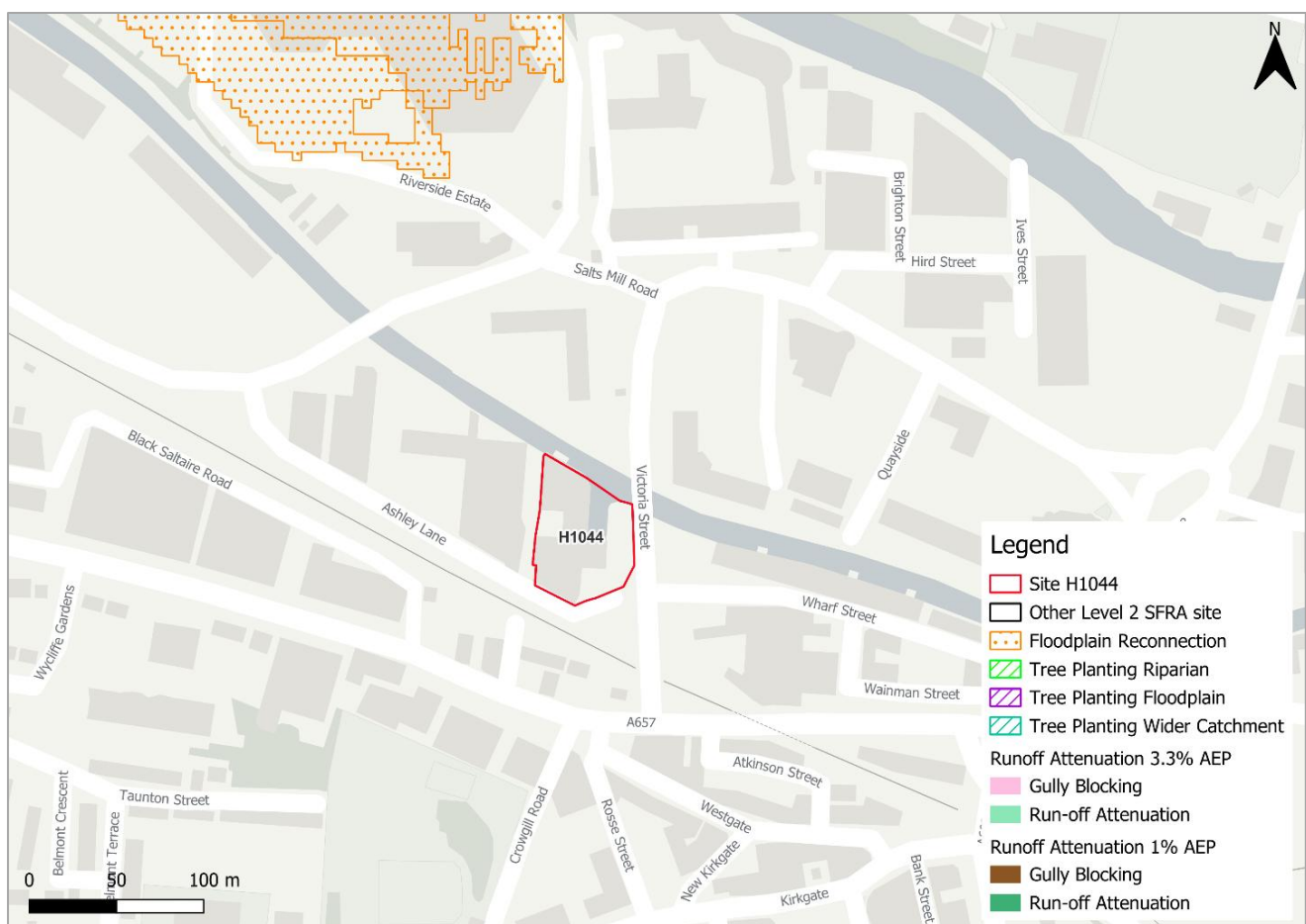


Figure 2-2: Natural Flood Management (NFM) potential mapping

2.3 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 incidents 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 also not located within a FAA.

Based on available information, safe access and escape routes could likely be achieved during a flood event via Ashley Lane during all events.

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 located wholly within Flood Zone 1.
- The existing area of the Leeds and Liverpool Canal on site should be left free of development. The current building will likely be demolished for new residential development. The new development must not be built over the top of the canalised area. This area should be left open and ideally, built development should not take place within 8m of the canal bank.
- Given the proximity of the canal to the site, suitable emergency plans should be in place, in the unlikely event of canal failure.

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 predominantly very low. Approximately 11% of the site is at medium surface water risk. A further 8% at low risk as shown in Table 3-1.

In the medium risk event, surface water risk is confined to the open section of the Leeds and Liverpool Canal within the north of the site. There is also an area of ponding within the west of the site. In the low risk event, there is additional flow path extending through the centre of the site. Surface water flood risk is clearly constrained by the existing development within the site.

Greatest flood depths within the site in the medium risk event are between 0.6 and 0.9m (Figure 3-1) Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map) with some areas of significant hazard (Figure 3-2) Figure 3-2: Medium risk event surface water flood hazard (Risk of Flooding from Surface Water map), excluding the canalised area. Safe access and escape routes should be possible via Ashley Lane in the high and medium risk events. Routes via Victoria Street should be considered in the low risk 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)
81	8	11	0



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

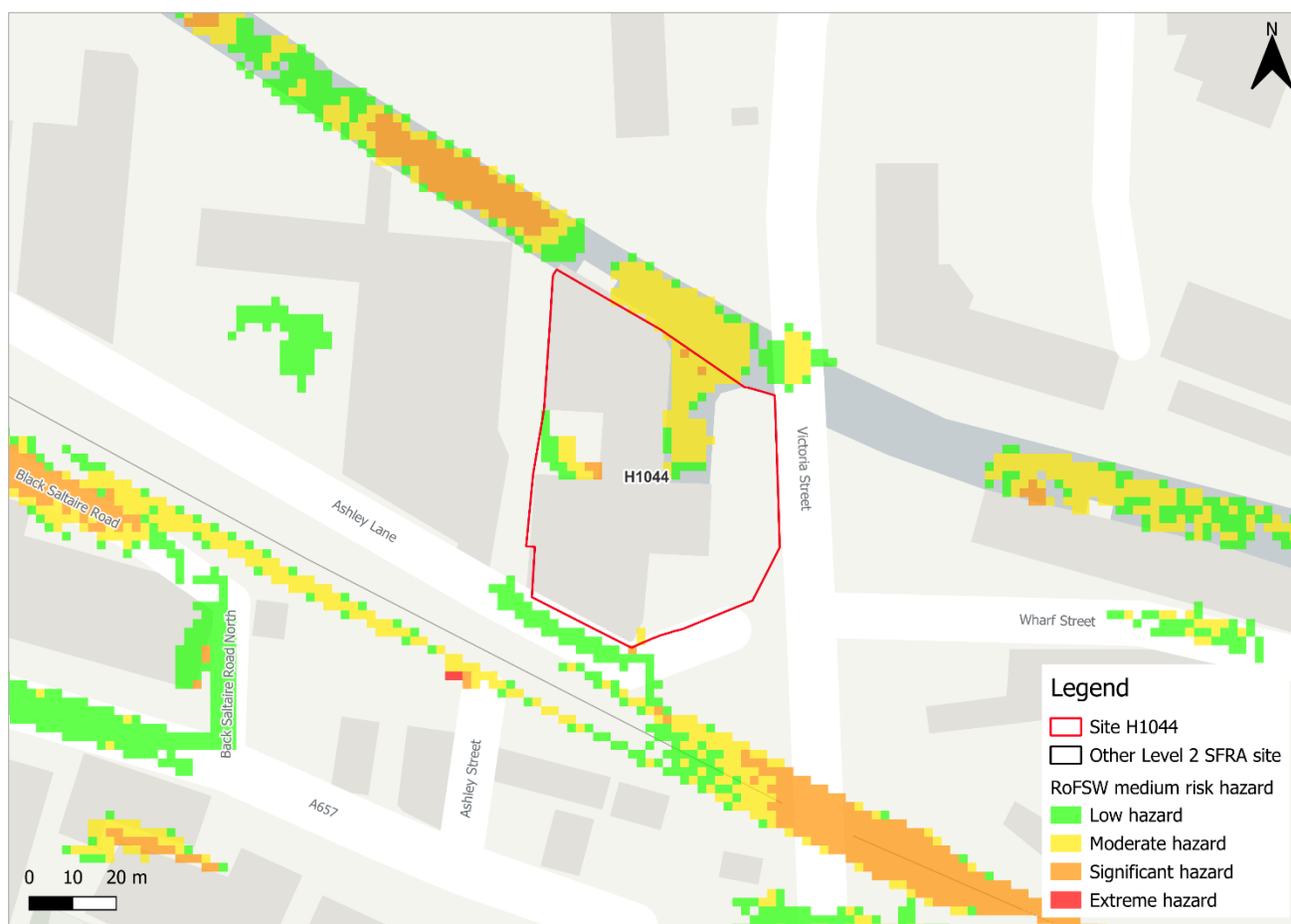


Figure 3-2: Medium risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

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 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 similar, yet greater level of risk to the low risk present day event. Maximum depths are > 1.2m (Figure 3-3Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)) with some areas of extreme hazard (Figure 3-4Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)). Safe access and escape routes may be challenging to achieve via Ashley Lane in this event, however routes via Victoria Street could be considered.

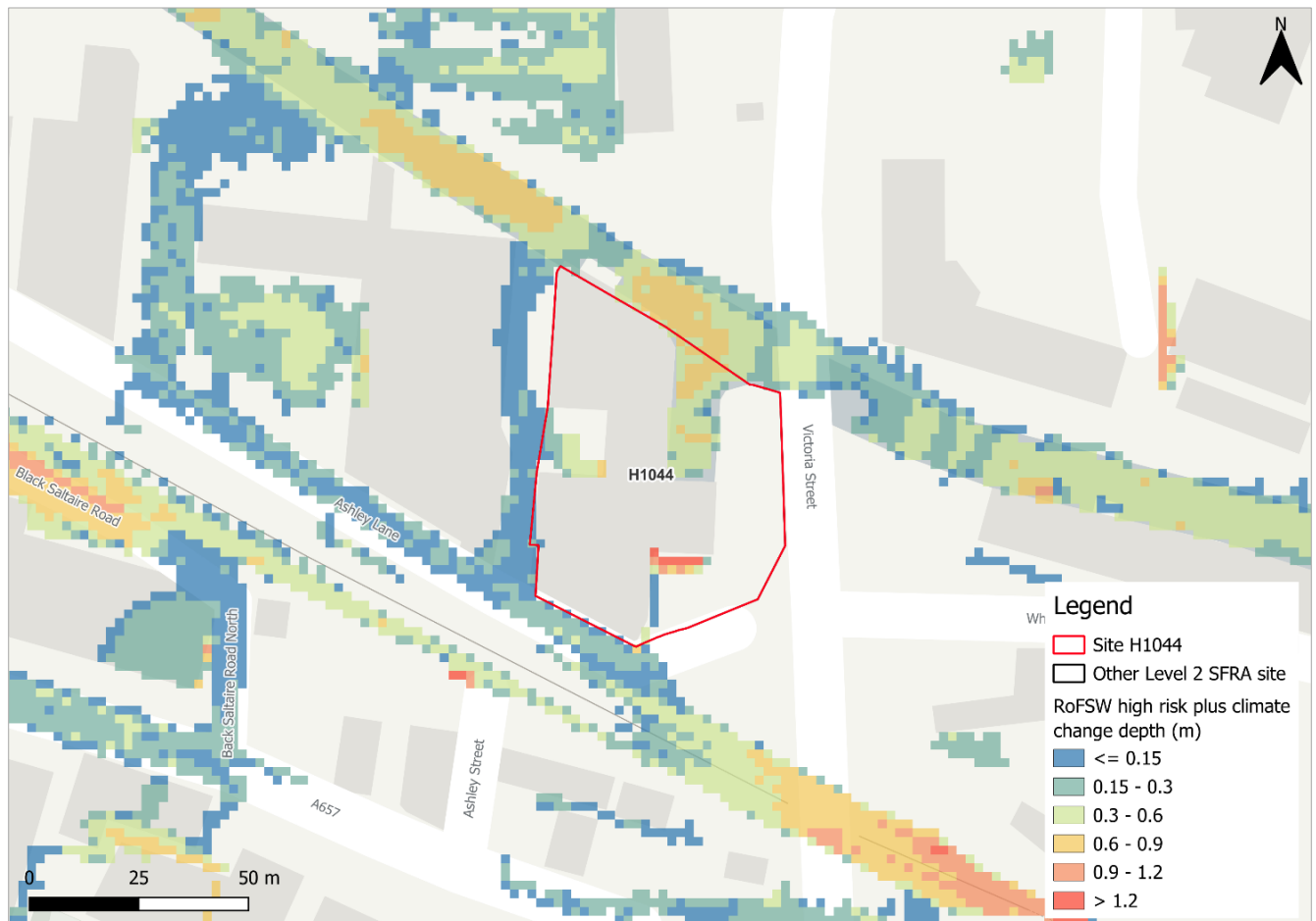


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)

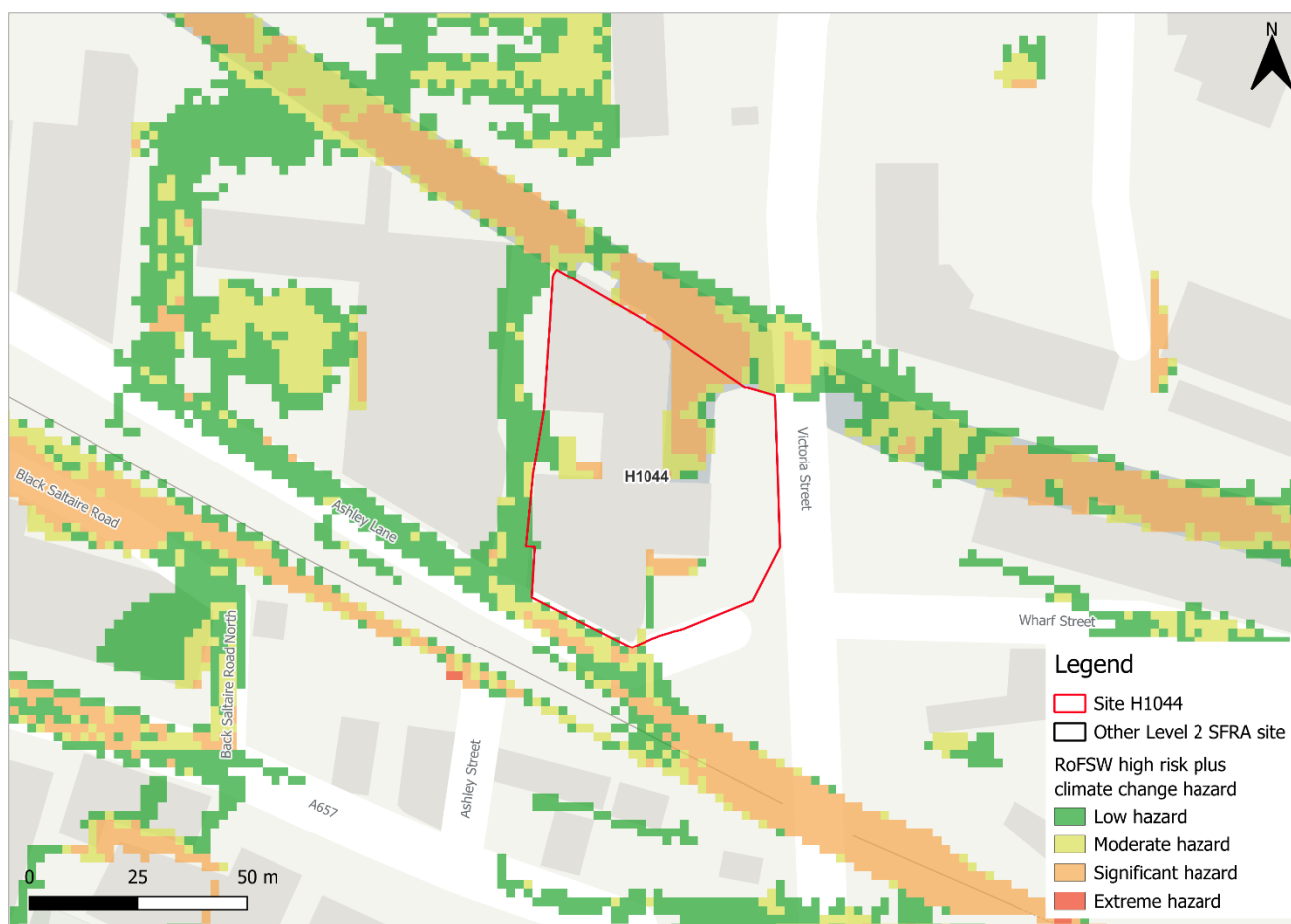


Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk is predominantly very low, however surface water risk is constrained by the area of existing development within the site and the canalised area. Any change in site layout where current buildings are to be demolished will require detailed surface water modelling.
- Safe access and escape routes should be achievable via Ashley Lane in the present day high and medium risk events. Victoria Street should be considered as a safe access and escape route in the present day low risk and medium risk plus climate change events.
- Any regrading of land must include like for like volumes to ensure risk is contained safely onsite for the lifetime of development.
- 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.
- 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.

- 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.

Across the south of the site, there is a risk of groundwater emergence to subsurface assets, but surface manifestation of groundwater is unlikely. There is a small area where there is the possibility of groundwater emerging at the surface locally. The majority of the site, however, is in an area where there is no risk of groundwater emergence. Groundwater conditions may therefore be suited to infiltration SuDS within these areas.

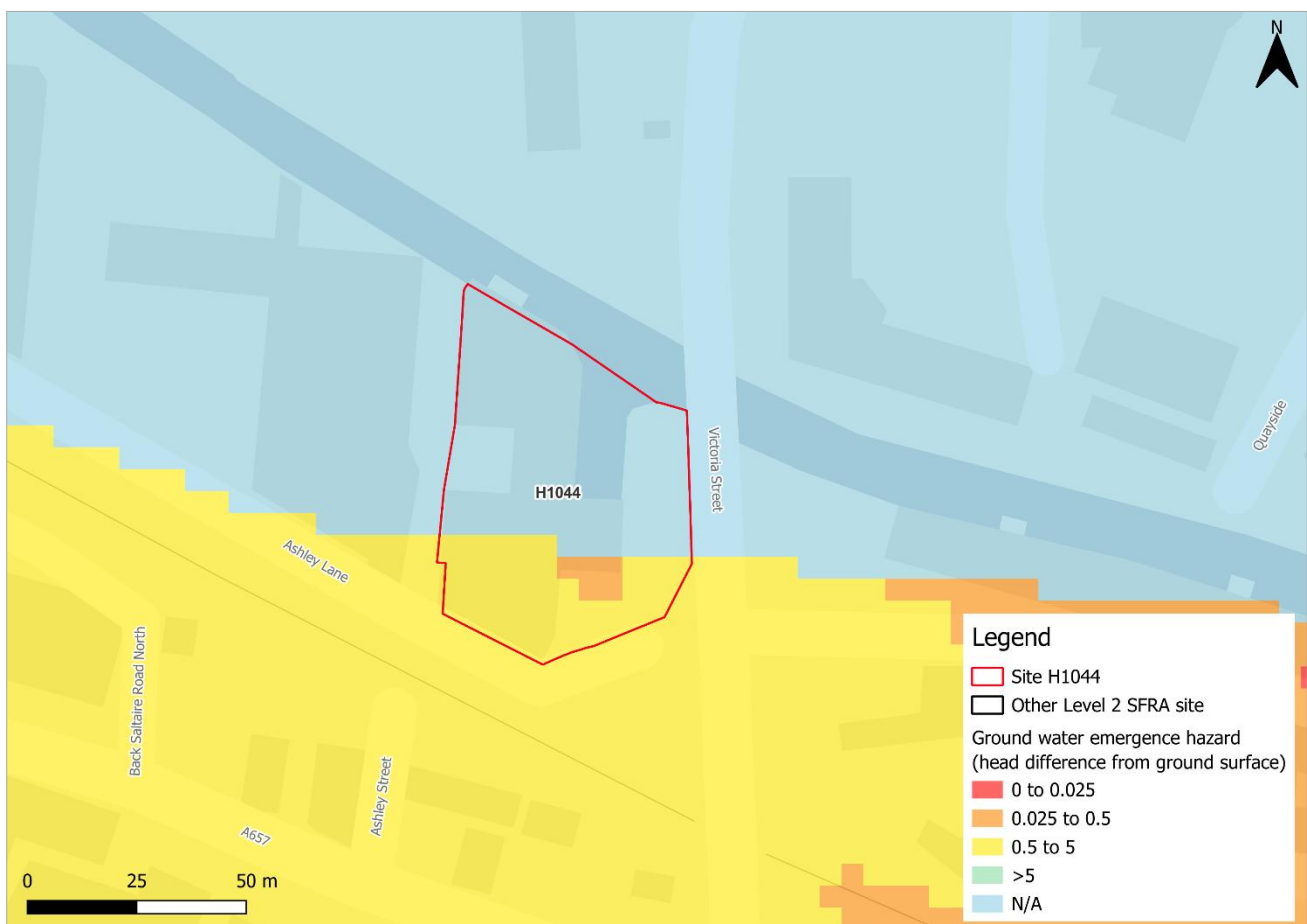


Figure 4-1: JBA 5m Groundwater Emergence Map

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 Leeds and Liverpool Canal runs along the northern boundary of the site and encroaches into the site. There is no known existing flood model of the canal therefore any residual risk from the canal is unknown at this stage. The canal is situated at a lower elevation than the existing ground levels within the site, therefore the site is not likely to be at risk from a canal breach. The site is owned by the proprietors of the Douglas Navigation.

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, 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

- There is no anticipated residual risk to this 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 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:

- It should be appropriate to develop this site for more vulnerable purposes given its location in Flood Zone 1. Development should avoid the existing area of the Leeds and Liverpool Canal on site.
- Built development should not be situated within 8m of the canal to allow for maintenance access and consultation with the proprietors of the Douglas Navigation should be carried out by the developer.
- Surface water should be retained onsite which may reduce units. This will require detailed surface water modelling based on layout plans and detailed design and full consultation with the LLFA on required runoff rates, likely to be greenfield or betterment. The use of infiltration SuDS should be investigated across the majority of the site.
- 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 H1046

Final Draft

July 2026

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

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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. Georgina Williams of JBA Consulting carried out this work.

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We would like to thank the Environment Agency for their assistance with 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 H1046. 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' (2026) and is therefore familiar with the terminology used in this report.

1.1 Site H1046

- Location: Crag Road
- Existing site use: Industrial
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 4.95 hectares
- Proposed development impermeable area: 3.71 hectares
- Watercourse: Bradford Beck
- CBMDC river model: Bradford Beck 2026
- 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
 - Modelling of residual risk from Bradford Beck culvert

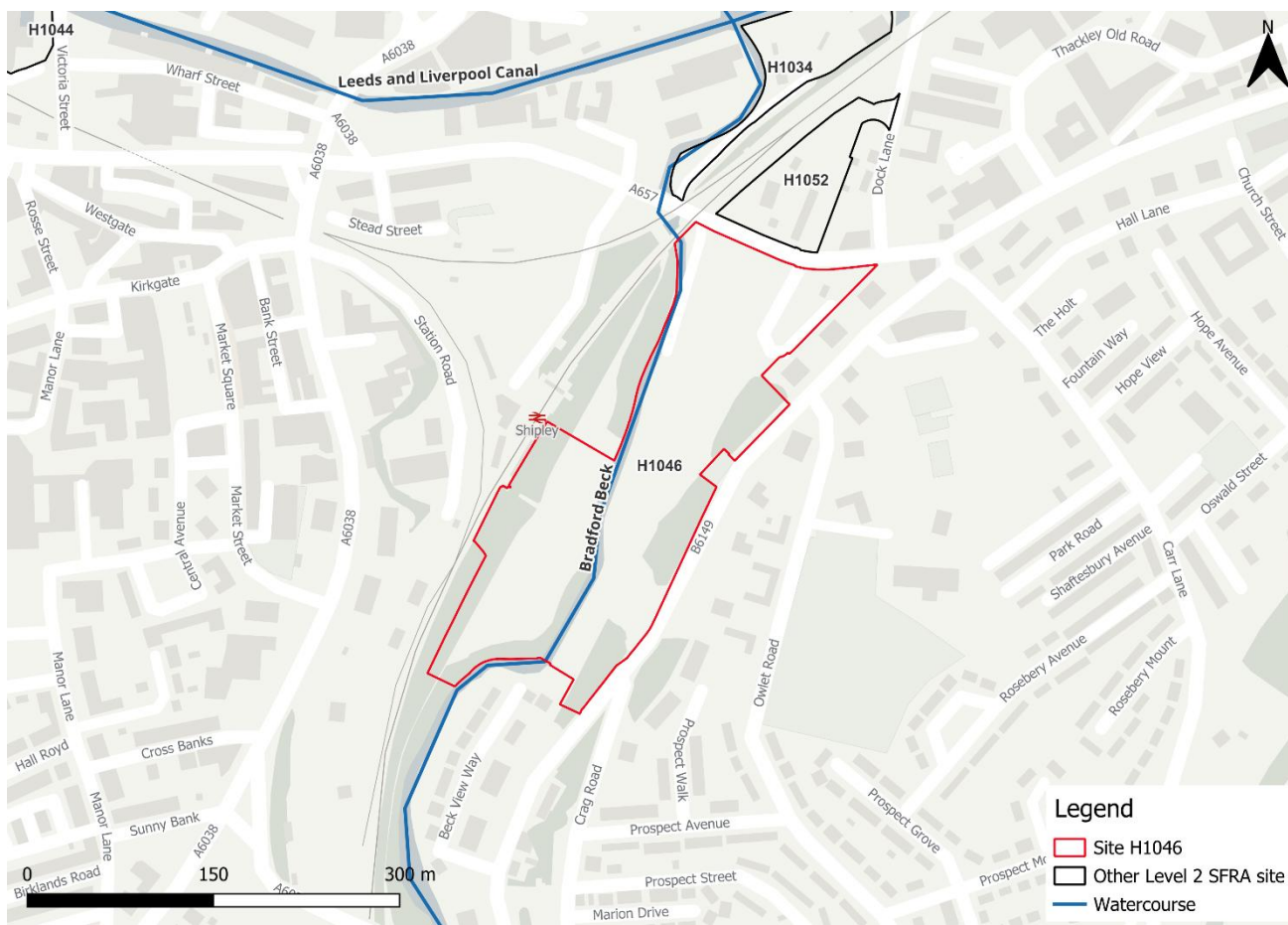


Figure 1-1: Existing site location boundary

The topography of the site is varied, with higher elevation along the eastern and western site boundaries, sloping down towards Bradford Beck which flows through the centre of the site (Figure 1-2).

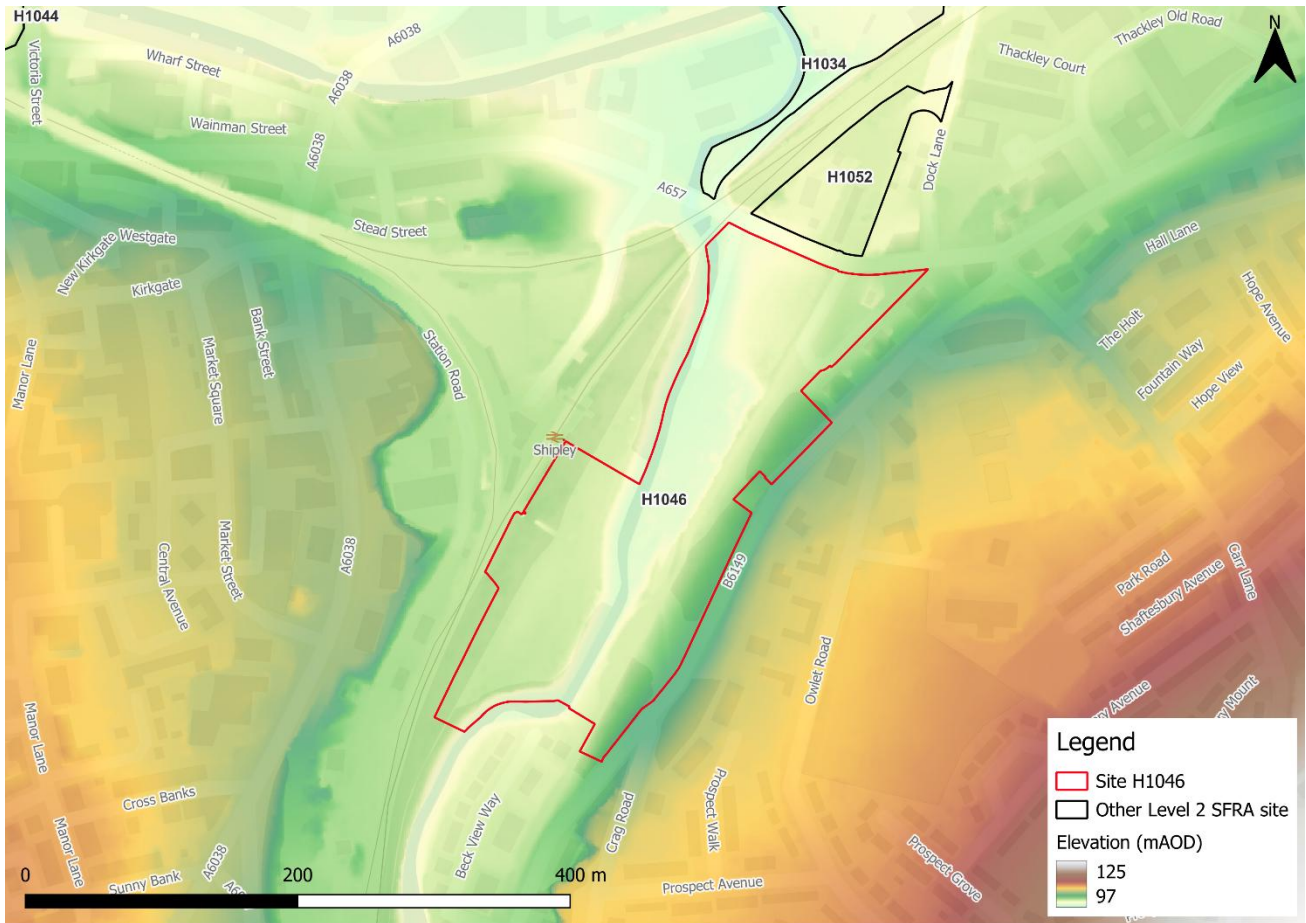


Figure 1-2: Topography

The underlying bedrock within the site is defined as 'Millstone Grit Group', which comprises mudstone, siltstone and sandstone (Figure 1-3). This is overlain with superficial deposits of till. Mudstone and siltstone typically have low permeability, whereas sandstone has a higher permeability.

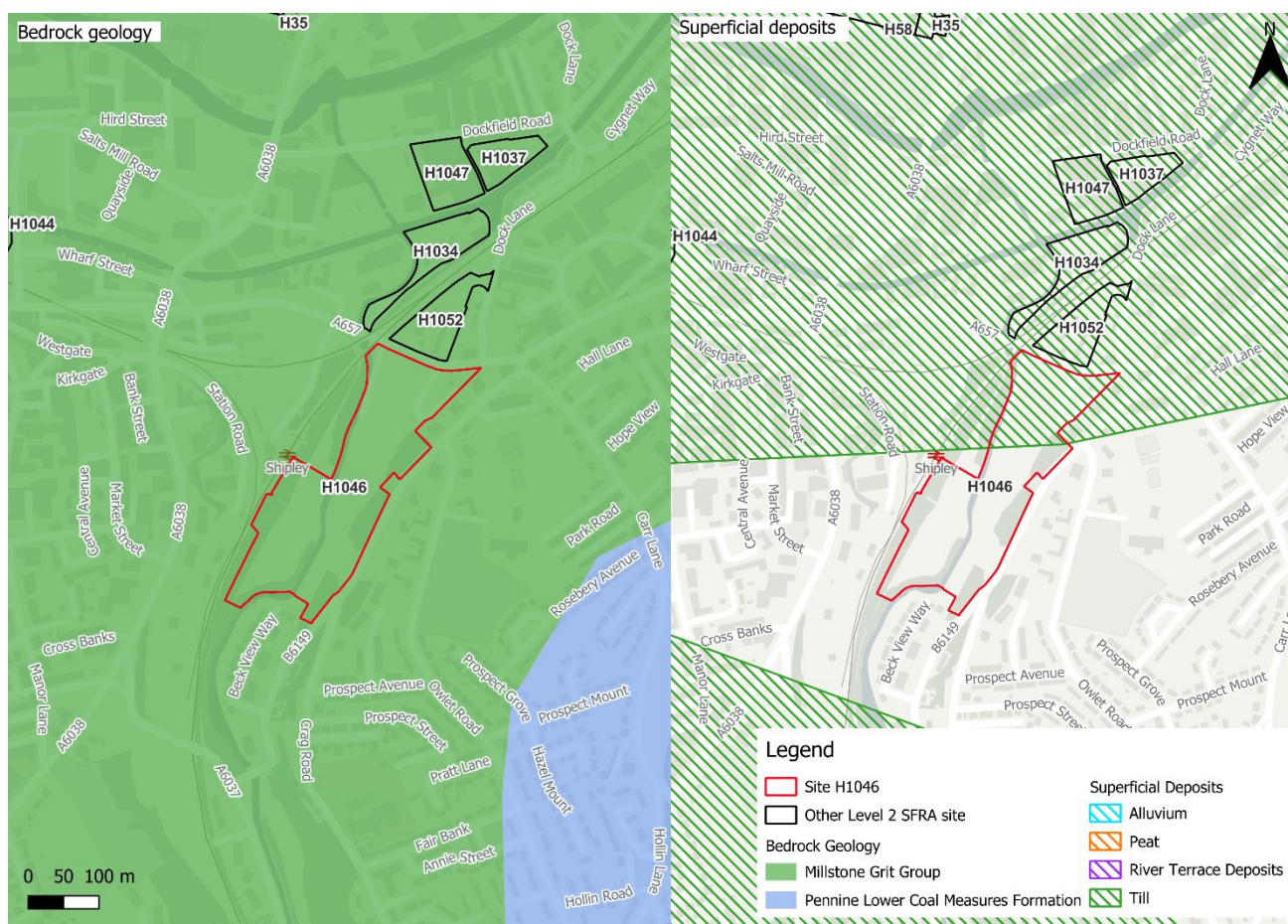


Figure 1-3: Soils and geology

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 (January 2026) 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).

Fluvial flood risk to the site comes from Bradford Beck which runs through the site from south to north. Functional floodplain is present through the site and along the north-western and southern site boundaries, within and adjacent to the channel of Bradford Beck. There should be no development within the functional floodplain. The area of the site within Flood Zones 3a and 2 is largely similar to the area within the functional floodplain. The remainder of the site is within Flood Zone 1 and is therefore at low risk of fluvial flooding.

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)
75	2	1	22

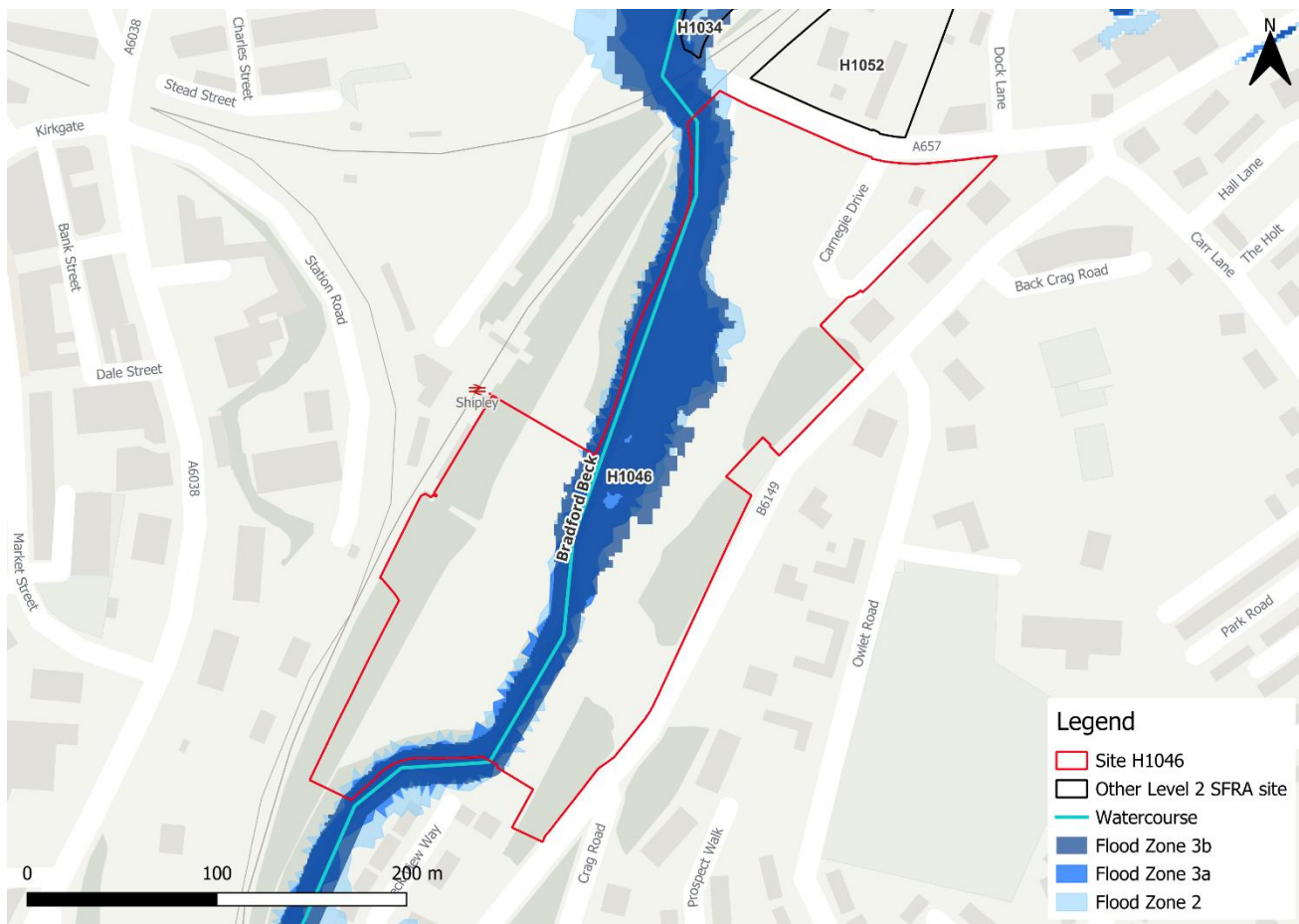


Figure 2-1: Existing risk from rivers to the site

2.1.2 Bradford Beck 2026 model outputs - present day

Figure 2-2 shows the modelled flood depths for the 1% AEP undefended event. Modelled risk to the site is similar to that shown by Flood Zone 3a, impacting the areas adjacent to the channel of Bradford Beck which flows through the centre of the site and along the north-western and southern site boundaries. However, it is noted that the current Flood Zone 3a does not yet account for the latest Bradford Beck model outputs. Onsite modelled flood depths (Figure 2-2), velocities (Figure 2-3) and hazards (Figure 2-4) are significant, however fluvial risk is largely confined to the areas adjacent to the channel of Bradford Beck.



Figure 2-2: Flood depths for 1% AEP undefended flood event

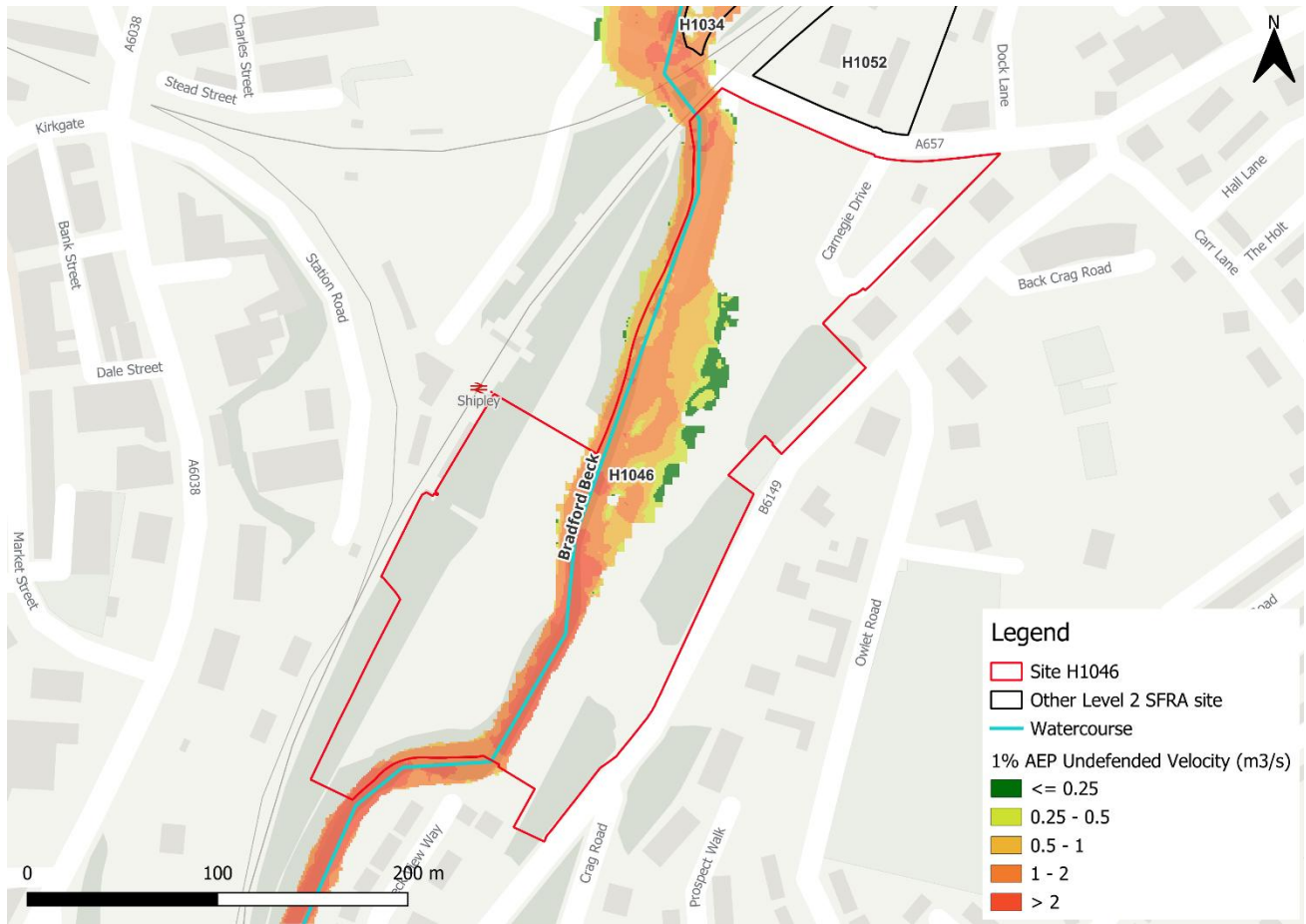


Figure 2-3: Flood velocities for 1% AEP undefended flood event

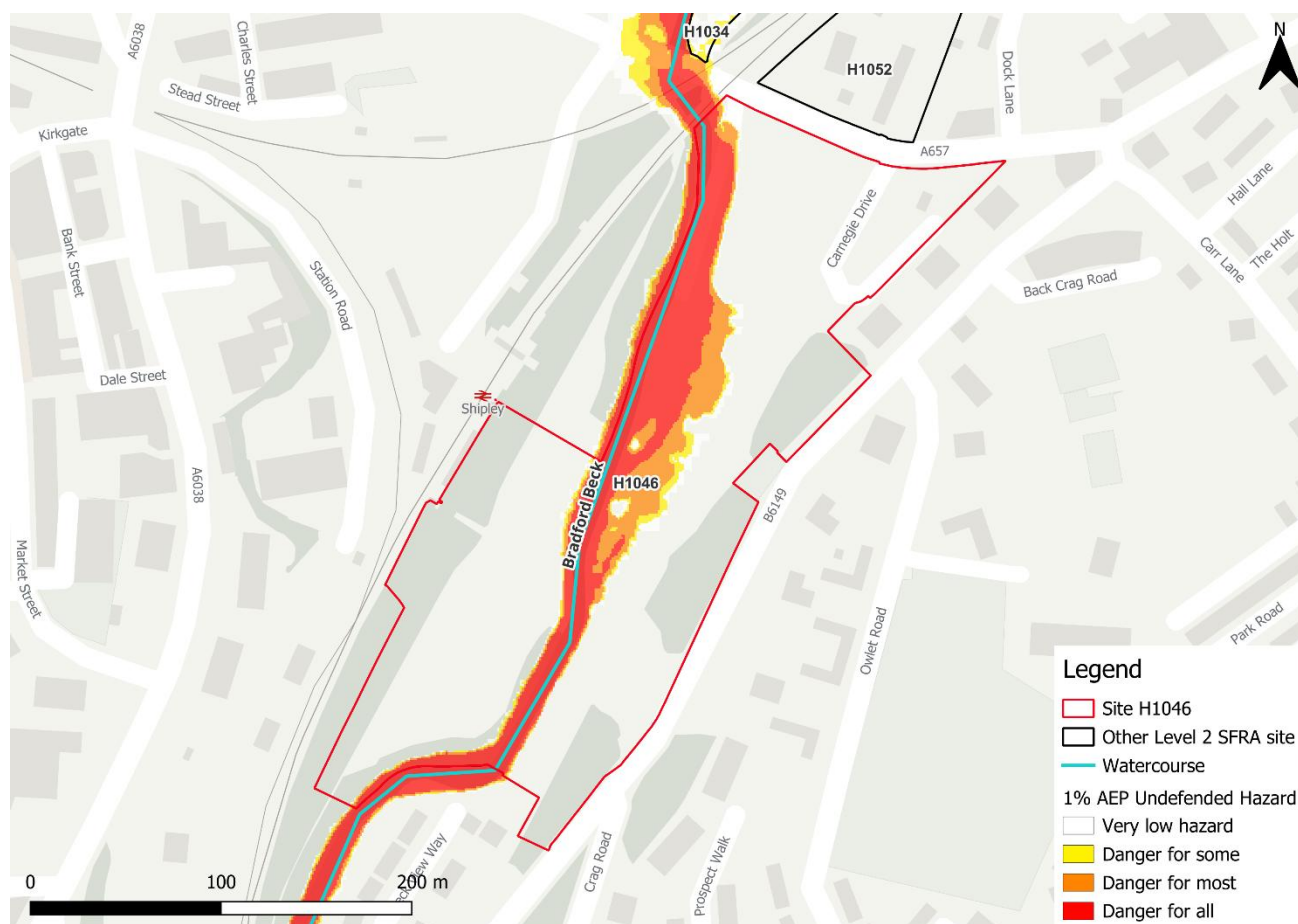


Figure 2-4: Flood hazard¹ for 1% AEP undefended flood event

2.2 Impacts from climate change

The EA's SFRA guidance states that SFRA should assess the central allowance for less vulnerable, more vulnerable, highly vulnerable and water compatible development (Table 2-2). The impacts of climate change on flood risk from the Bradford Beck 2026 model have been modelled without flood defence infrastructure in place. As documented in Section 2.3.1, there are no formal engineered defences that would benefit the site.

¹ Fluvial hazard ratings based on Table 4 of the SUPPLEMENTARY NOTE ON FLOOD HAZARD RATINGS AND THRESHOLDS FOR DEVELOPMENT PLANNING AND CONTROL PURPOSE – Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1. May 2008.

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%

2.2.1 Bradford Beck 2026 model outputs - climate change

Figure 2-5 shows the onsite modelled flood depths for the 1% AEP undefended event plus central climate change allowance. Risk is modelled to be similar in extent, depth, velocity and hazard in comparison to present day conditions. Maximum depths within the area at risk are significant, at greater than 1.2m.

Maximum velocities within the site are greater than 2 m³/s (Figure 2-6). The modelled flood hazard within the area at risk is largely categorised as 'danger for all' (Figure 2-7). As in the present day scenario, onsite modelled flood depths, velocities and hazards are significant, however fluvial risk is largely confined to the areas adjacent to the channel of Bradford Beck.

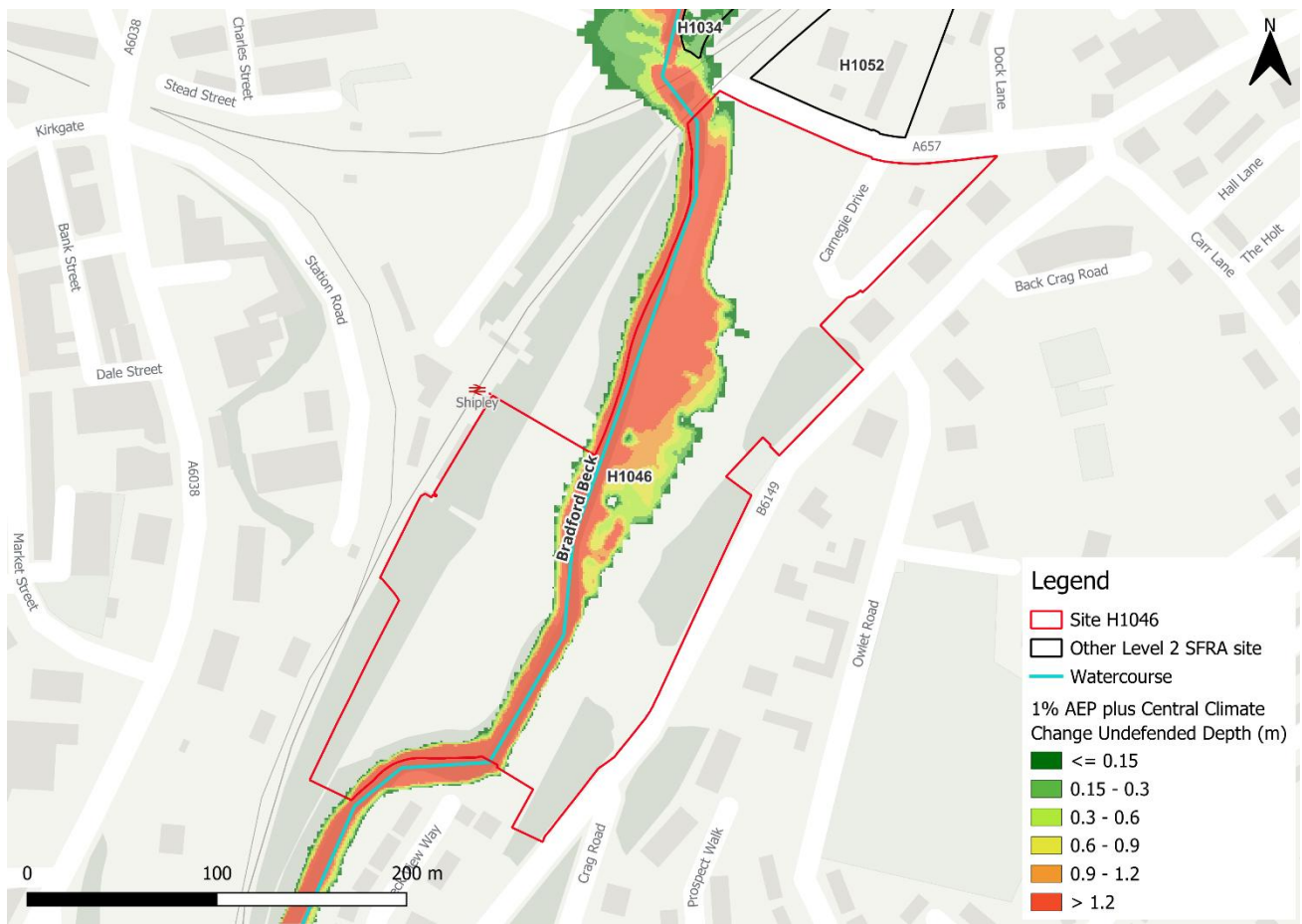


Figure 2-5: Flood depths for 1% AEP undefended flood event +23% (central climate change allowance)

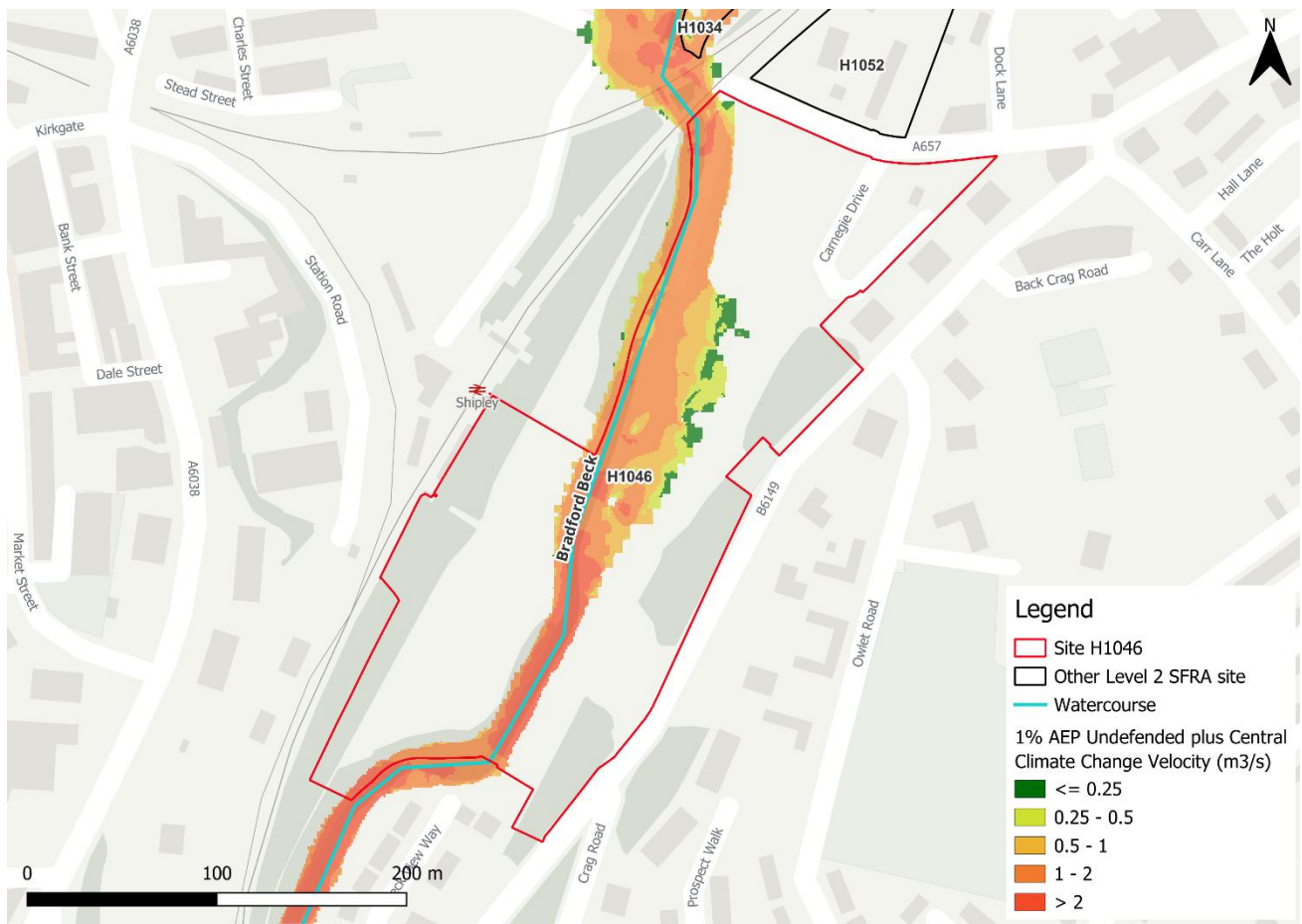


Figure 2-6: Flood velocities for 1% AEP undefended flood event +23% (central climate change allowance)

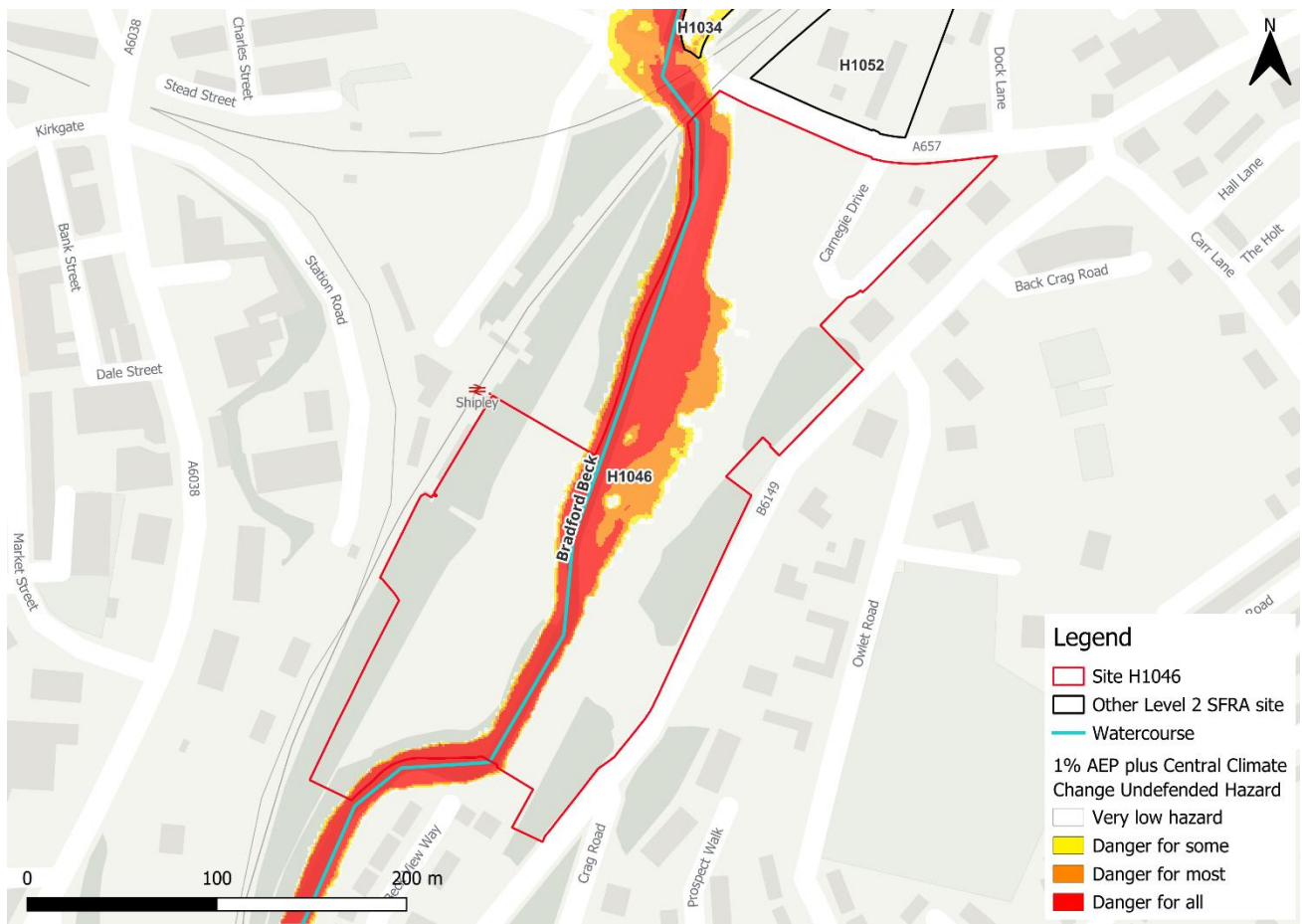


Figure 2-7: Flood hazard for 1% AEP undefended flood event +23% (central climate change allowance)

2.2.2 Flood Map for Planning - Climate Change

Climate change data in this area is unavailable from the EA's Flood Map for Planning plus Climate Change (2070-2125) dataset, as shown in Figure 2-8.

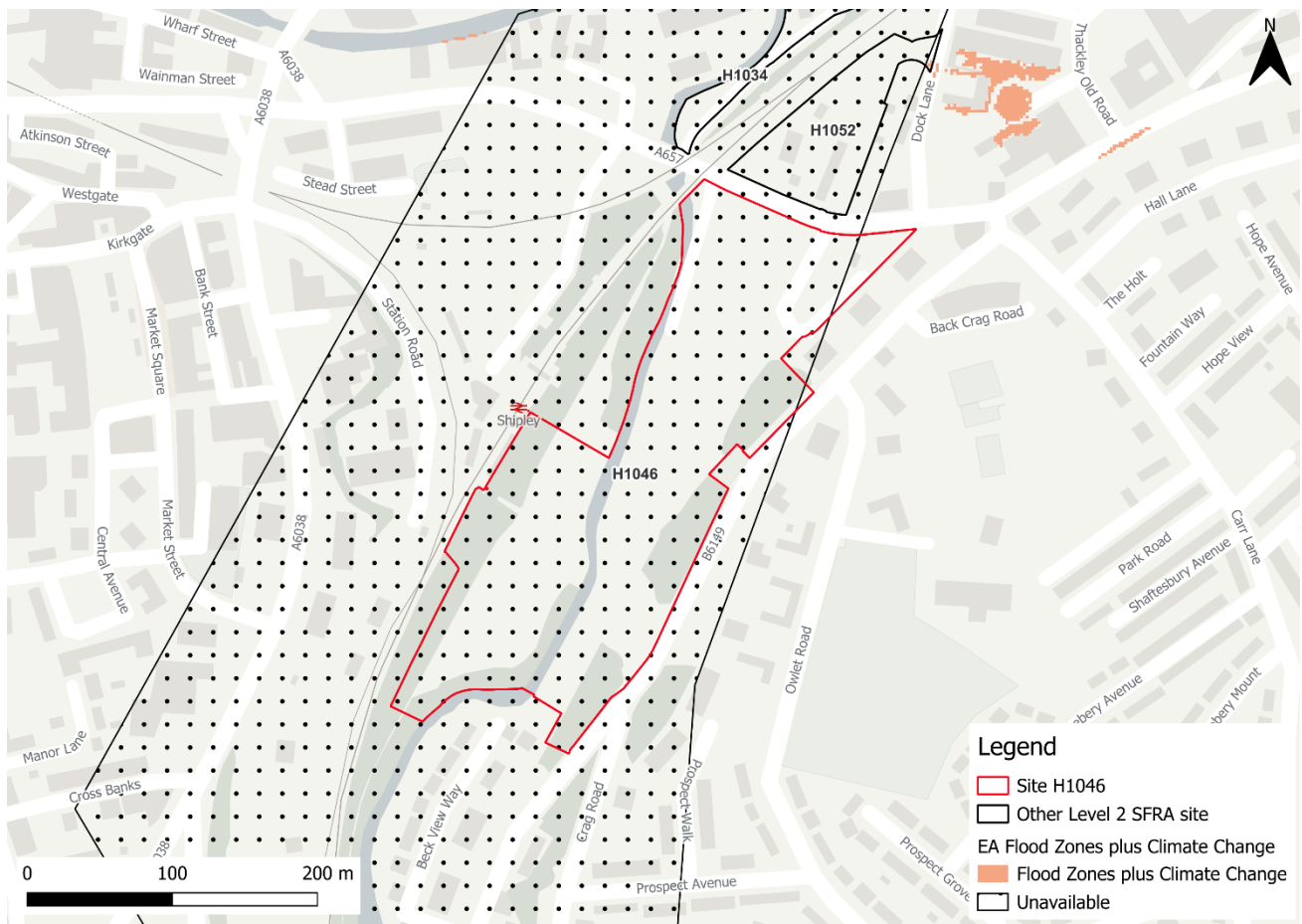


Figure 2-8: EA Flood Zones plus Climate Change

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 two small areas in the north of the site, that indicate opportunities for floodplain reconnection, which can decrease the magnitude of the flood peak and reduce downstream flood depths especially for high frequency, low return period floods. These areas are shown in Figure 2-9. The WwNP mapping is broadscale and indicative. Further investigation is required for any land shown to have potential for WwNP.

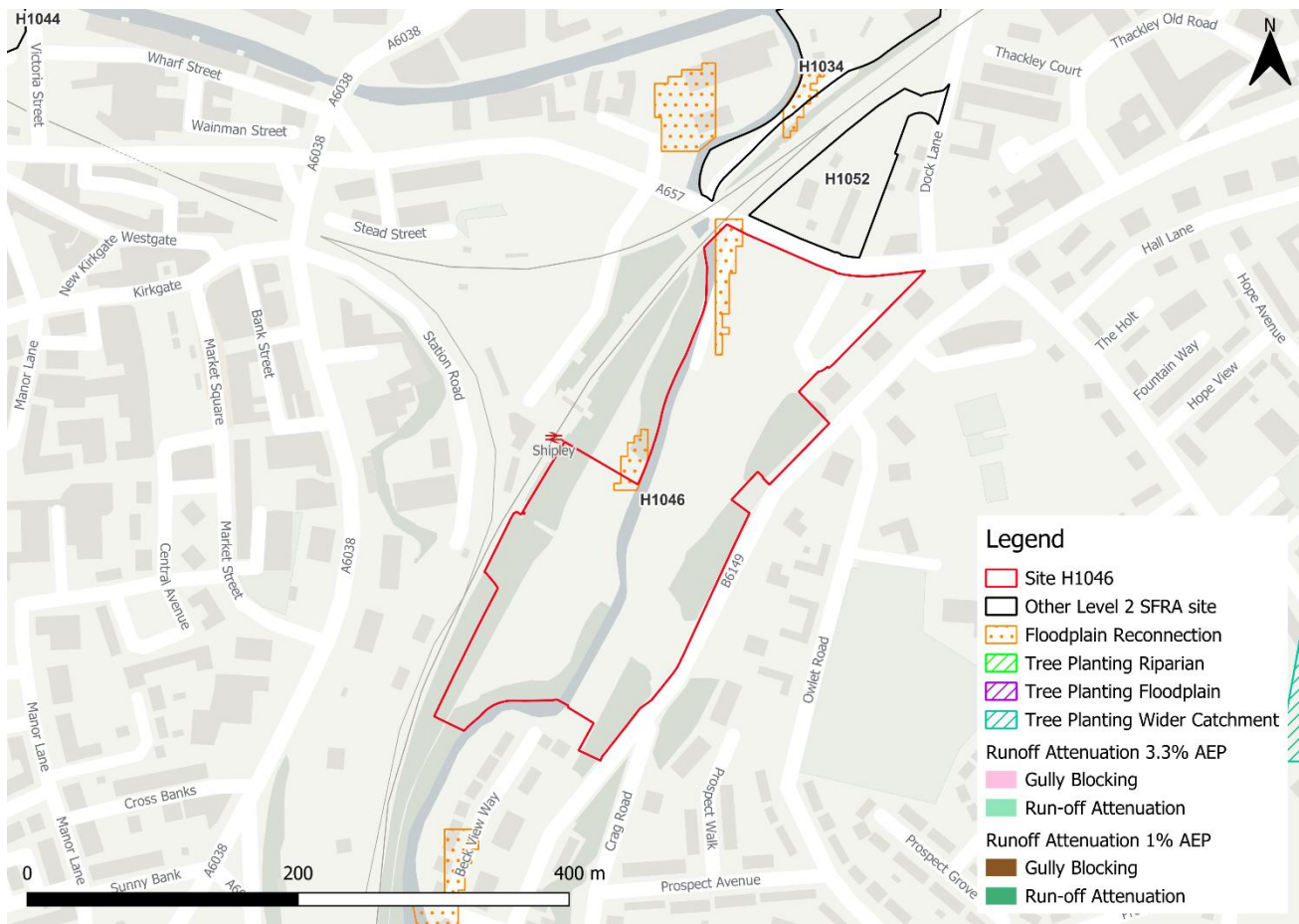


Figure 2-9: Natural Flood Management (NFM) potential mapping

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 events at the site.

2.5 LLFA flood incidents

The LLFA have records of one flood incident occurring within the site, which occurred in 2012 due to Bradford Beck bursting its banks, causing significant damage. Developers should contact the LLFA for further information at the FRA stage, to assess potential flood risk to the site associated with this incident.

2.6 Emergency planning

2.6.1 Flood warnings

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. The area along Bradford Beck situated in throughout the centre of the site is located within a FAA, namely 123WAF961 - Middle River Aire catchment.

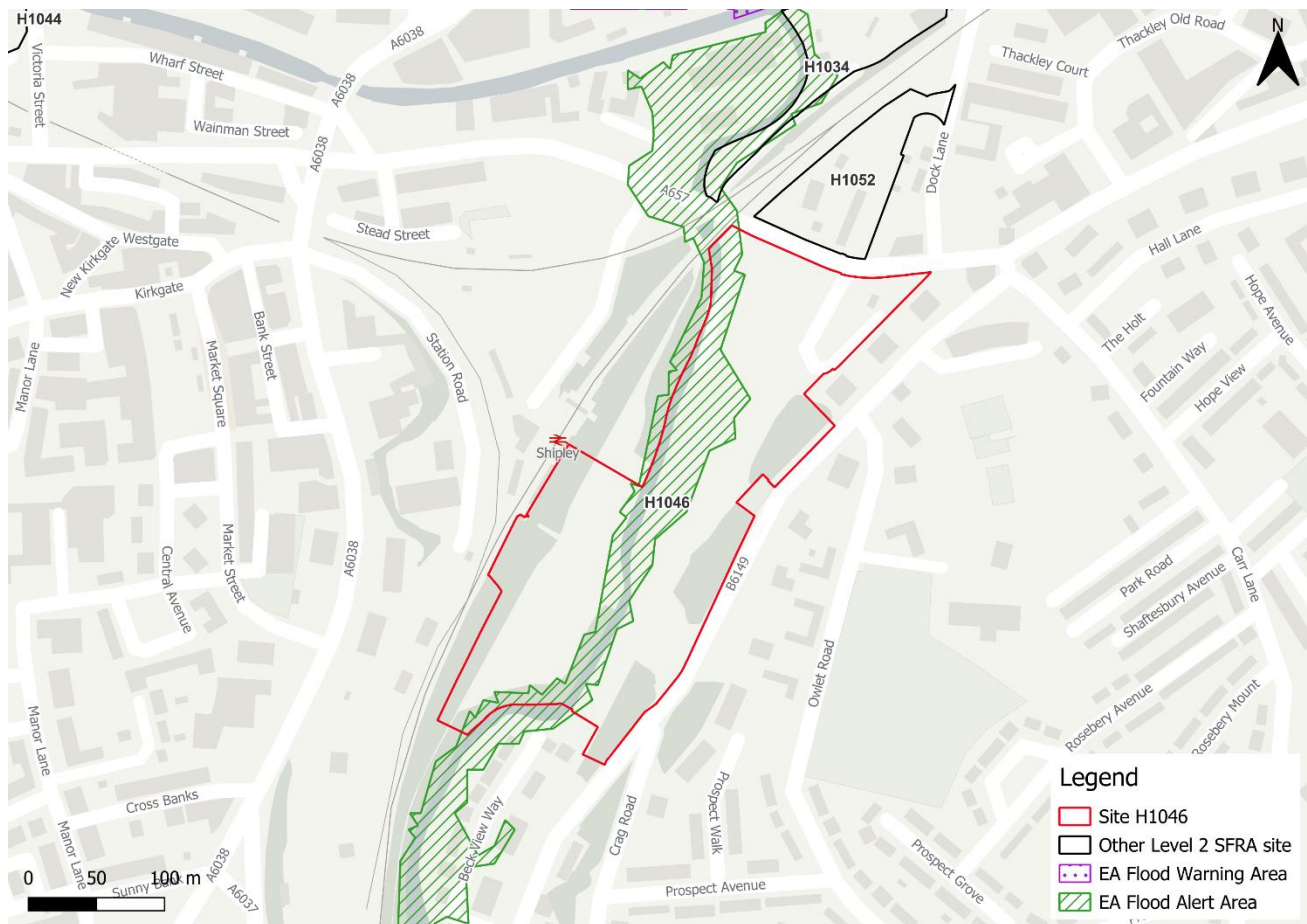


Figure 2-10: EA Flood Warning Areas and Flood Alert Areas

2.6.2 Access and escape routes

Based on available information on fluvial flood risk, safe access and escape routes could likely be achieved during a flood event from the eastern side of the site via the A657 to the north and the B6149 to the east (Figure 2-11). Safe access and escape routes may be challenging to achieve from the western side of the site, given its bounded by the railway line to the west and the Bradford Beck channel cuts off access to routes to the east. Access routes would need to be provided over Bradford Beck. Any access route would need to be constructed as to not impact the current flow regime, whilst accounting for the impacts of climate change. Modelling would be required to inform this.

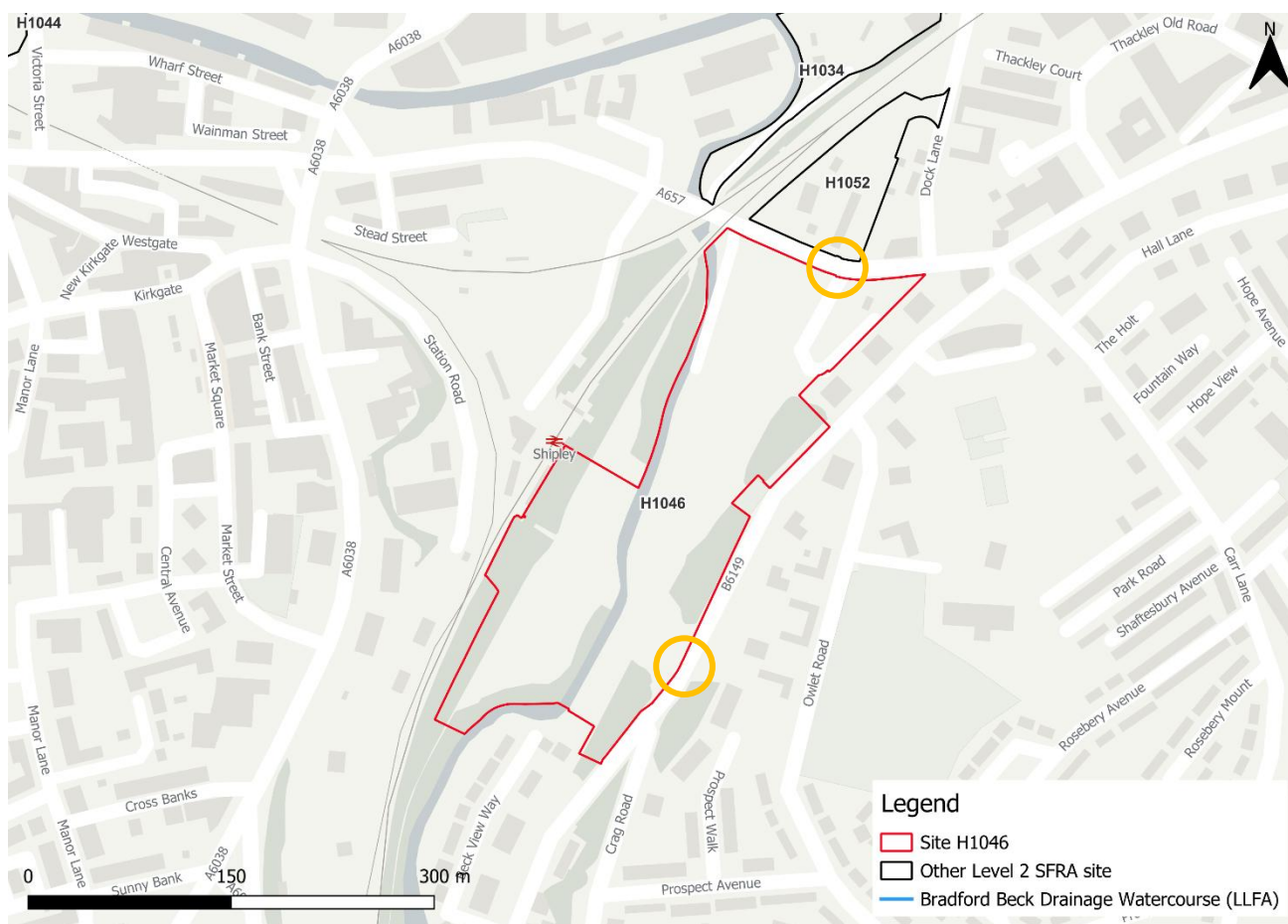


Figure 2-11: Potential access and escape routes

2.7 Observations, mitigation options, site suitability and sequential approach to development management - fluvial

- Observations:
 - 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 LPA must consider whether the change of use is acceptable and whether the development can be designed to be safe, including for adequate emergency planning provision, accounting for the information provided in this Level 2 SFRA (para 014 FRCC-PPG).
 - The site is modelled to be within the functional floodplain along the north-western and southern site boundaries, within and adjacent to the channel of Bradford Beck. Development is not permitted within the functional floodplain. If feasible, this area would be included as a green / blue corridor in site design offering multifunctional benefits alongside flood risk mitigation including Biodiversity Net Gain (BNG) contributions, and social and amenity benefits.
 - If works are proposed on or near Bradford Beck, a separate permission may be required. The type of permission needed from the Lead Local Flood Authority will depend on the activity and location proposed.

- The centre of the site and along the north-western and southern site boundaries are modelled to be at risk from fluvial sources (according to the Bradford Beck 2026 model) in the 1% AEP undefended scenario, to a similar extent as Flood Zone 3a. The remainder of the site is within Flood Zone 1.
- Given the site is more vulnerable and within Flood Zone 3a, and also within the 1% AEP undefended event modelled flood outline, the site must be subject to and must pass the exception test.
- Given the site as at high and medium risk from Bradford Beck, and future risk with climate change is modelled to be significant, it is recommended that the western side of the site is not redeveloped for more vulnerable uses. More vulnerable development should be directed to the east of the site, within Flood Zone 1. Development may be possible within the area of Flood Zone 1 within the west of the site if safe access and escape routes can be made available.
- The 1% AEP event with an allowance for climate change is what the EA considers to be the design event for a development to mitigate fluvial flood risk. The extent of flooding in the 1% AEP undefended central climate change event is shown to be similar to that of the present day event.
- Were any plans for development to proceed, the site-specific FRA must show that development will be safe for its lifetime taking account of the vulnerability of its users, including for appropriate evacuation procedures and flood response infrastructure are in place to manage the fluvial risk associated with the extreme flood event.
- Mitigation:
 - EA flood alerts should continue to be in place to ensure early evacuation of site users before an extreme flood event occurs.
- Access and escape:
 - Based on available information on fluvial flood risk, safe access and escape routes could likely be achieved during a flood event from the eastern side of the site via the A657 to the north and the B6149 to the east.
 - Safe access and escape routes may be challenging to achieve from the western side of the site, given its bounded by the railway line to the west and the Bradford Beck channel cuts off access to routes to the east.
 - Access routes would need to be provided over Bradford Beck. Any access route would need to be constructed as to not impact the current flow regime, whilst accounting for the impacts of climate change. Modelling would be required to inform this.

3 Flood risk from surface water

3.1 Existing risk

At the time of writing, the EA's latest national Risk of Flooding from Surface Water (RoFSW) does not include depth and hazard information suitable for planning purposes. Therefore, this Level 2 SFRA considers the third generation RoFSW depth and hazard mapping in addition to the NaFRA2 extents, as agreed with the EA. Surface water depth and hazard should be confirmed at the site-specific FRA stage.

3.1.1 Risk of Flooding from Surface Water - NaFRA2 extents

Based on the EA's national scale RoFSW map (January 2026), surface water flood risk to the site is predominantly very low, as shown in Table 3-1.

Surface water flood risk in the high and medium risk events is largely confined to an area of ponding at the north-eastern corner of the site, an area of ponding in the south-eastern corner of the site (constrained by the wooded area to the east of it) and a flow path within the south-western area of the site (Figure 3-1). This area of surface water risk is located outside of the area of onsite fluvial risk, therefore posing additional risk within the west of the site.

In the low risk event, the areas of ponding and the flow path expand to cover more of the site. There are two small additional areas of ponding at the centre of the site; one adjacent to Bradford Beck and the other adjacent to the eastern site boundary, within a wooded area. Satellite imagery appears to show a footbridge crossing Bradford Beck within the southern half of the site. Safe access and escape routes should be achievable from the eastern side of the site via the A567 to the north, travelling east. However, consideration will need to be given to safe access and escape routes from the west of the site, currently cut off by the Bradford Beck channel.

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)
92	5	2	1

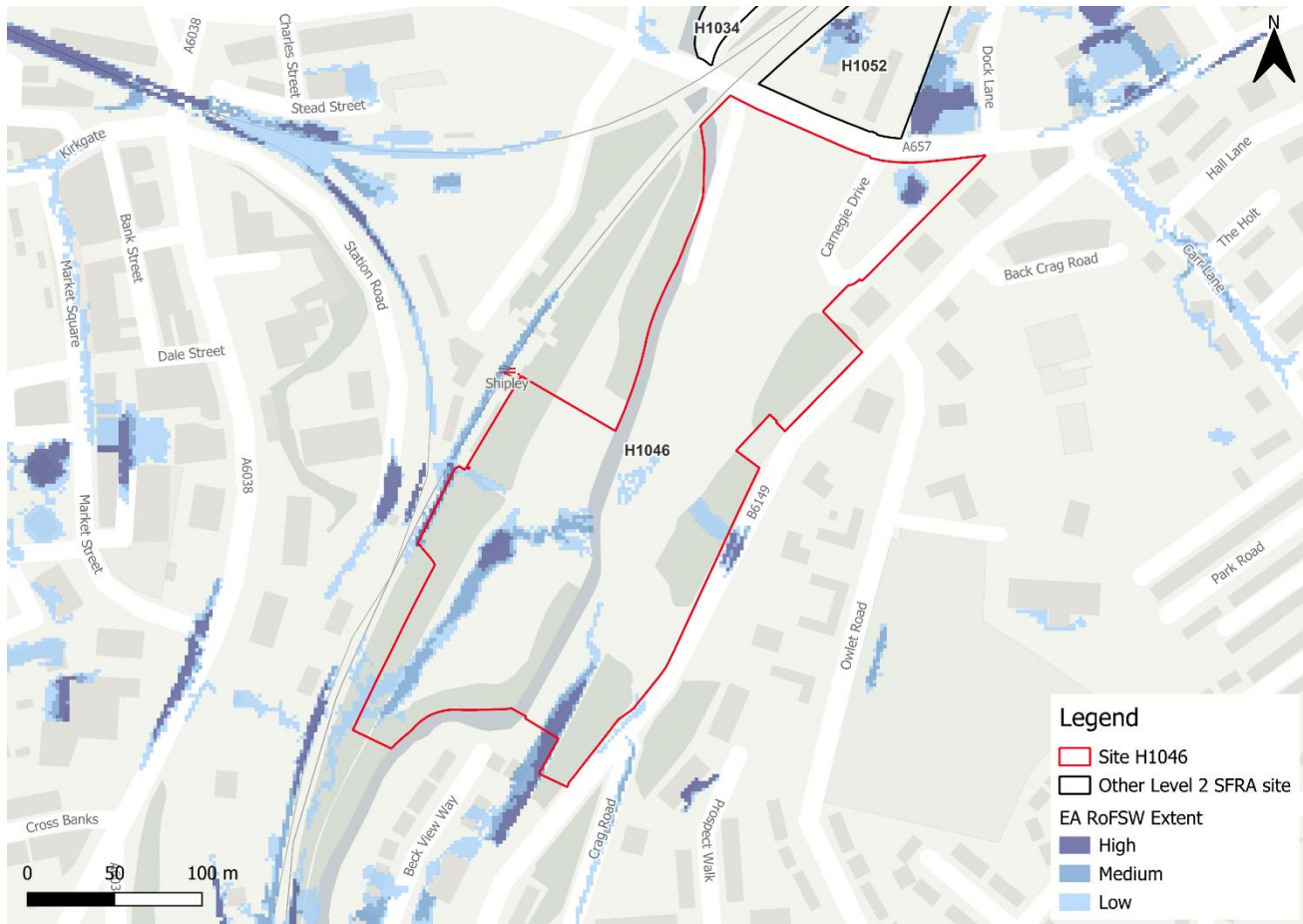


Figure 3-1: Surface water flood extents (NaFRA2 - Risk of Flooding from Surface Water map)

3.1.2 Risk of Flooding from Surface Water - third generation depths and hazards

Based on the EA's national scale third generation RoFSW map, the greatest flood depths within the site in the medium risk event are between 0.6 and 0.9 m (Figure 3-2), with hazard largely categorised as 'low', with a small area modelled to be 'significant' (Figure 3-3).

Safe access and escape routes should be achievable via the A657 to the north, travelling east, in all events. There is flooding modelled to this route in the low risk event however flood hazard is modelled to remain largely low, based on the third generation mapping. Safe access and escape routes should be confirmed based on a drainage strategy through the FRA.

There are differences between the NaFRA2 RoFSW map and the third-generation depth and hazard mapping. The NaFRA2 RoFSW map does not include most watercourse channels. Additionally, the NaFRA2 RoFSW map does not map flooding less than 0.075m (7.5cm) in depth. Therefore, where the map may show no flooding, there may be shallow flooding up to a depth of 0.075m. In contrast, the third generation RoFSW does not map flooding with a hazard rating of less than 0.575. This could explain the differences observed between the NaFRA2 and third generation RoFSW. Assessment of surface water should be

carried out at the site-specific FRA stage to robustly establish current and future surface water flood risk conditions.

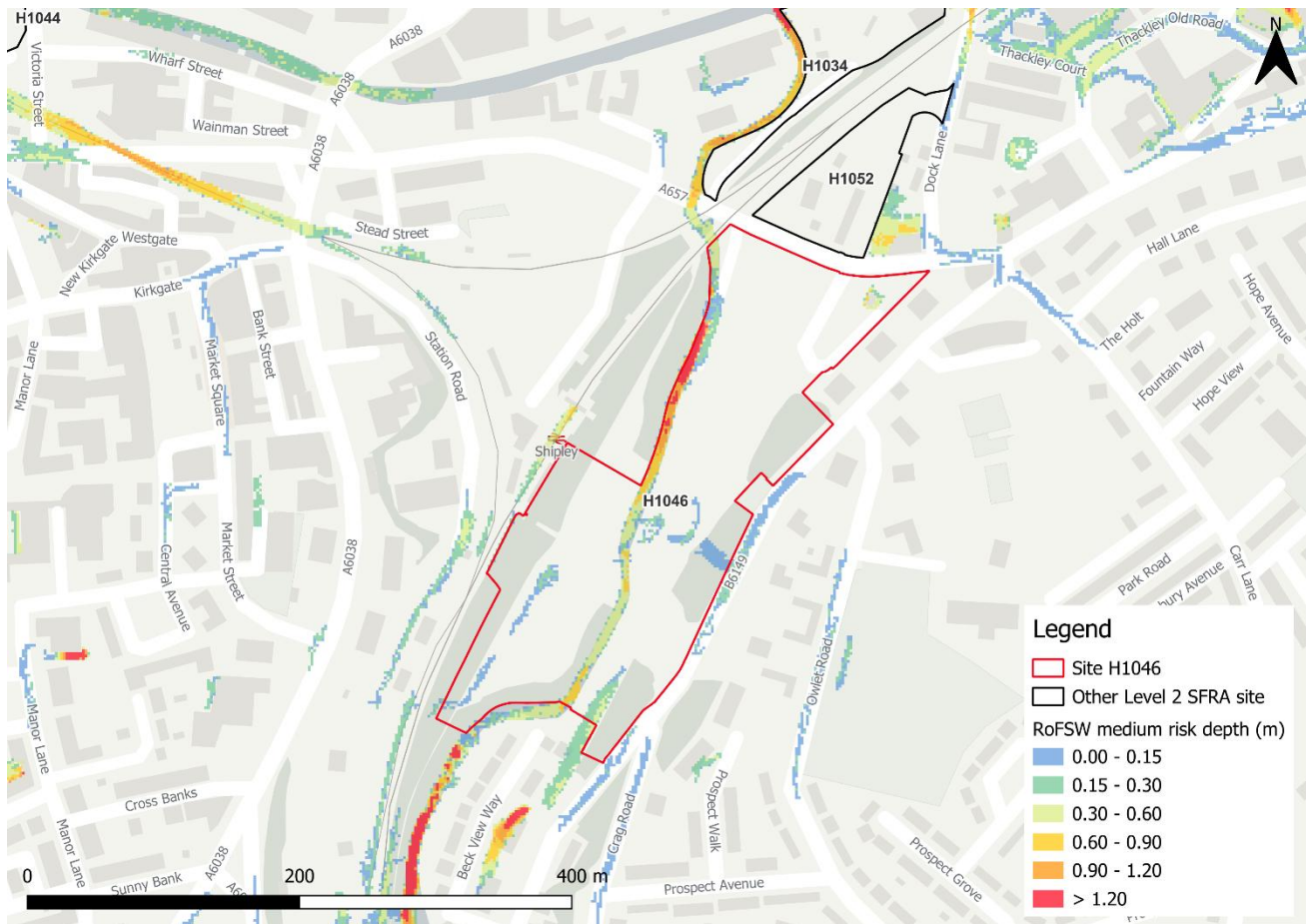


Figure 3-2: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

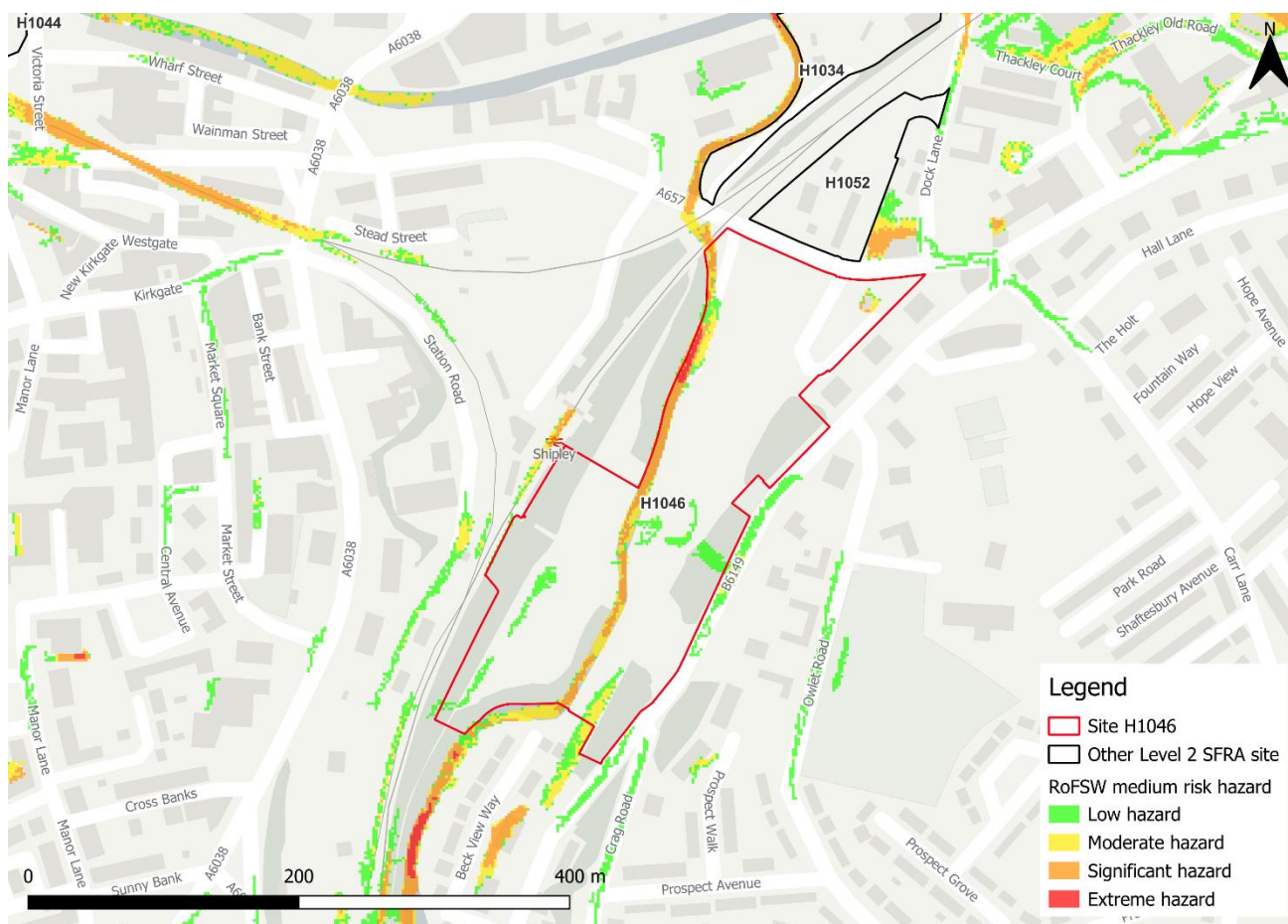


Figure 3-3: Medium risk event surface water flood hazard² (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

At the time of writing, the available national surface water climate change mapping is unsuitable for consideration in development planning. This Level 2 SFRA considers the low risk surface water event as a conservative proxy for the medium risk event plus climate change, as agreed with the EA. The impact of climate change on surface water flood risk should be considered at the site-specific FRA stage.

Using the low risk event as a proxy, the medium risk surface water event is likely to slightly increase in extent within the site when accounting for climate change (Figure 3-4). The third generation mapping indicates maximum flood depths are modelled to be between 0.9 and 1.2m, located adjacent to Bradford Beck (Figure 3-5), with areas of hazard categorised as extreme (Figure 3-6). Safe access and escape routes should remain possible via A657 with consideration to the shallow surface water depths also present during the climate change event. Access routes from the west of the site will need to be provided over Bradford Beck,

² 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

subject to detailed modelling and accounting for the impact of climate change. This should be confirmed through the site-specific FRA.

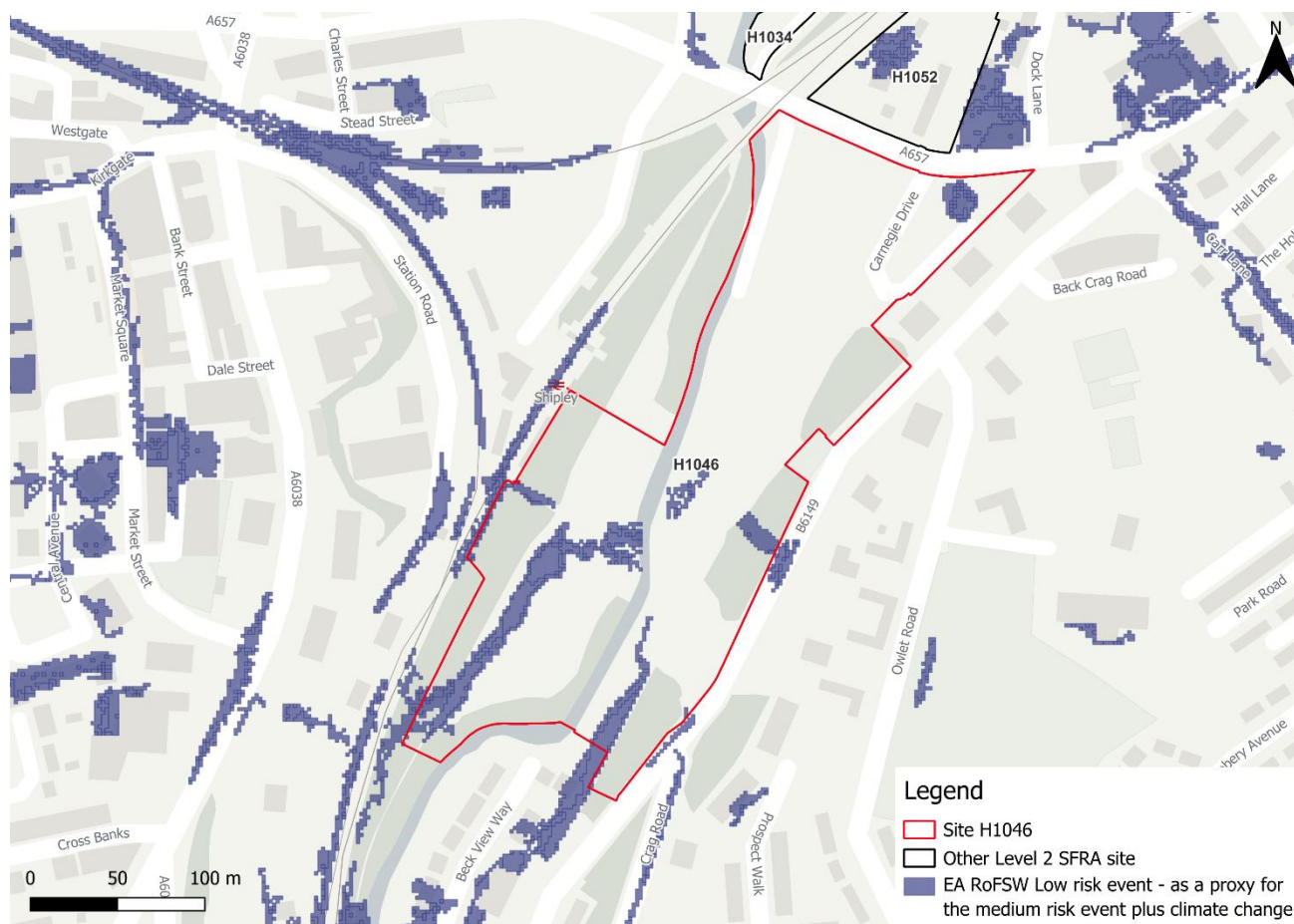


Figure 3-4: Low risk event surface water flood extent, as a proxy for the medium risk event plus climate change (NaFRA2 - Risk of Flooding from Surface Water map)

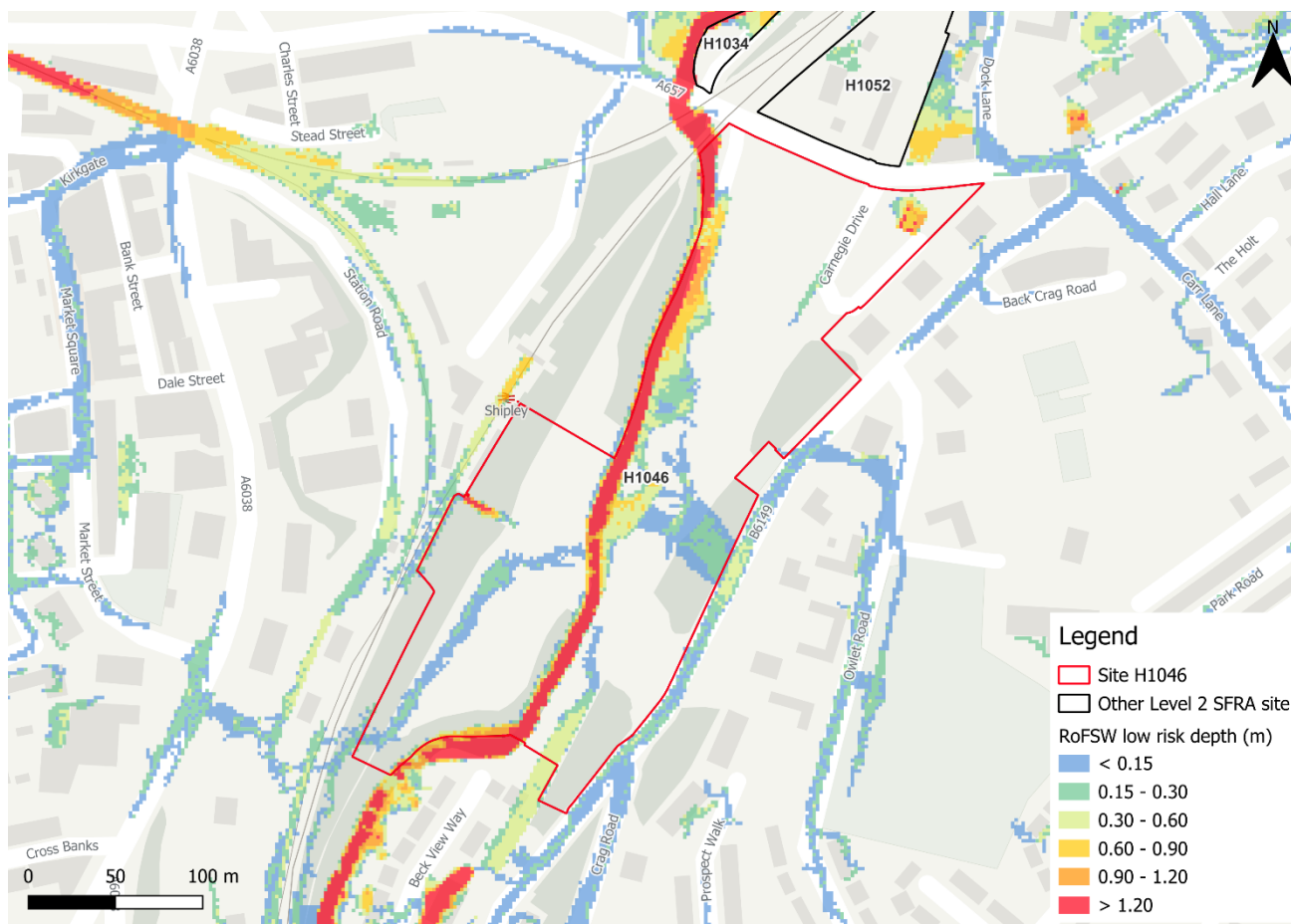


Figure 3-5: Low risk event surface water flood depths, as a proxy for the medium risk event plus climate change (Third generation - Risk of Flooding from Surface Water map)

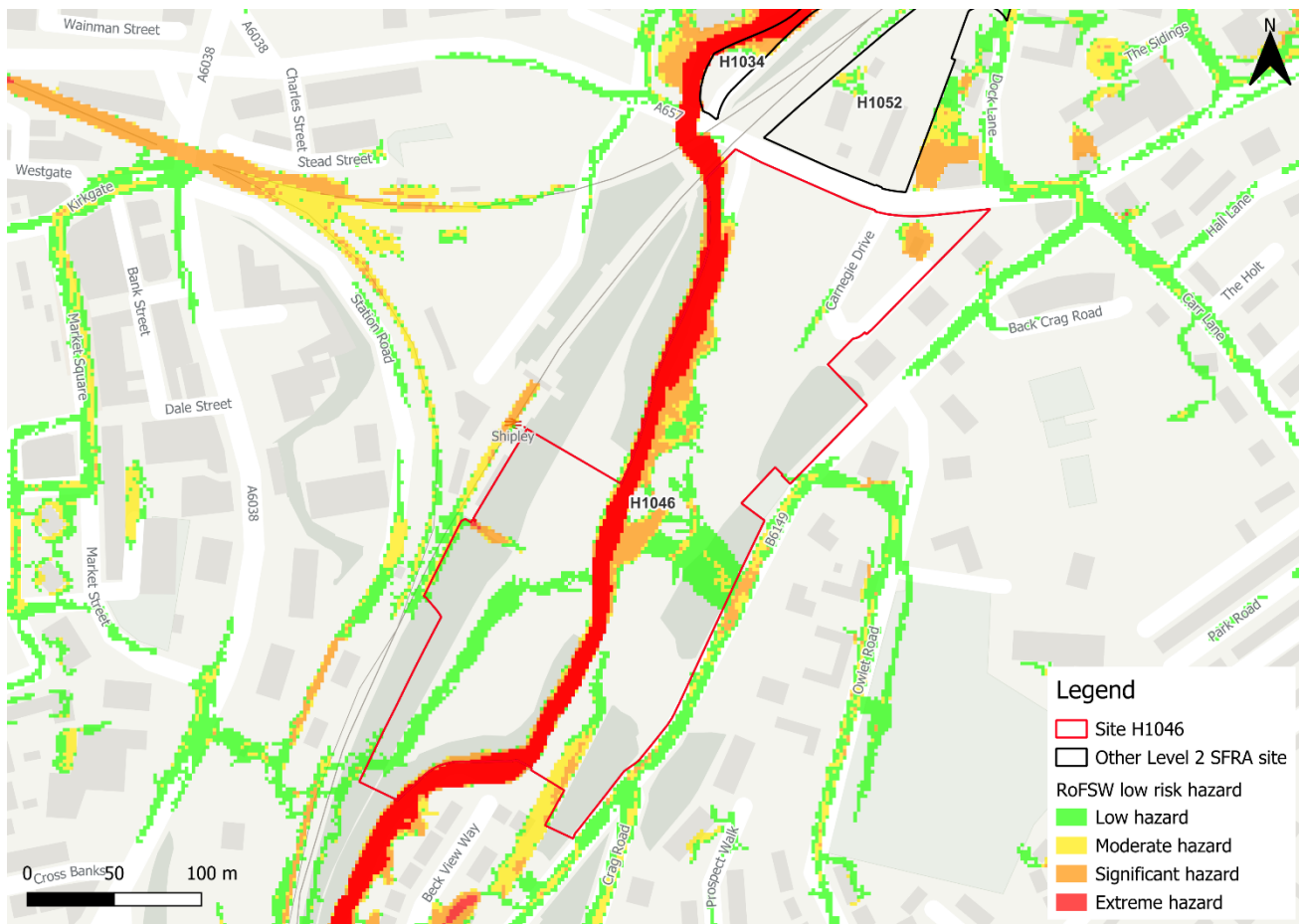


Figure 3-6: Low risk event surface water flood hazard, as a proxy for the medium risk event plus climate change (Third generation - Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk to the site is predominantly very low with 92% of the site being at very low surface water flood risk. Surface water risk in the medium risk event is largely confined to an area of ponding at the north-eastern corner of the site, an area of ponding in the south-eastern corner of the site (constrained by the wooded area to the east of it) and a flow path within the south-western area of the site.
- The effects of climate change on surface water have not been modelled for this SFRA; however, the low risk surface water event has been used as a proxy for the medium risk event plus climate change. In this event, there are two additional areas of ponding. One at the centre of the site and one at the eastern site boundary.
- Topographic low spots and flow paths should be considered and included in site design and ideally left in place to flood naturally when required, which may limit development within the west of the site.
- The areas at surface water flood risk are largely within the fluvial risk areas, excluding the flow path within the west, and should therefore be included within any mitigation solutions for fluvial risk.

- Safe access and escape routes should be achievable via the A657 from the east of the site, however, based on the third generation mapping, this route becomes inundated to shallow depths during the low risk and medium risk plus climate change events. Consideration will need to be given to safe access and escape routes from the west of the site, currently cut off by the Bradford Beck channel. This should be confirmed through a drainage strategy through the FRA.
- The drainage strategy must ensure there is no increase in surface water flood risk elsewhere as a result of new development. Existing brownfield rates will likely apply, though the developer should consult local LLFA guidance and the National SuDS guidance.
- 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.
- 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 Guide³. Figure 4-1 shows the map covering this site and the surrounding areas and Table 4-1 explains the risk classifications.

The entire site is located within an area where there is no risk of groundwater emergence. This is reflected in the geology of the area being a combination of mudstone, siltstone and sandstone (Figure 1-3), contributing to potentially reduced rates of infiltration and low water tables. Infiltration SuDS may therefore be an appropriate option at this site as there is a lower risk of groundwater emergence. However, the underlying bedrock geology being less permeable means that the type of infiltration SuDS needs to be considered further through the drainage strategy.

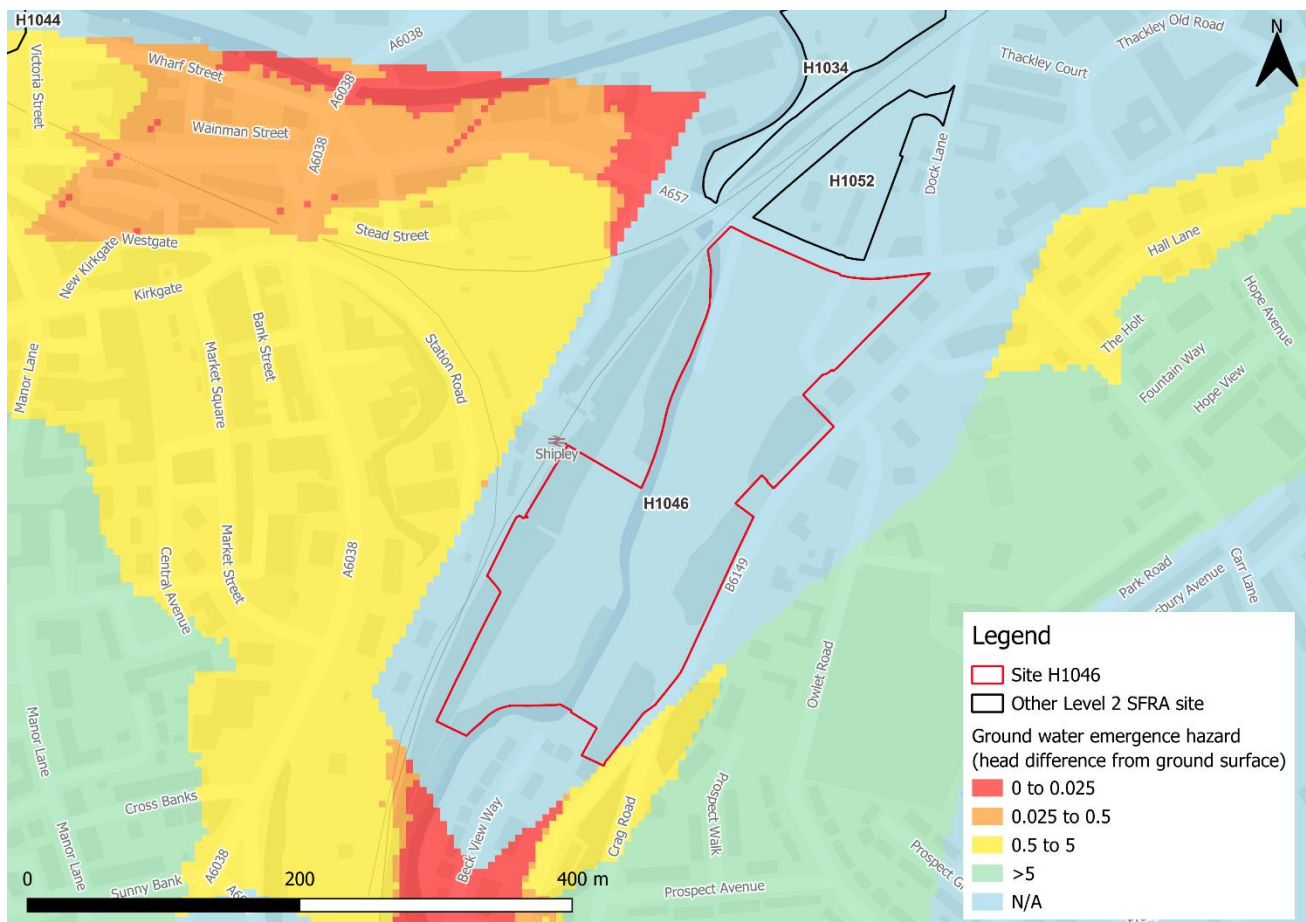


Figure 4-1: JBA 5m Groundwater Emergence Map

³ [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. defence breaches, or blockages of culverts or drainage assets. Residual risk at this site comes from the potential blockage of the structure beneath Leeds Road (A657).

5.1 Potential blockage

A blockage of the structure beneath Leeds Road (A657) may cause water in the channel to back up and cause flooding to the site, depending on the severity of the blockage and the magnitude of the flood event. Culvert course and condition surveys may be required, including for consultation with the culvert owner.

The Bradford Beck 2026 model includes for a scenario in which all culverts within the model are blocked by 50%. Figure 5-1 shows the modelled flood depths for this scenario. Flood depths directly south of the 50% blockage of the structure beneath the A657 location (outside of the site) are modelled to increase slightly. As a result, flood depths at the centre of the site are shown to slightly decrease.



Figure 5-1: Flood depths for 1% AEP undefended flood event 50% culvert blockage scenario - structure beneath Leeds Road (A657)

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 16 reservoirs. Of these 16 reservoirs, 13 are located within Bradford, two located within North Yorkshire and one located within Lancashire. These are operated by either Yorkshire Water Services Ltd, the National Trust or the City of Bradford Metropolitan District Council.

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 relevant reservoir undertaker 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.

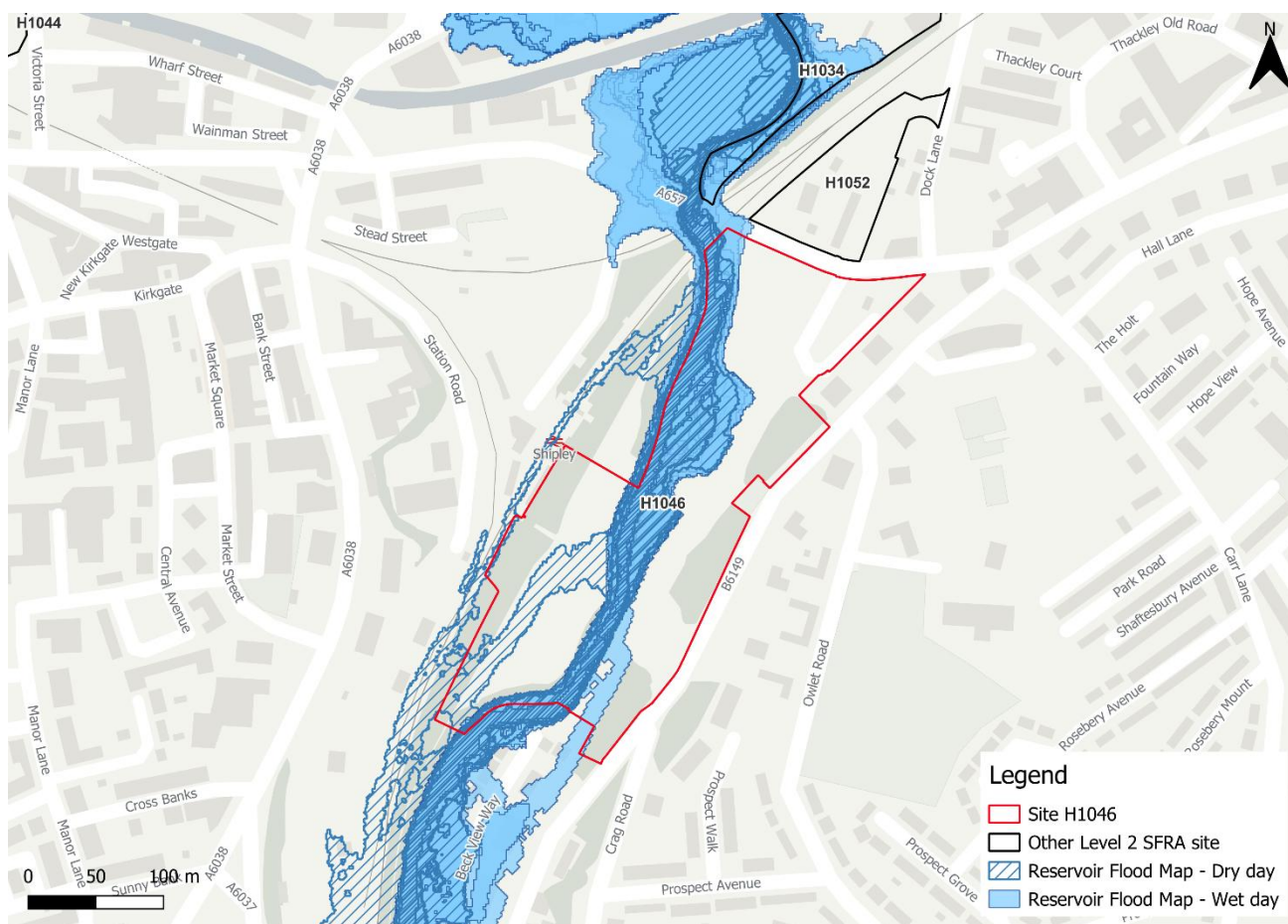


Figure 5-2: Flood risk from reservoirs

5.3 Observations, mitigation options and site suitability - residual risk

- The site is at potential residual risk from a blockage of the culvert beneath the A657 to the north of the site. The modelled 50% culvert blockage scenario indicates a slight decrease in depth within the site. This may be due to the increase in flood depths directly south of the culvert (north of the site boundary).
- 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 escape routes must be in place for the lifetime of development. Resistance and resilience measures may also need to 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).
- The site is also at potential residual risk from a breach of 17 reservoirs. However, only four reservoirs impact the site in the 'dry day' flood extent. Namely Chellow Height East, Chellow Height West, Lower Chellow and Upper Chellow. All located

within Bradford. This indicates the remaining 13 reservoirs are all modelled to impact the site based on the 'wet day' flood extent, which represents a predication of the credible worst case scenario, therefore it is unlikely that such an extreme flood event would occur.

- Given the potential reservoir flood risk to the site, developers should consider⁴:
 - 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
 - Using this Level 2 SFRA to understand whether any proposed development will be safe throughout its lifetime.

⁴ [Reservoir flood maps: when and how to use them | Environment Agency | 2021](#)

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 test⁵, given it is proposed for more vulnerable uses and is located within Flood Zone 3a. It must be proven that the development can be safe for its lifetime, which is generally considered to be 100 years for residential development. Based on the available information documented within this Level 2 SFRA, this site cannot pass the exception test given both the 1% AEP event modelled present day and future fluvial risk, unless all development can be directed to Flood Zone 1 and 2.

6.2 Recommendations summary

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

- There should be no development within the existing area of functional floodplain present on site.
- It is recommended that the area of the site within both the functional floodplain and the modelled 1% AEP undefended event plus climate change is left as open space and used as a multifunctional greenspace for flood storage, amenity use and to provide environmental / ecological benefits, including for Biodiversity Net Gain (BNG) contributions.
- Development should be directed to the east of the site, to the areas of the site within Flood Zone 1.
- The Flood Map for Planning requires updating to include the outputs of the 2026 model of Bradford Beck.
- Safe access and escape routes must be considered further at the site-specific FRA stage through a drainage strategy which should assess flood depths and hazards, both in the present day and climate change scenarios.
- Were any plans for development to proceed, the site-specific FRA must show that development will be safe for its lifetime, taking account of the vulnerability of its users, including for appropriate evacuation procedures and flood response infrastructure.

6.3 Site-specific FRA requirements and further work

At the planning application stage, the following should be considered:

- Further modelling to understand the impacts of climate change on surface water flood risk to the site.
- Further consideration of safe access and escape routes given the modelled fluvial and surface water risk to current routes. Consideration will need to be

⁵ Para 178 National Planning Policy Framework 2024

given to the access routes to the west of the site, informed by detailed modelling and accounting for climate change.

- A condition and capacity assessment of the culvert beneath Leeds Road (A657) to the north of the site.
- Consultation with the relevant reservoir owners to understand the impact of development on reservoir risk designation.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA 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.

7 Licencing

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