

Bradford Level 2 Strategic Flood Risk Assessment - Site H1047

Final Draft

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Prepared for:



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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 H1047. 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 H1047

- Location: Regent House
- Existing site use: Industrial
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 0.7 hectares
- Proposed development impermeable area: 0.62 hectares
- Watercourse: Bradford Beck / River Aire
- Environment Agency (EA) river model: 2022 Leeds FAS Kildwick to Esholt
- 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

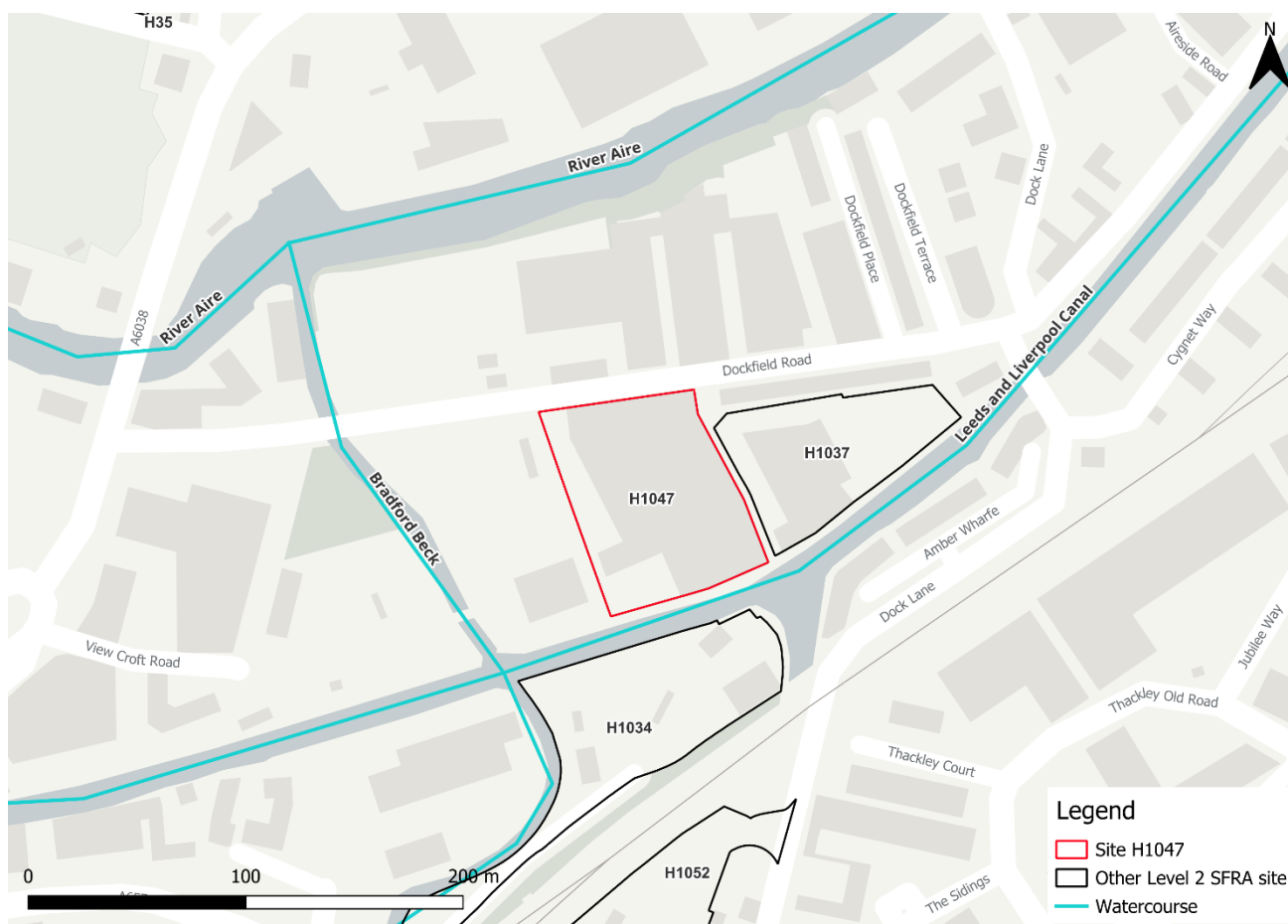


Figure 1-1: Existing site location boundary

The topography of the site is varied, 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, west of the site, is approximately 3m lower in elevation than the eastern areas of the site.

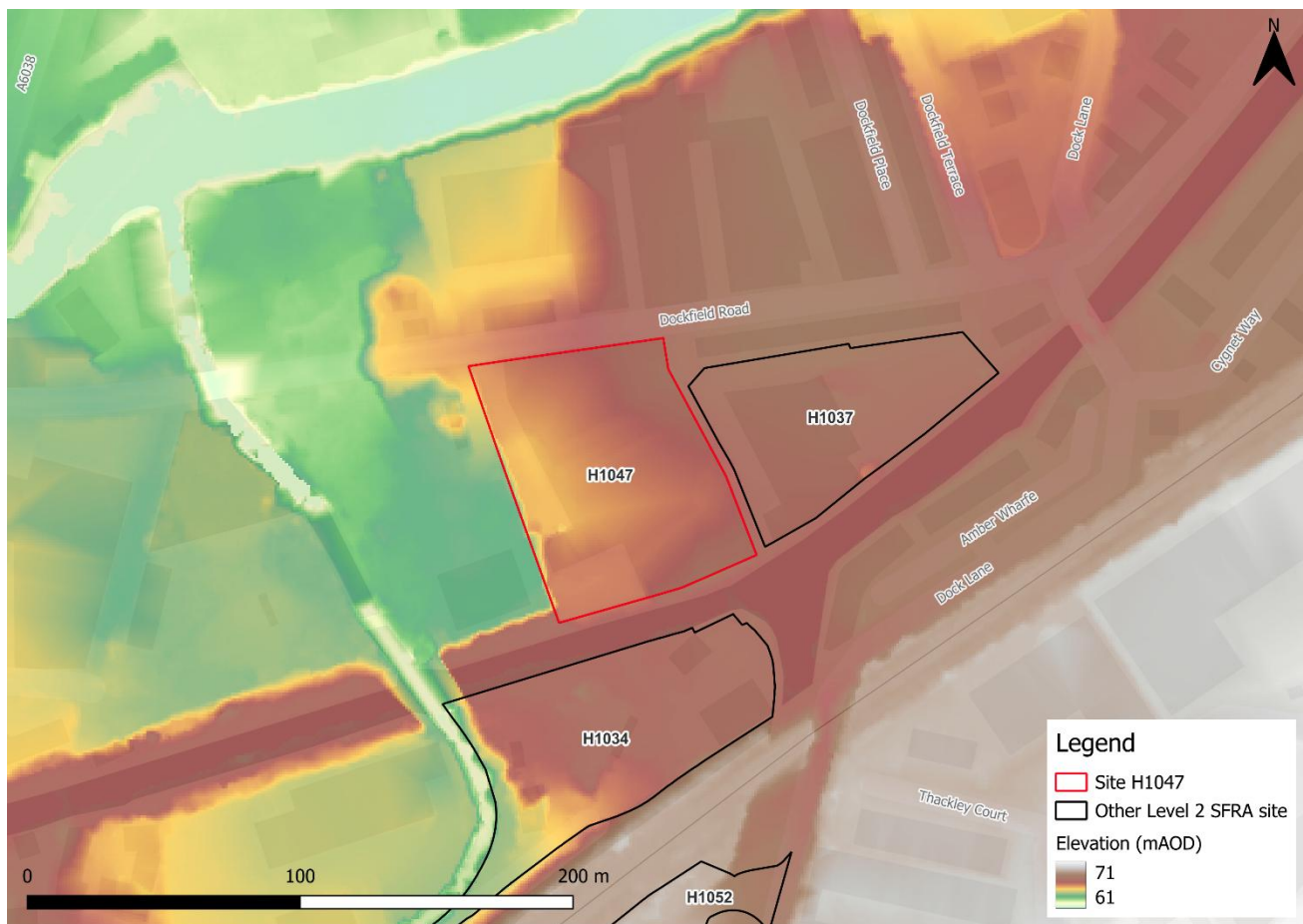


Figure 1-2: Topography

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 the River Aire north of the site and Bradford Beck which runs adjacent to the western site boundary. A small part of the western side of the site is situated within Flood Zone 2 and therefore at medium risk of fluvial flooding. The remaining area of the site is within Flood Zone 1 and 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)
99	1	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 reach of the watercourse adjacent to the site.

2.1.3 Leeds FAS Kildwick to Esholt model outputs - present day

Figure 2-2 shows the modelled flood depths for the 0.1% AEP undefended event. Modelled risk to the site is similar to that shown by Flood Zone 2 of the Flood Map for Planning, impacting a small part of the western site boundary. Maximum flood depths within the site are up to 0.15m.

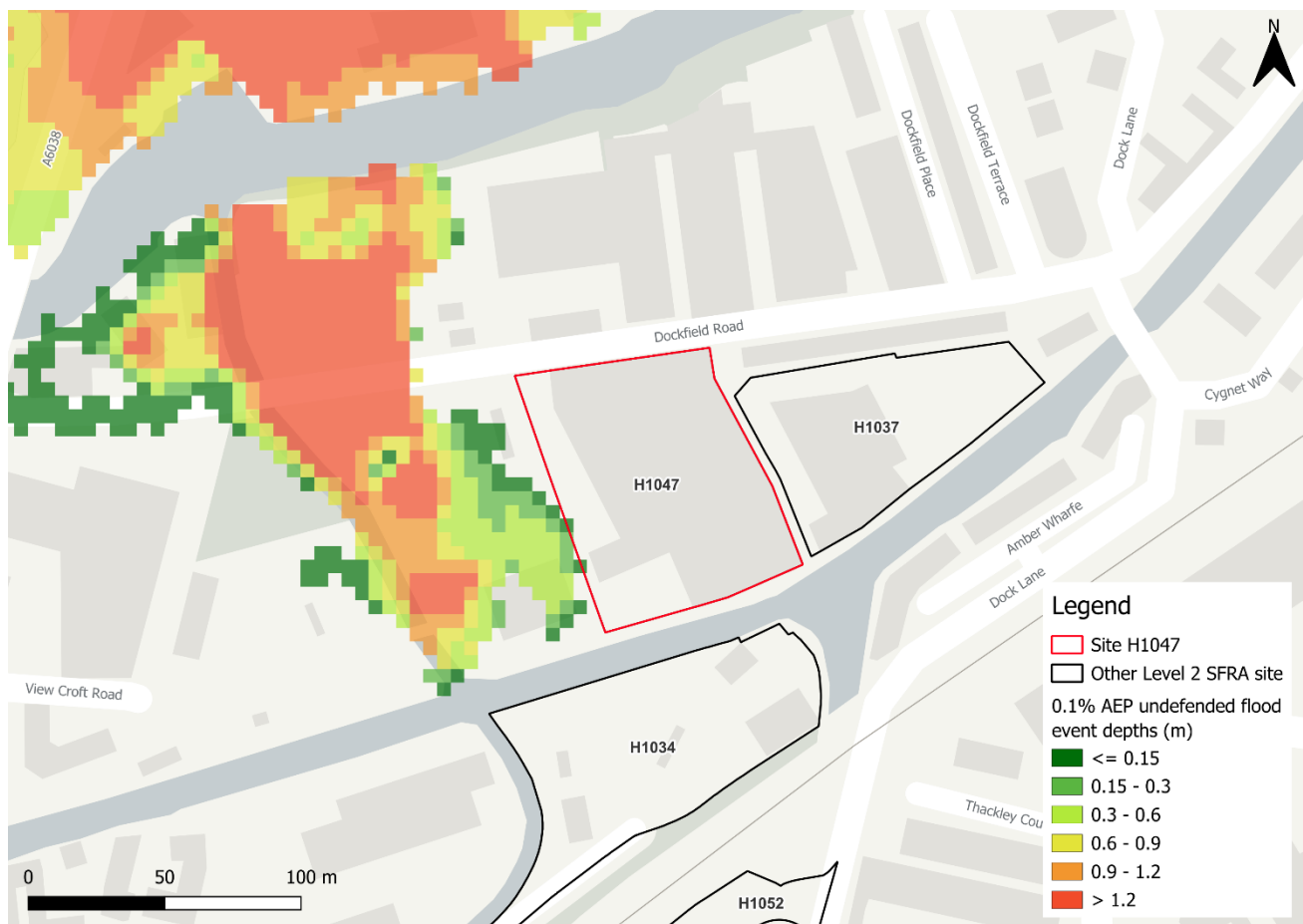


Figure 2-2: Flood depths for 0.1% AEP undefended flood event

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: 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

As documented in Section 2.1.1, the Bradford Beck 2026 model does not cover the site.

2.2.2 Leeds FAS Kildwick to Esholt model outputs - climate change

Figure 2-3 shows the modelled flood depths for the 0.1% AEP undefended event +23% for climate change. Risk is modelled to be similar to the present day 0.1% AEP event, impacting a small part of the western site boundary. Maximum flood depths within the site increase to between 0.15 and 0.3m.

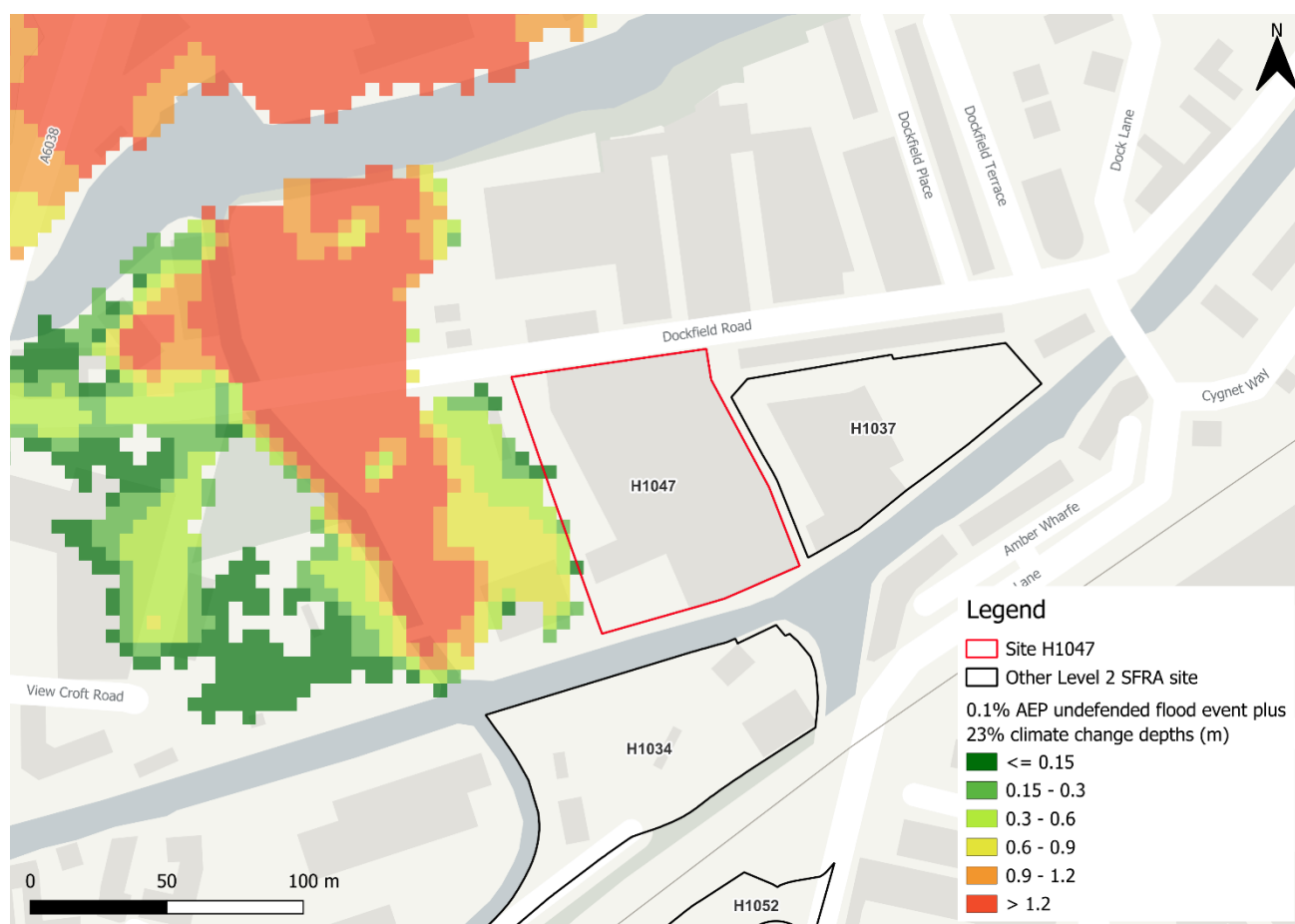


Figure 2-3: Flood depths for 0.1% AEP undefended flood event +23% (central climate change allowance)

2.2.3 Flood Map for Planning - Climate Change

The EA's Flood Map for Planning plus Climate Change (2070-2125) dataset indicates that climate change is unlikely to result in a significant increase in flooding from the River Aire to the site (Figure 2-4). The extent of flooding shown is similar to that shown in the Leeds FAS Kildwick to Esholt model outputs.

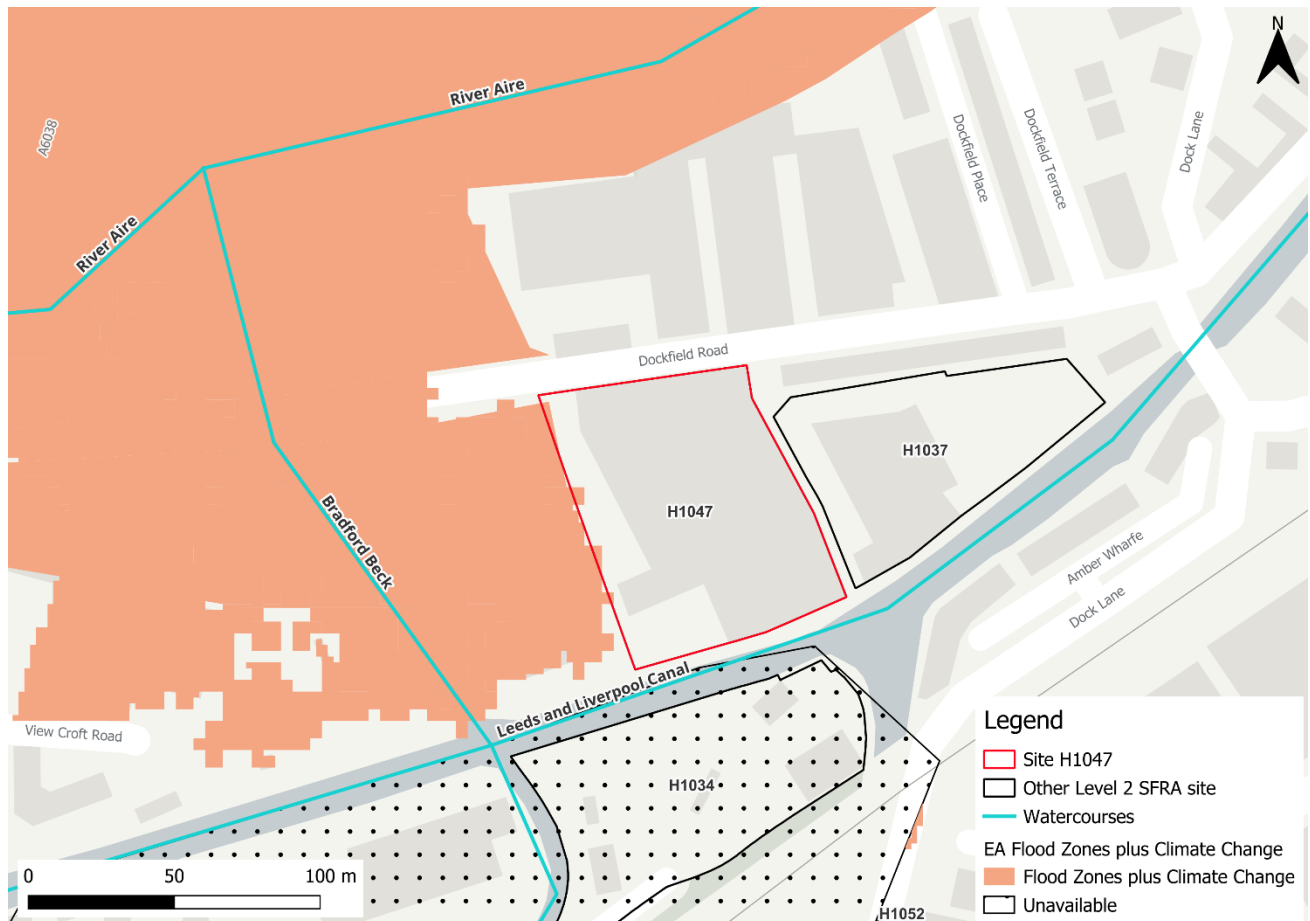


Figure 2-4: Flood Zones plus Climate Change dataset

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 that could benefit the site.

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) has been considered and mapped in Figure 2-5 which shows a small area in the northwest of the site has been subject to flooding in the past. The RFO dataset indicates that this historic event occurred as a result of the channel capacity of the River Aire being exceeded in December 2015.

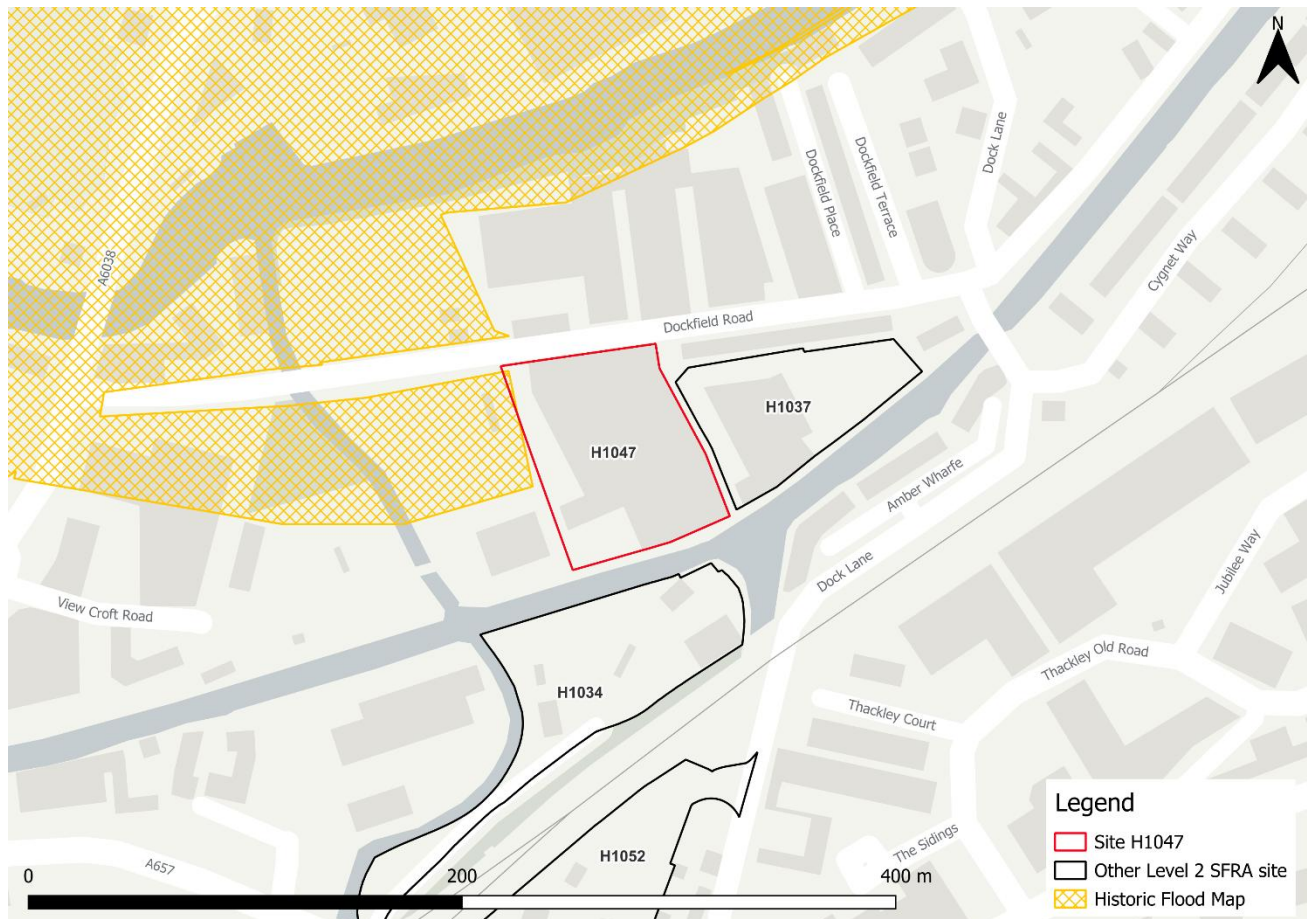


Figure 2-5: Recorded historic flood events onsite and around the site

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 northwest of the site is located within a FWA, namely 123FWF119 - River Aire at Shipley.

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

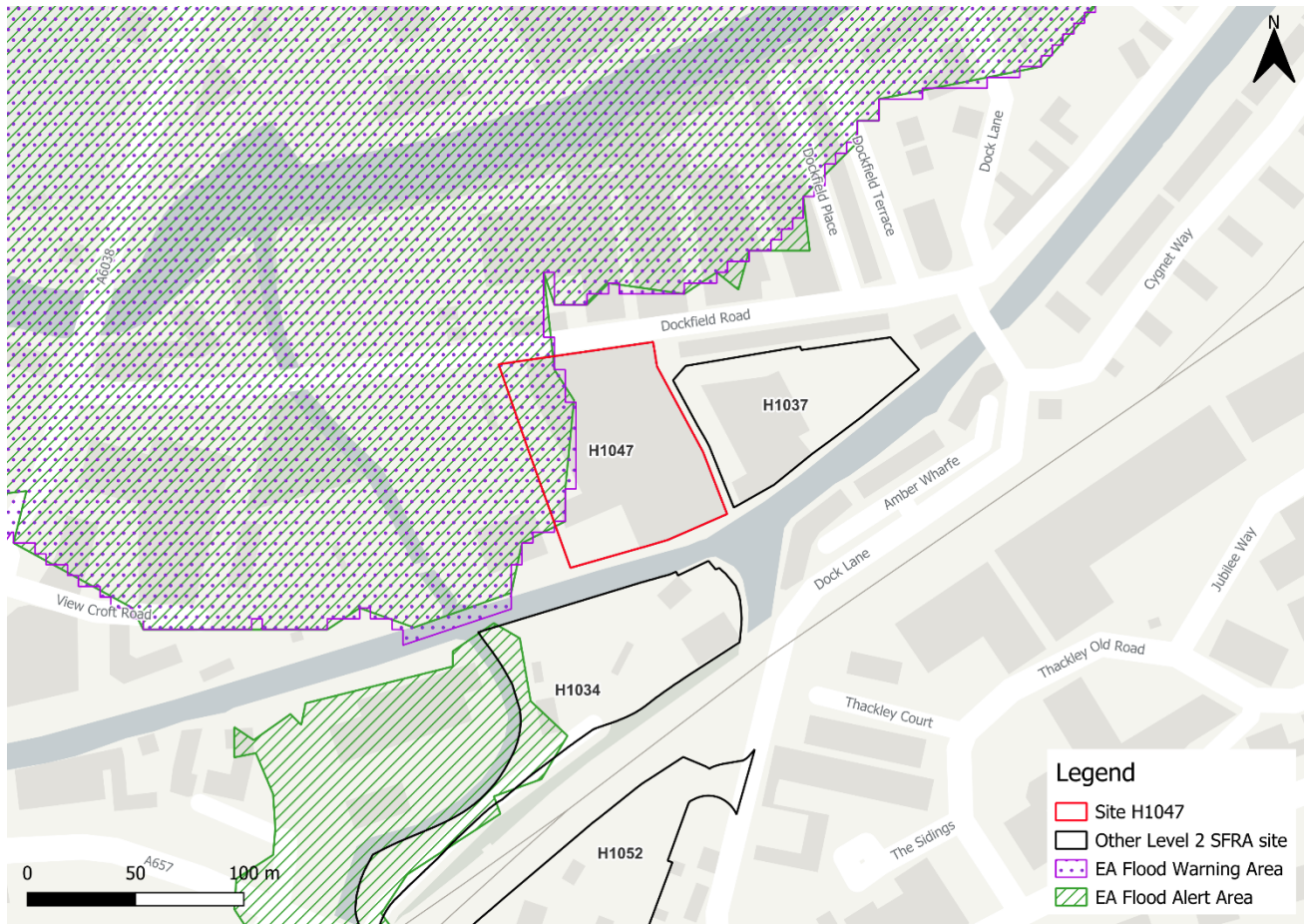


Figure 2-6: EA Flood Warning Areas and Flood Alert Areas

2.5.2 Access and escape routes

Based on available information on fluvial flood risk, safe access and escape routes would likely be achievable via Dockfield Road to the north of the site, travelling east during a fluvial flood event (Figure 2-7).

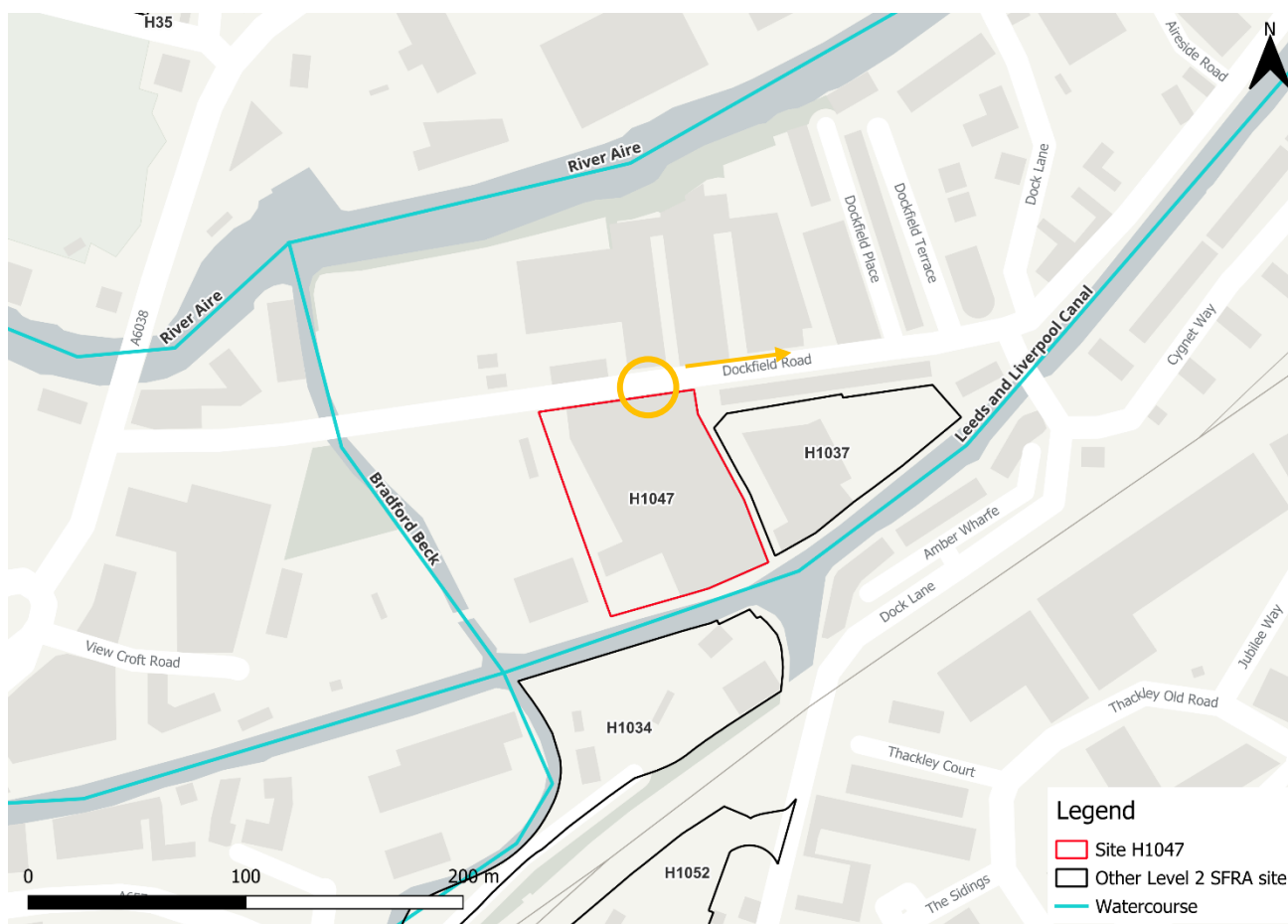


Figure 2-7: Potential access and escape routes

2.6 Observations, mitigation options and site suitability - 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).
 - Based on available information, the western site boundary is impacted by shallow depths of flooding during the present day and climate change low risk events.
 - Development should be directed to the areas of the site situated within Flood Zone 1.
- 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 would likely be achievable via Dockfield Road to the north 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 Risk of Flooding from Surface Water (RoFSW) map (January 2026), surface water risk to the site is predominantly very low, as shown in Table 3-1.

Surface water in the high and medium risk events is confined to a flow path along the eastern site boundary. In the low risk event, two areas of ponding form in topographic low spots. One adjacent to the western site boundary and one within the southwestern corner of the site. Surface water risk onsite is constrained by the existing development within the site (Figure 3-1). Safe access and escape via Dockfield Road is unlikely to be impacted by surface water flooding.

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	6	1	1

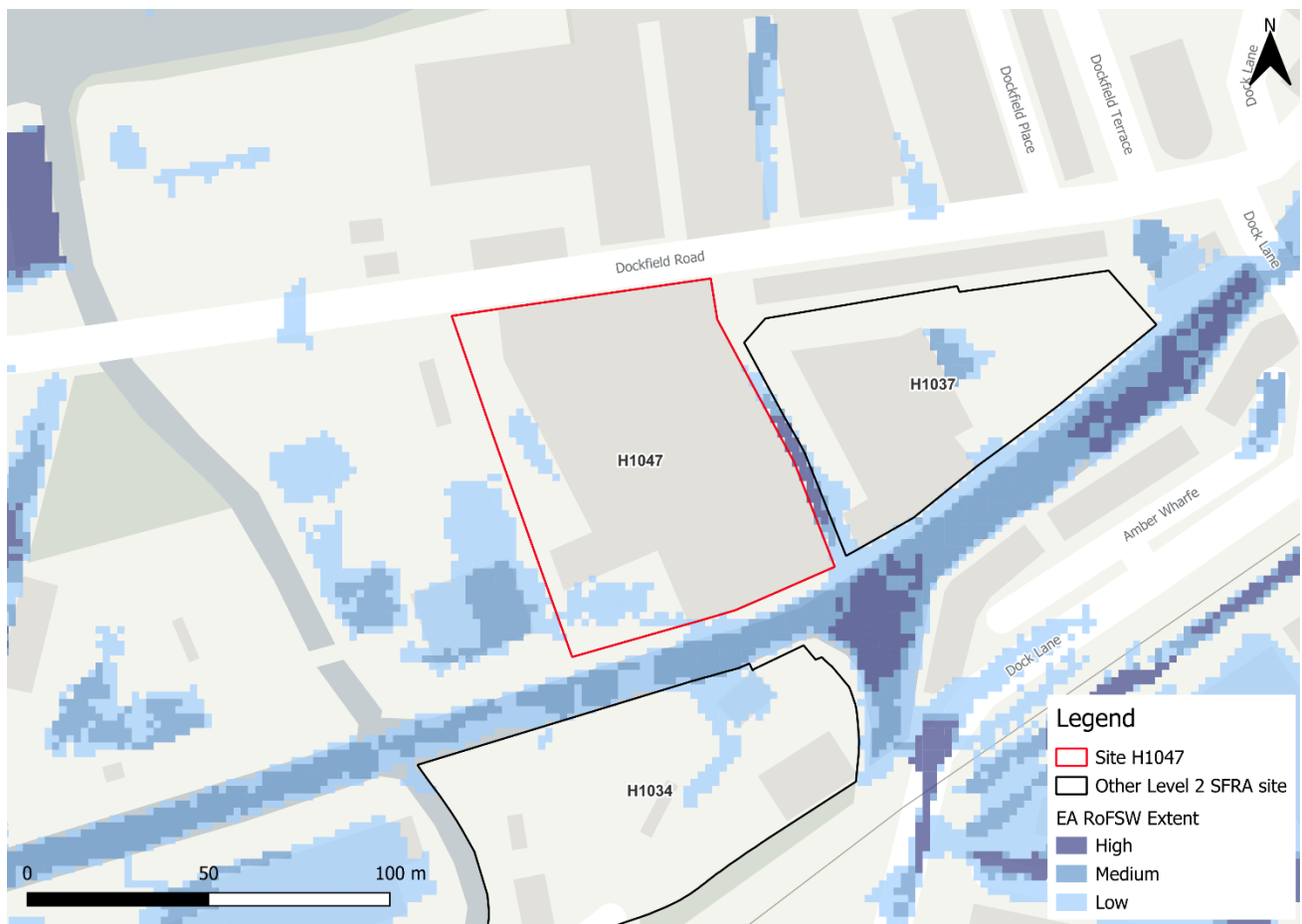


Figure 3-1: Surface water flood extents (NaFRA2 - Risk of Flooding from Surface Water map)

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 hazards categorised as 'significant' (Figure 3-3).

Safe access and escape routes via Dockfield Road should be achievable in all events.

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 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, 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 between 0.9 and 1.2m (Figure 3-5), however, this is confined to the eastern boundary of the site. Within the southwestern corner of the site, flood depths are shown to increase to up to between 0.3 and 0.6m with areas of hazard categorised as 'moderate' to 'significant' (Figure 3-6).

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, 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 confined to the eastern boundary 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 area of ponding within the west of the site.
- Topographic low spots should be considered and included in site design and ideally left in place to flood naturally when required.
- Safe access and escape routes would likely remain achievable in all surface water events via Dockfield Road.
- 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 Guide². 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. 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 1-3).

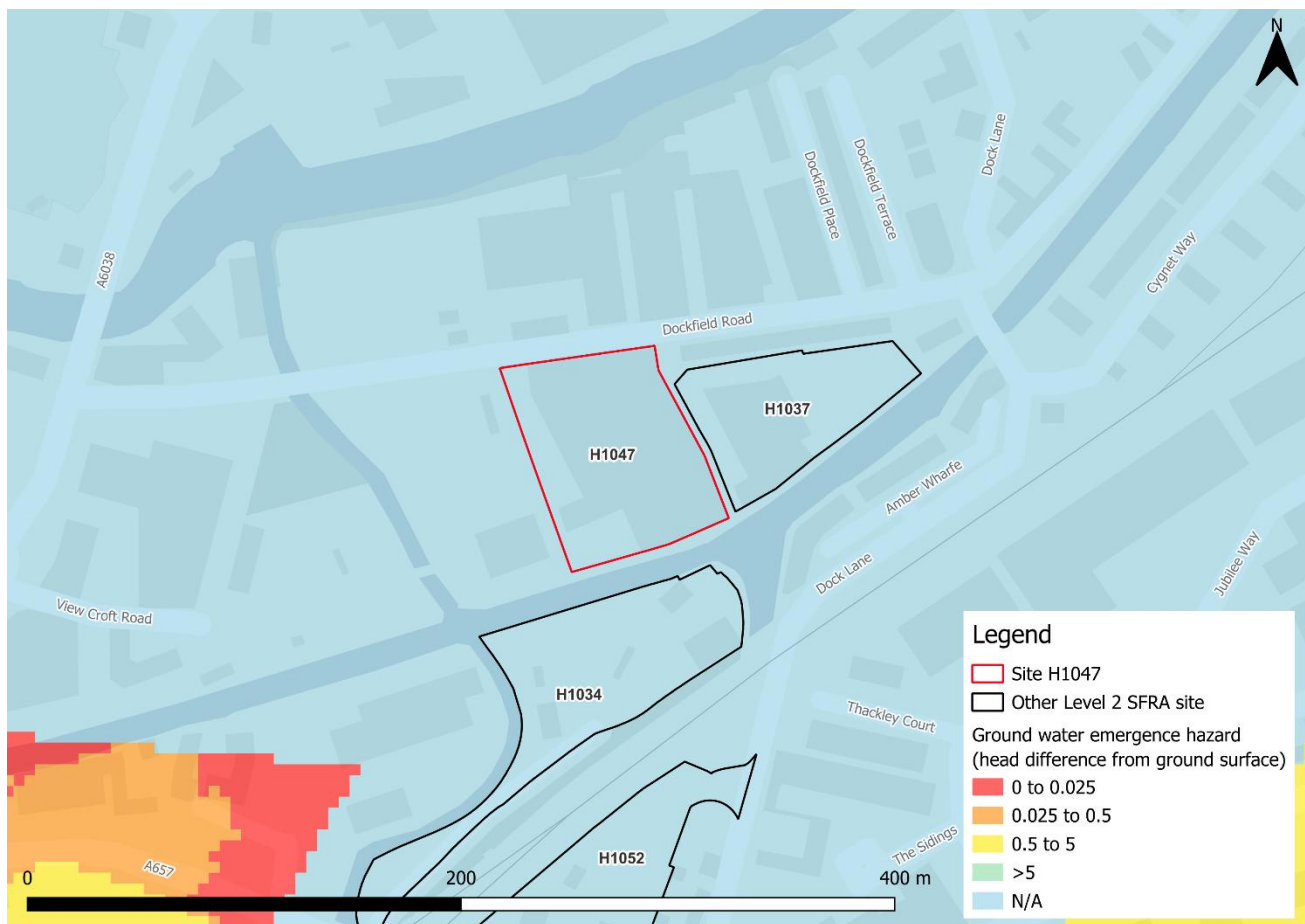


Figure 4-1: JBA 5m Groundwater Emergence Map

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 bridges, culverts or drainage assets. Residual risk at this site may come from a blockage of the bridge over Bradford Beck beneath Dockfield Road, northeast of the site.

5.1 Potential blockage

A blockage of the structure beneath Dockfield Road may cause water in the channel of Bradford Beck to back up and cause flooding to the site, depending on the severity of the blockage and the magnitude of the flood event. The location of the bridge is marked on Figure 5-1.



Figure 5-1: Potential blockage location

5.2 Flood risk from canals

The Leeds and Liverpool Canal runs along the southern 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 above the site and therefore less likely to pose a significant risk to the site 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 19 reservoirs. Of these 19 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.

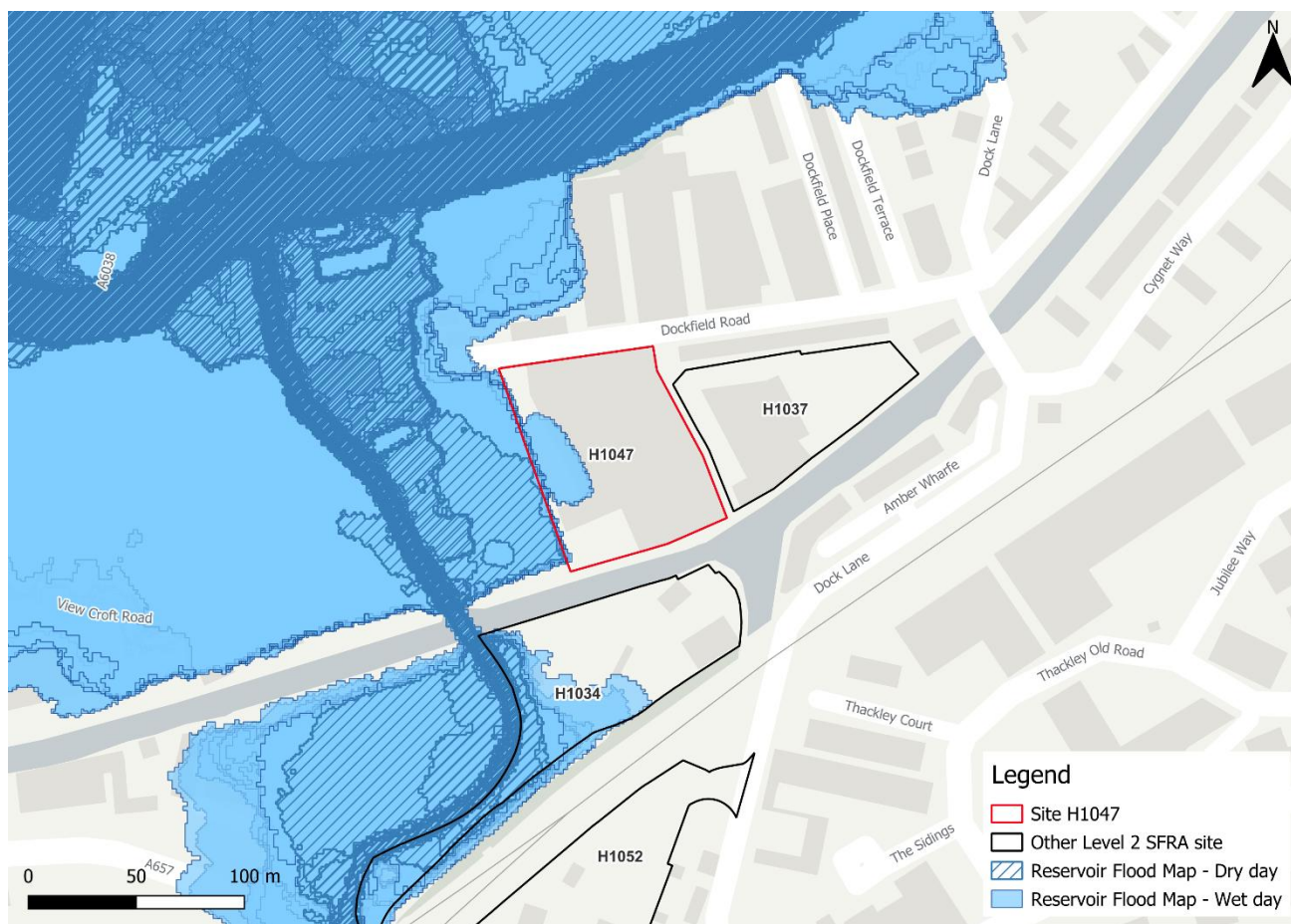


Figure 5-2: Flood risk from reservoirs

5.4 Observations, mitigation options and site suitability - residual risk

- The site is at potential residual risk from a blockage of the bridge over Bradford Beck, northeast of the site. The site-specific FRA could consider modelling a blockage scenario to understand whether there would be any additional risk to the site as a result of a blockage.
- 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 at potential residual risk from a breach of 19 reservoirs. However, only one reservoir impacts the site in the 'dry day' flood extent, namely Chellow Heights East reservoirs, located within Bradford. This indicates that the remaining

18 reservoirs are only modelled to impact the site based on the 'wet day' flood extent, which represents a prediction of the credible worst case scenario, therefore it's unlikely that any actual flood would be this large.

- Given the potential reservoir risk to the site, developers should consider³:
 - Consulting with the local resilience forum for advice on emergency planning,
 - Consulting with relevant reservoir owners to understand the impact development may have on their reservoirs, and
 - Using this Level 2 SFRA to understand whether any proposed development will be safe throughout its lifetime.

³ [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 not required to pass part b) of the exception test⁴ 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 given its location largely within Flood Zone 1 and very low surface water flood risk.
- Development should be directed away from the western site boundary to the areas of the site within Flood Zone 1.
- The Flood Map for Planning requires updating to include for the 2026 model of Bradford Beck.

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.
- A condition assessment of the bridge beneath Dockfield to the northeast 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.

⁴ Para 178 National Planning Policy Framework 2024

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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. Laura Thompson 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 H1059. 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' (2025) and is therefore familiar with the terminology used in this report.

1.1 Site H1059

- Location: Bingley Road, Nabwood, Shipley
- Existing site use: Agriculture
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 5.5 hectares
- Proposed development impermeable area: 4 hectares
- Watercourse: River Aire (main river)
- Environment Agency (EA) river model: Leeds FAS Kildwick to Esholt 2022
- 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 latest EA climate change allowances for peak river flows and peak rainfall intensities

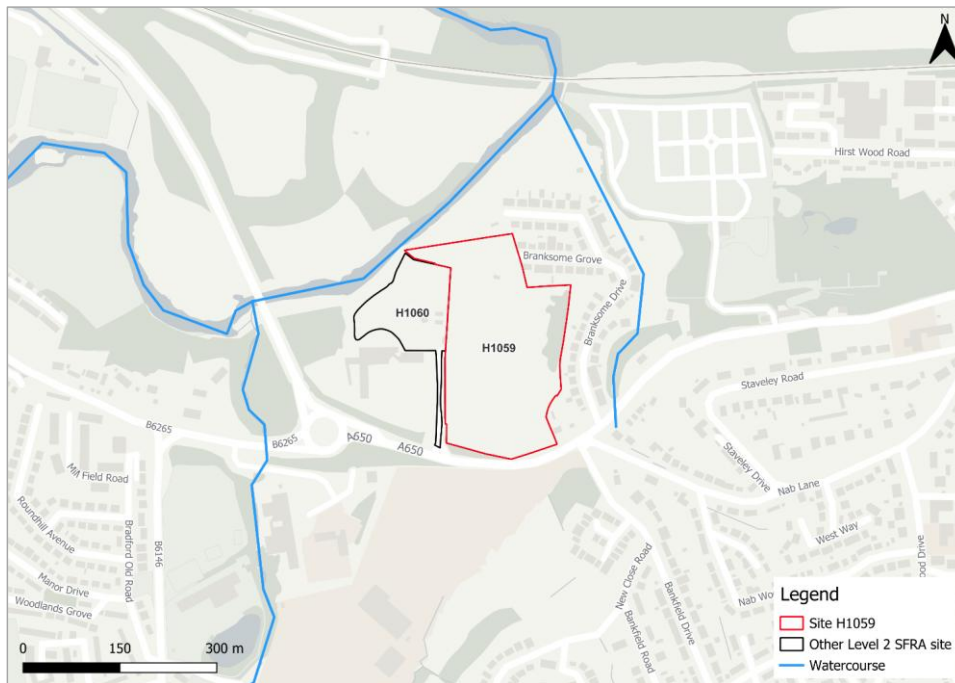


Figure 1-1: Existing site location boundary

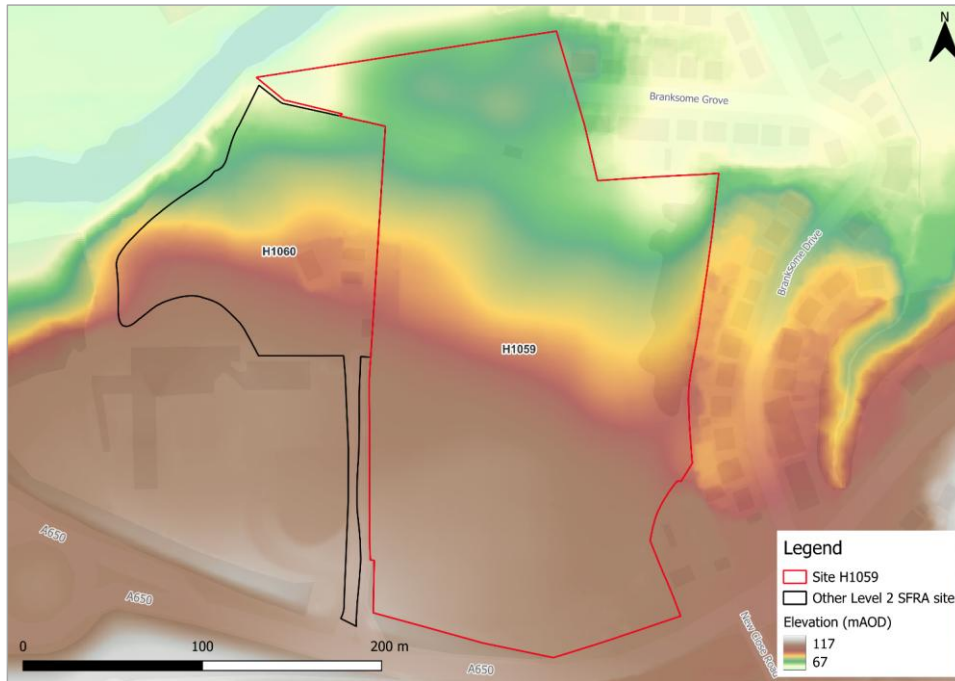


Figure 1-2: Topography

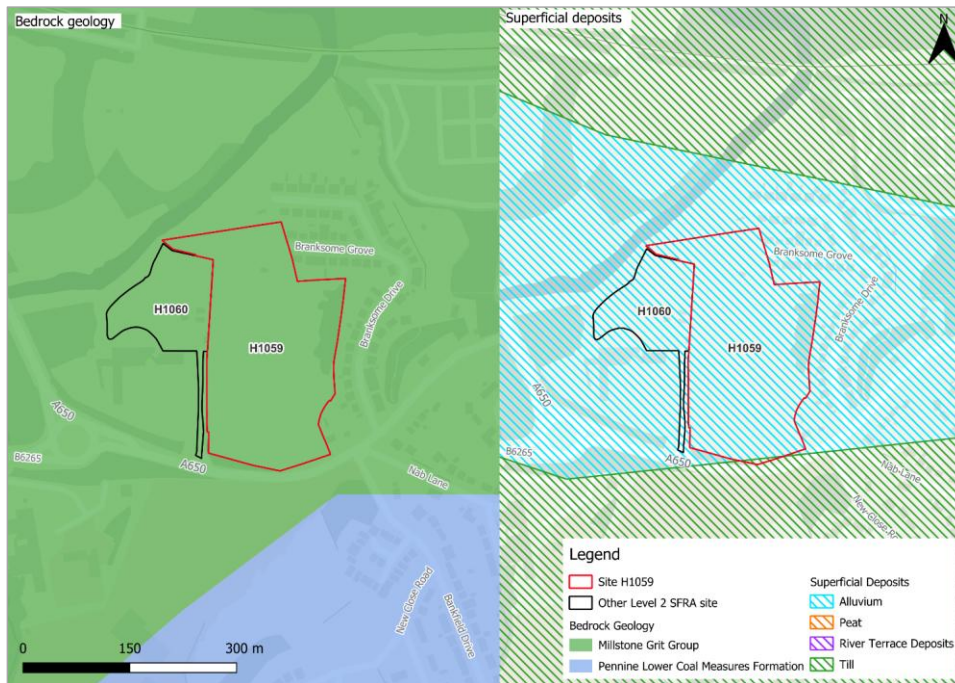


Figure 1-3: Soils and geology

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

Fluvial flood risk to the site comes from the River Aire to the north of the site. The River Aire is designated main river. A small area of functional floodplain is present within the northwestern corner of the site. The area of functional floodplain should be left free of development. The functional floodplain in this location is based on the 3.33% AEP defended event from the Leeds FAS Kildwick to Esholt 2022 model. There is a small area of Flood Zone 3a, and therefore at high risk, and Flood Zone 2, and therefore at medium risk, also within the northwestern corner of the site. Flood Zone 2 in this area is partially based on the EA's Historic Flood Map.

There is also risk to the east of the site from Nab Wood Beck which flows north into the Aire. The flood zones associated with this watercourse do not follow the course of the river which flows to the east of the houses on Branksome Drive. The flood zones in this area may therefore be erroneous. The EA should be consulted on risk from this watercourse. However, a model for this watercourse has not been made available for this Level 2 SFRA and any additional risk from climate change cannot be quantified at this stage.

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

Flood Zone 1 (% area)	Flood Zone 2 (% area)	Flood Zone 3a (% area)	Flood Zone 3b (% area)
97	1	1	1



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

2.1.2 Leeds FAS Kildwick to Esholt 2022 model outputs

Figure 2-2 shows the modelled flood depths for the 1% AEP undefended event which is the event Flood Zone 3 of the Flood Map for Planning is based on. Modelled risk to the site is the same as that shown by Flood Zone 3a, impacting the northwestern corner of the site only. Maximum flood depths within the area at risk are modelled to be between 0.3 and 0.6 m. Modelled flood velocities are generally low across the area at risk (Figure 2-3), with maximum velocities of 0.5 m³/s. Modelled flood hazards are categorised as 'very low hazard' and 'danger for some' (Figure 2-4). Safe access and escape routes are likely to be achievable via the A650 to the south of the site. Section 2.3.1 discusses the defended model outputs.

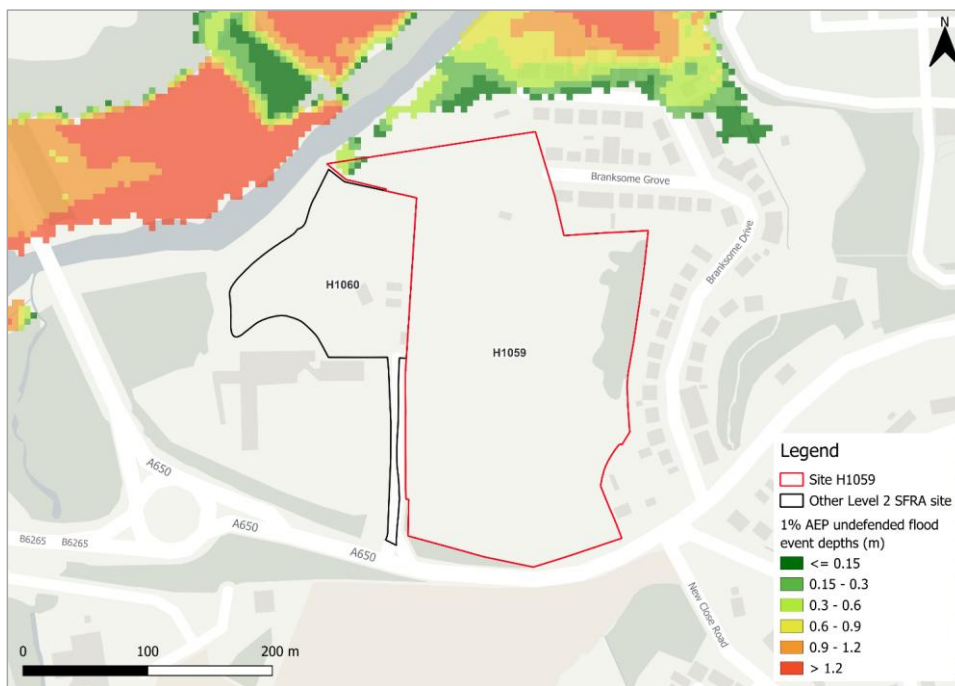


Figure 2-2: Flood depths for 1% AEP undefended flood event

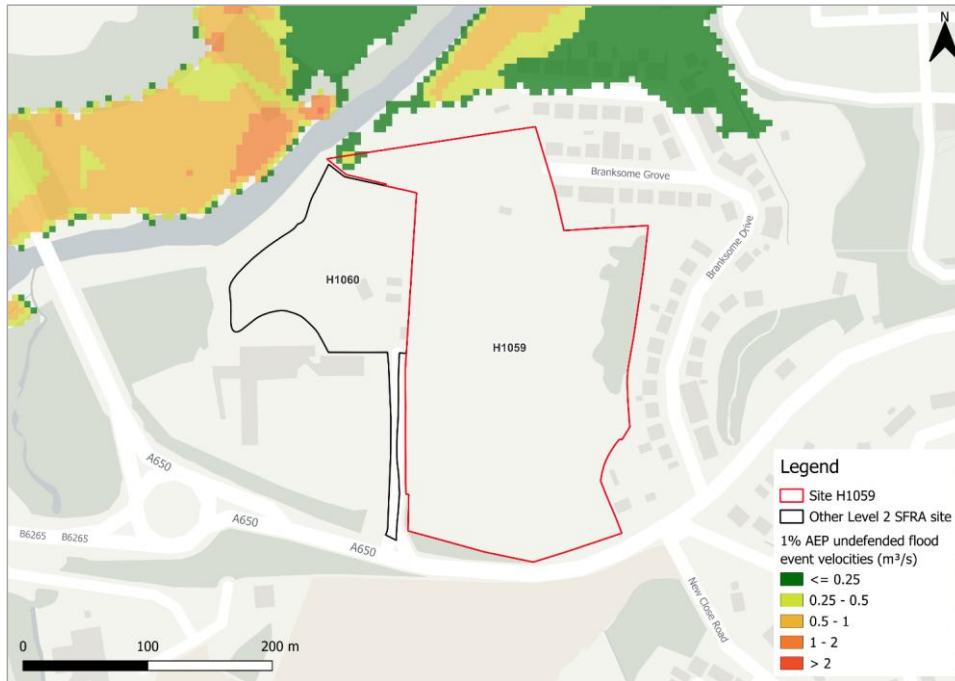


Figure 2-3: Flood velocities for 1% AEP undefended flood event

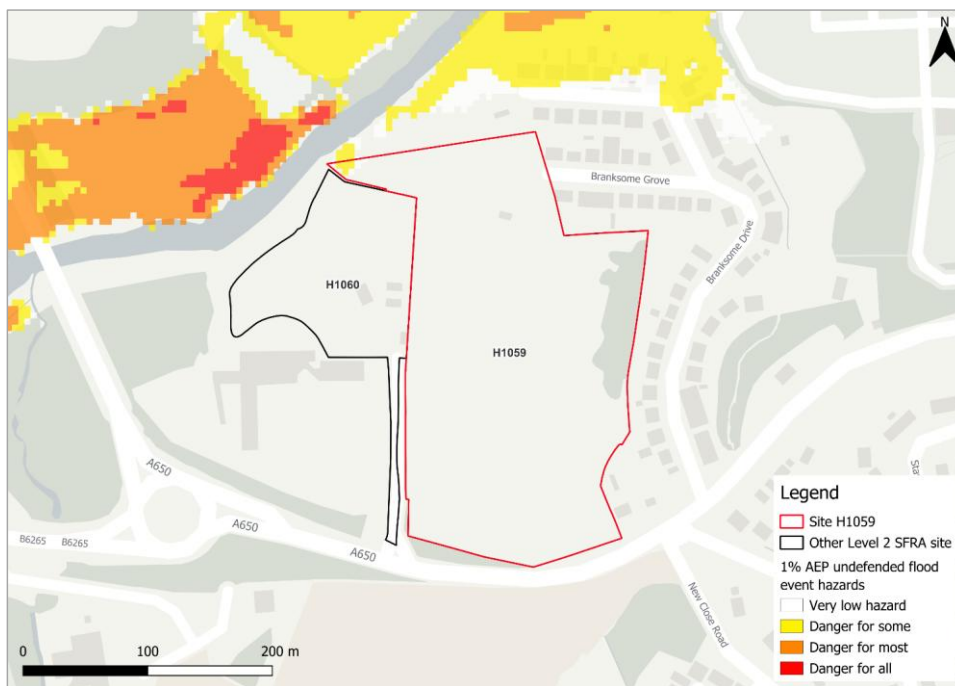


Figure 2-4: Flood hazard¹ for 1% AEP undefended flood event

2.2 Impacts from climate change

The impacts of climate change on flood risk from the River Aire have been modelled without flood defence infrastructure in place. This allows for direct comparison with the existing risk of the Flood Map for Planning. Section 2.3.1 discusses the defended model outputs.

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

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%

There is no significant increase to the area of the site within the functional floodplain as a result of 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 very similar in extent to the present day event. Maximum onsite depths increase to between 0.6 and 0.9 m. Modelled flood velocities (Figure 2-6) and hazards (Figure 2-7) remain similar to the present day event. Safe access and escape routes should remain achievable via the A650 to the south.

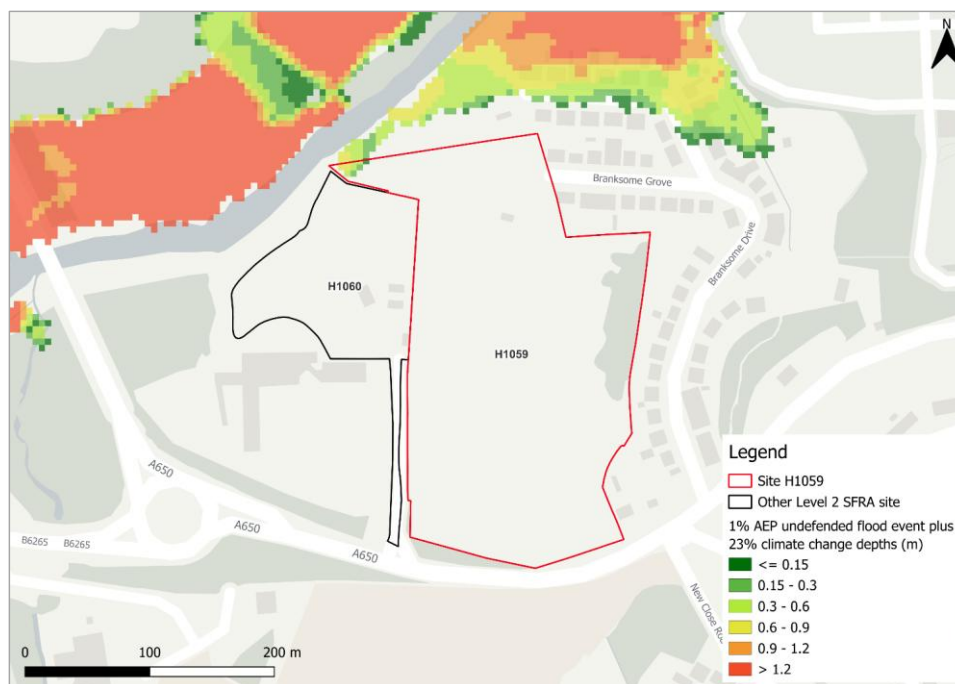


Figure 2-5: Flood depths for 1% AEP undefended flood event +23% (central climate change allowance)

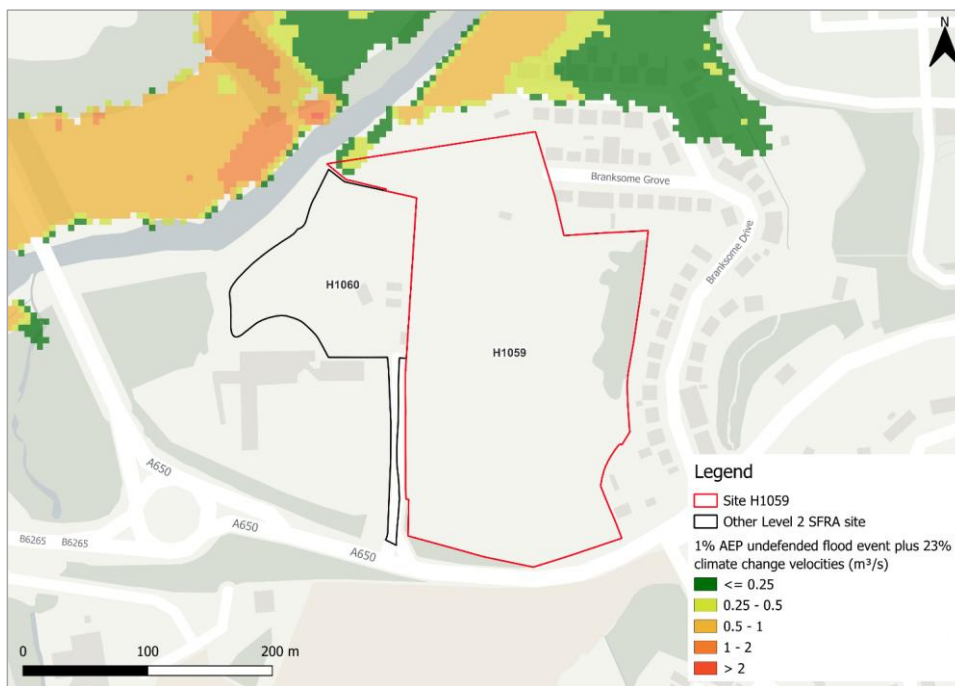


Figure 2-6: Flood velocities for 1% AEP undefended flood event +23% (central climate change allowance)

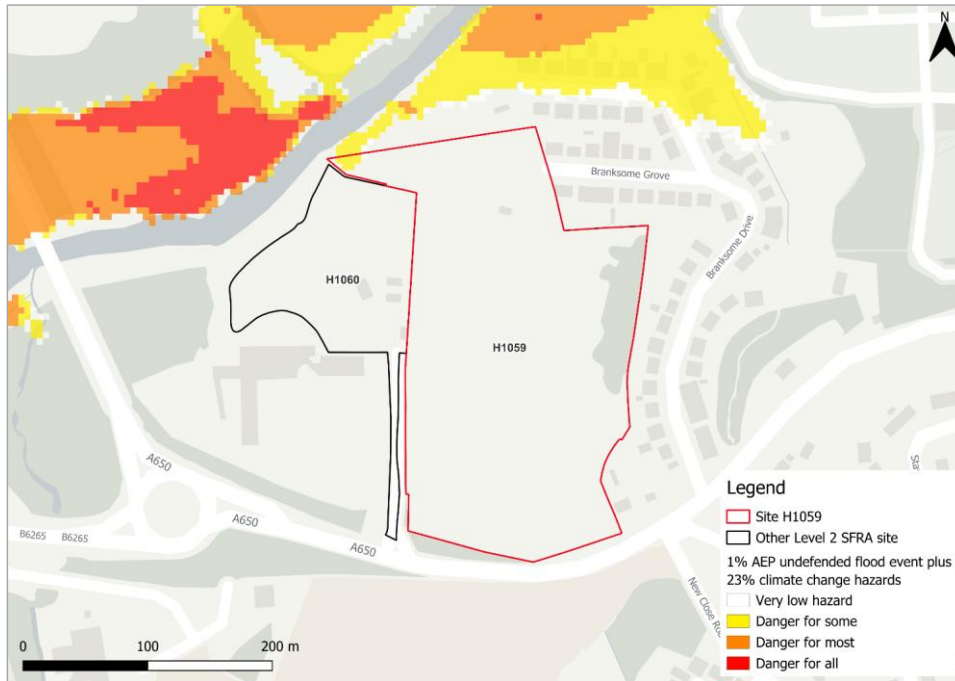


Figure 2-7: Flood hazard for 1% AEP undefended flood event +23% (central climate change allowance)

2.3 Flood risk management

2.3.1 Flood defences

The site does not benefit from any formal engineered flood defences, according to the EA's spatial flood defences dataset. This is reflected in the defended modelled 1% AEP flood extent and depths being very similar to the undefended event within the site (Figure 2-8). This is consistent with the modelled climate change events.

There are areas of natural high ground along the banks of the River Aire adjacent to the site.

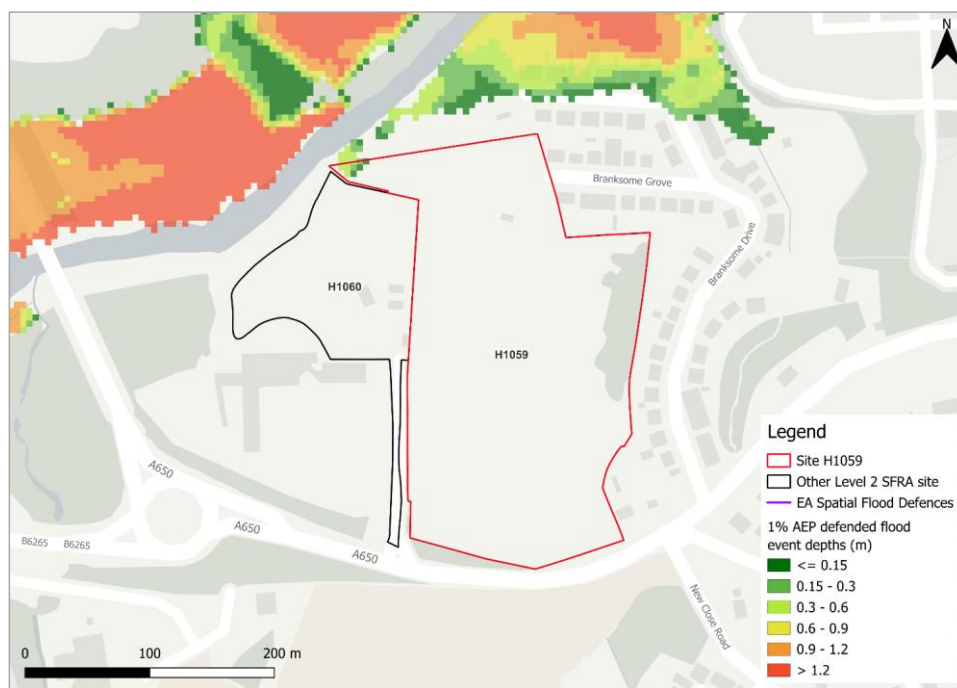


Figure 2-8: Flood depths for 1% AEP defended flood event

2.3.2 Working with Natural Processes

The EA's Working with Natural Processes (WwNP) dataset has been interrogated to identify opportunities for Natural Flood Management (NFM) that may help to reduce flood risk to the site and surrounding areas. Within the northwestern corner of the site, there is potential for riparian tree planting indicating areas where woodland would be effective to attenuate flooding. Upstream of the site, there is further potential for riparian planting, with additional areas that have the potential for floodplain reconnection, and floodplain / wider catchment woodland planting. 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.

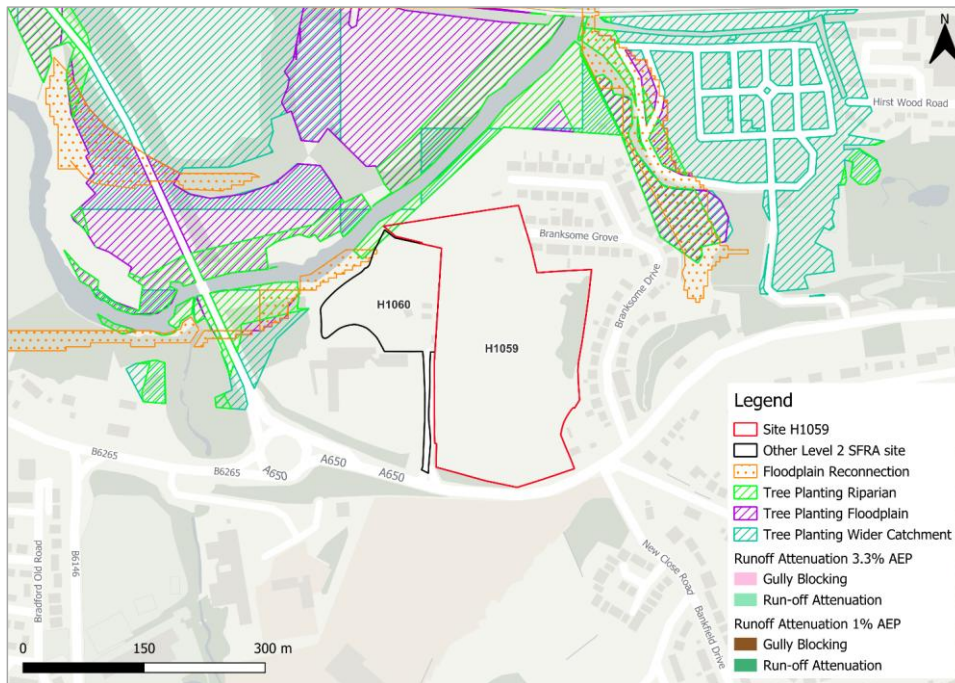


Figure 2-9: Natural Flood Management (NFM) potential mapping

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) has been considered and mapped in Figure 2-10 which shows the northwestern corner of the site has been subject to flooding in the past. The RFO dataset indicates that these historic events have occurred as a result of the channel capacity of the River Aire being exceeded in October 2000 and February 2002.

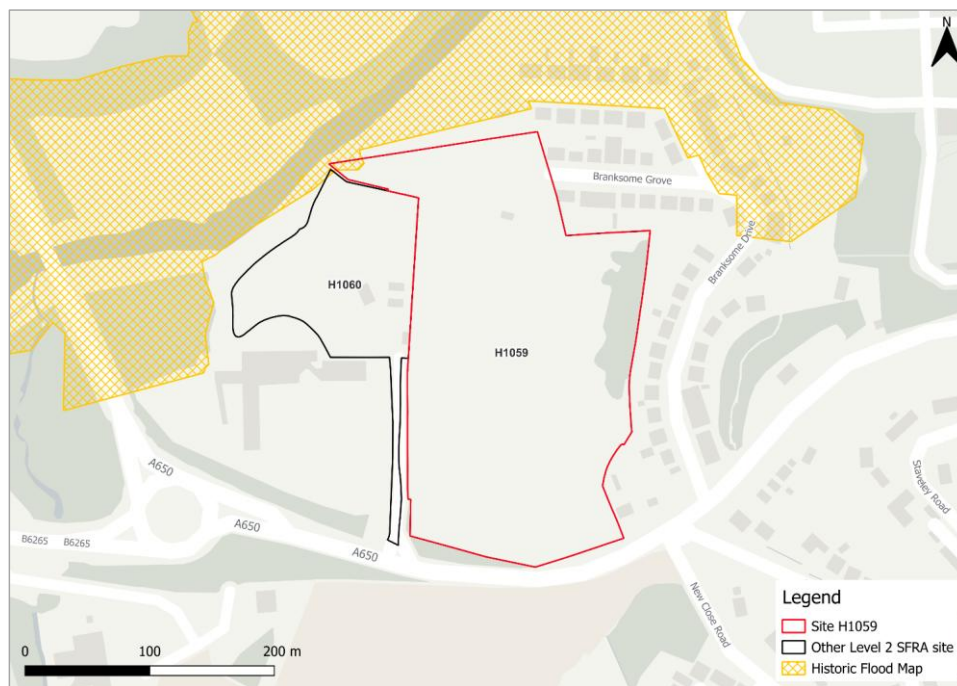


Figure 2-10: Recorded historic flood events onsite and around the site

2.5 LLFA flood incidents

The LLFA have records of 40 flood incidents taking place to the northwest of the site, these incidents largely occurred in 2015, with two taking place in 2020.

These incidents are possibly due to land drainage issues. Houses on Branksome Grove, northwest of the site, experienced surface water / sewer flooding, as well as flooding beneath flooring in 2015. Flooding was also reported of the highway at the junction of Bradford Road and Branksome Drive from Nab Wood Beck watercourse.

Developers should contact the LLFA for further information at the FRA stage, to assess potential flood risk to the site associated with these incidents.

2.6 Flood warning and access and escape routes

The EA operates a Flood Warning Service for properties located within a Flood Warning Area (FWA) for when a flood event is expected to occur. The site is partially located within a FWA, namely 123FWF118 - River Aire at Branksome Drive, Nab Wood.

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

issued when there is less confidence that flooding will occur in a FWA. The site is also partially located within a FAA, namely 123WAF961 - Middle River Aire catchment.

Based on available information, safe access and escape routes could likely be achieved during a flood event via the A650 to the south of the site.

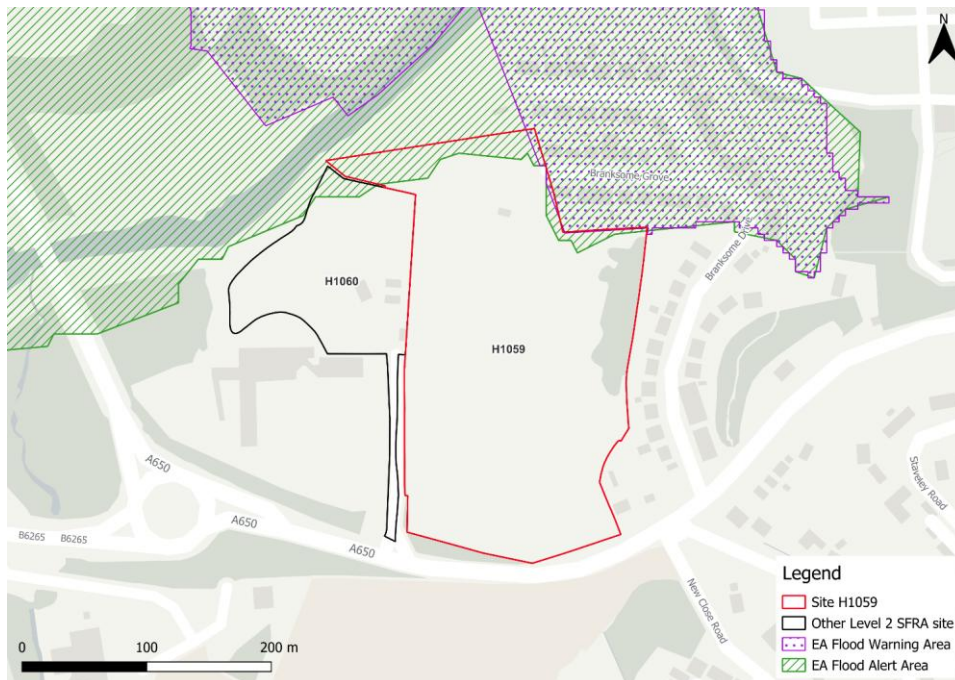


Figure 2-11: EA Flood Warning Areas and Flood Alert Areas

2.7 Observations, mitigation options and site suitability - fluvial

- The proposed development of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF.
- Given the change in use and therefore vulnerability of the site, the FRA must show that the development can be designed to be safe and that there is adequate emergency planning provision (para 014 FRCC-PPG).
- The site is modelled to be within the functional floodplain within the northwestern corner of the site, adjacent to the River Aire. Development is not permitted within the functional floodplain. If feasible, this area would be used as a green / blue corridor which can provide multifunctional benefits providing ecological, social and amenity value.
- If the development of the site involves any activity within 8 metres of the River Aire, a flood risk activity permit may be required from the EA in addition to planning permission. For non-tidal main rivers, a flood risk activity permit may be

required if the development of the site is within 8 metres of a riverbank, flood defence structure or culvert.

- The northwestern corner of the site is modelled to be at risk from fluvial sources (according to the Leeds FAS Kildwick to Esholt 2022 model) in the 1% AEP undefended scenario, to the same extent as Flood Zone 3a. Therefore, more vulnerable development should be directed to the areas of the site 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. It should be possible to direct all development to Flood Zone 1, including for climate change, and therefore satisfy the requirements of the exception test.
- 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 1% AEP undefended +23% climate change (central allowance) event is modelled to be similar in extent to the present day event.
- EA flood warnings and alerts should continue to be in place.
- Risk from Nab Wood Beck should be fully quantified. The EA should be consulted on the robustness of the flood zones for this watercourse.
- Were development of this site to proceed, given the proximity of this site to neighbouring site H1060, it would be prudent to formulate a strategy to develop these sites in tandem and for consultation between each developer to take place to ensure a joined-up approach for sustainable development is in place.

Commented [JD1]: CBMDC need to check whether H1060 is still within the site mix for the Reg 19 plan.

3 Flood risk from surface water

3.1 Existing risk

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

In the high risk event, surface water risk is confined to an area of ponding within a topographic low spot within the north of the site. This area increases slightly in extent in the medium risk event. In the low risk event, an additional shallow flow path develops within the east of the site.

Greatest flood depths within the site in the medium risk event are between 0.3 and 0.6 m (Figure 3-1) with hazards categorised as moderate (Figure 3-2). Safe access and escape routes are likely to be achievable via the A650 to the south of the 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)
97	1	1	1

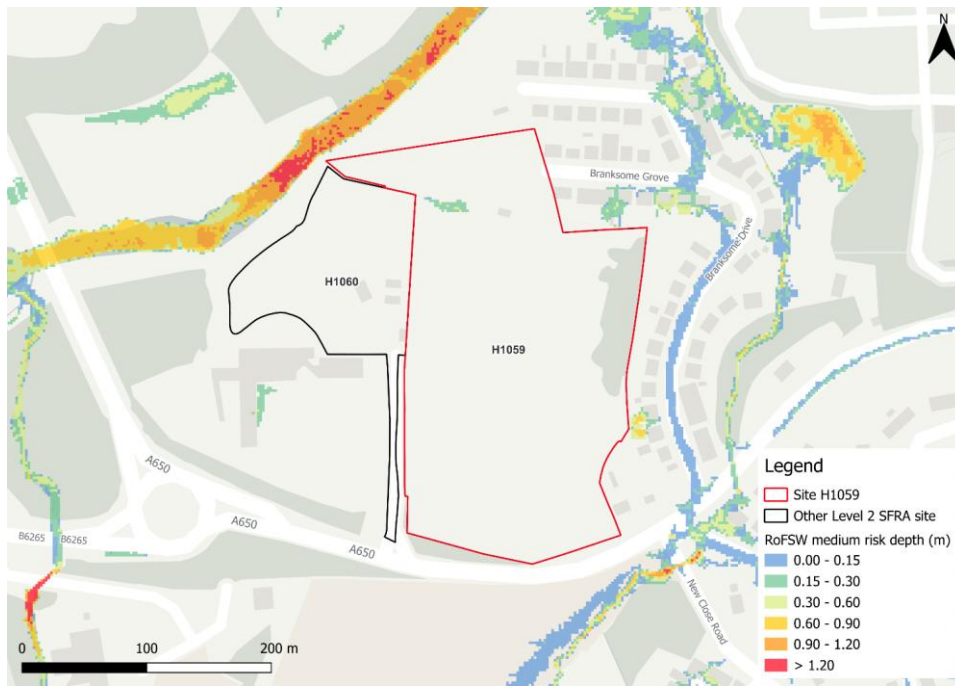


Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

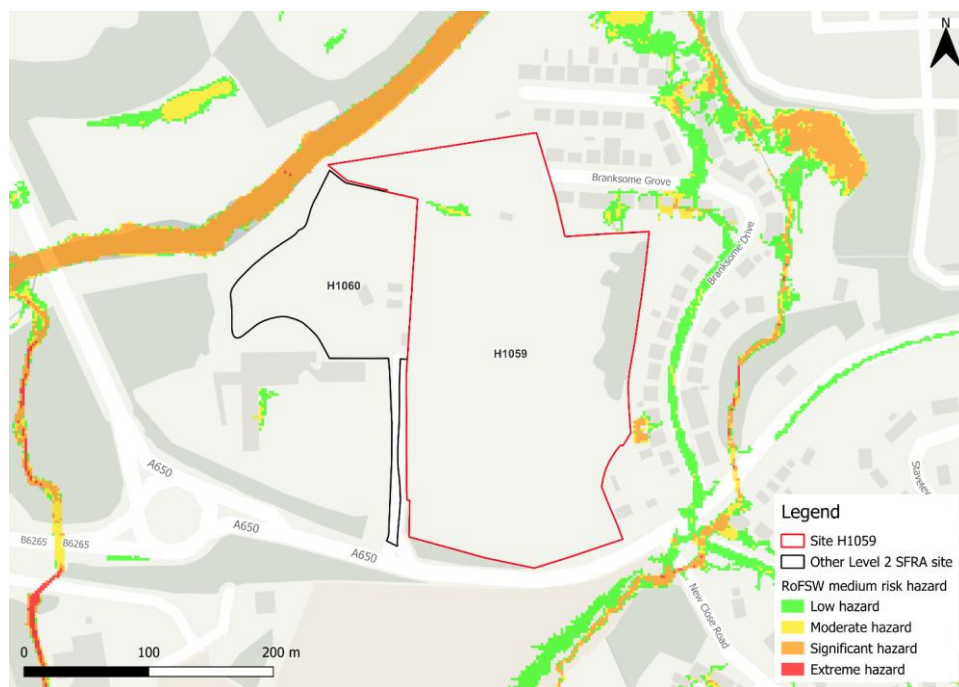


Figure 3-2: Medium risk event surface water flood hazard² (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

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

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

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

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

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

the medium risk climate change event showing a similar level of risk to the present day low risk event. Maximum depths are modelled to be between 0.3 and 0.6 m, with areas of hazard categorised as significant (Figure 3-4). Safe access and escape routes should remain achievable via the A650.

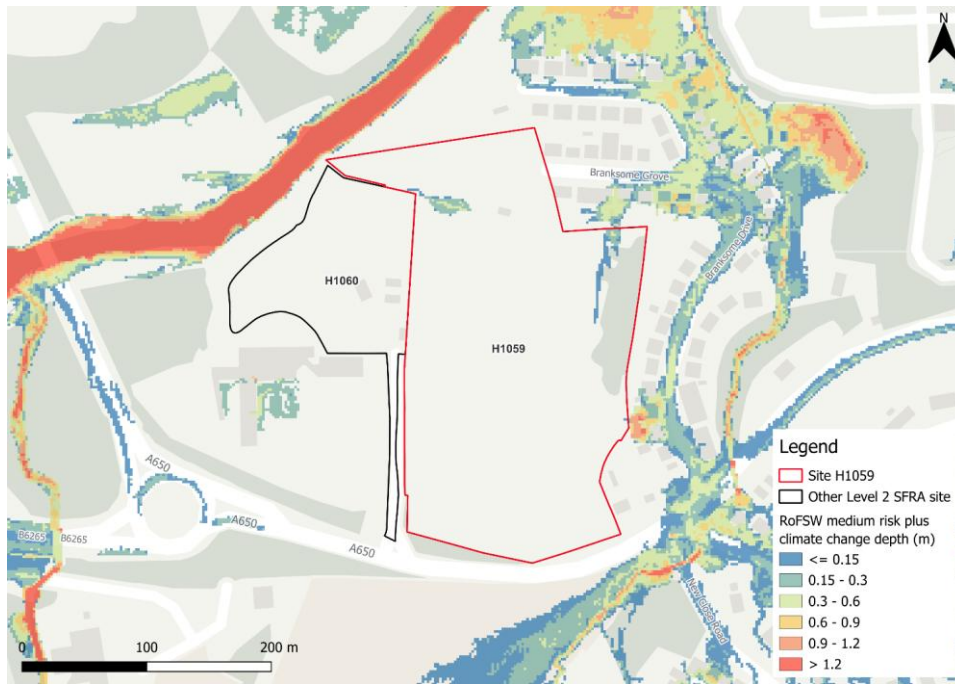


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)

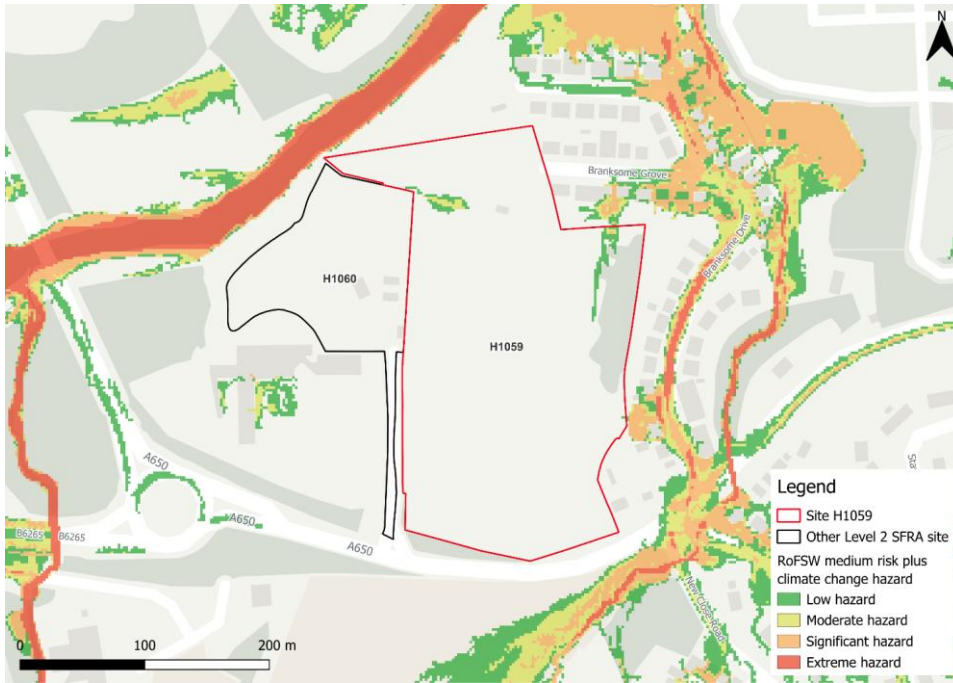


Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk is nominal and confined to a small area of ponding within the north of the site.
- As mentioned in Section 2.5, properties northwest of the site experienced surface water / sewer flooding in 2015. Developers should contact the LLFA for further information to inform potential risk to the site associated with these incidents.
- A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on layout plans and detailed design and full consultation with the LLFA. Runoff volumes must not exceed existing greenfield rates and, if possible, betterment should be achieved.
- Note that the RoFSW map is not suitable for identifying whether an individual property will flood and is therefore indicative. The RoFSW map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

4 Risk from groundwater

Risk of groundwater emergence is assessed in this SFRA using JBA's 5m Groundwater Emergence Map. This dataset is recommended for use by the EA in the SFRA Good Practice Guide³. Figure 4-1 shows the map covering this site and the surrounding areas and Table 4-1 explains the risk classifications.

The majority of the site is in an area where there is no risk of groundwater emergence. Groundwater conditions may therefore be suited to infiltration SuDS. Within the south of the site, there is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.

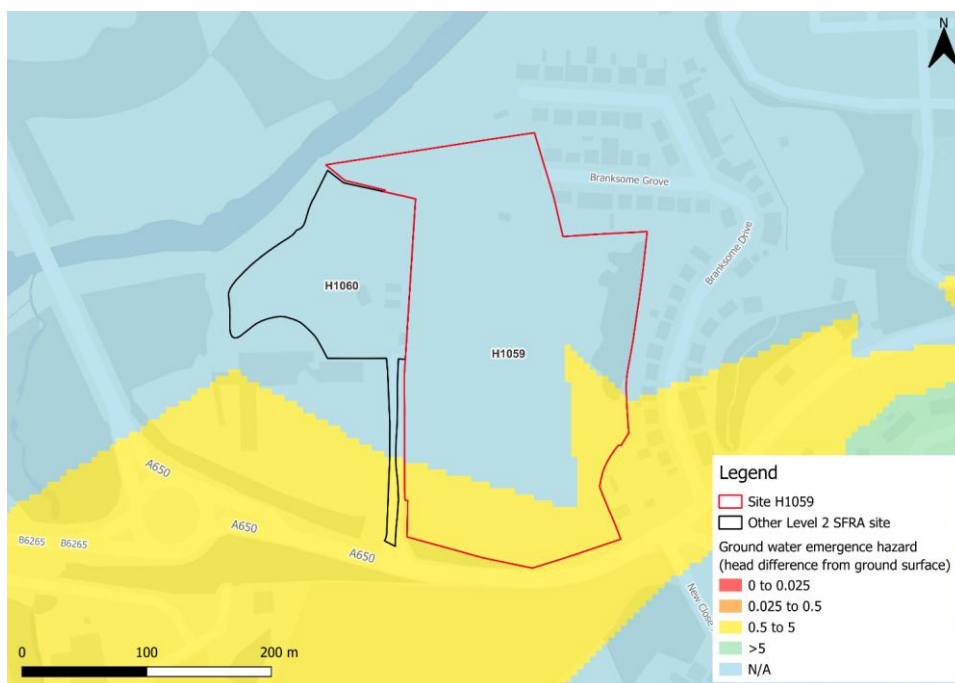


Figure 4-1: JBA 5m Groundwater Emergence Map

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

5.1 Flood risk from reservoirs

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

The site is potentially at risk from 18 reservoirs. Of these 18 reservoirs, 14 are located within Bradford, three located within North Yorkshire and one located within Pendle. These are operated by either Yorkshire Water Services Ltd, the National Trust or the Canal & River Trust.

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.

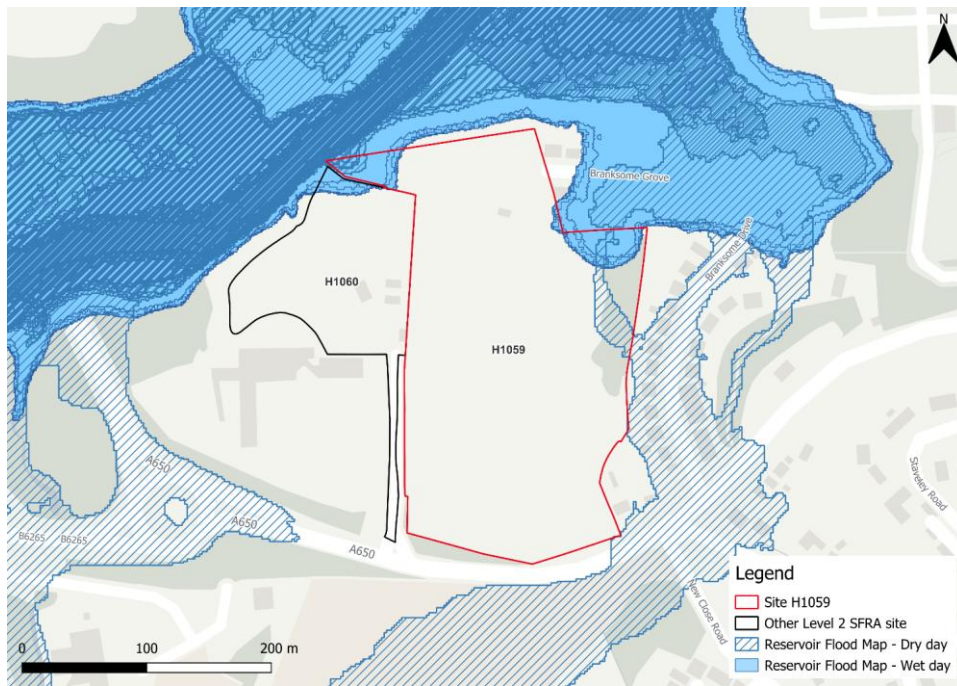


Figure 5-1: Flood risk from reservoirs

5.2 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.

5.3 Observations, mitigation options and site suitability - residual risk

- As mentioned in Section 2.5, properties northwest of the site experienced surface water / sewer flooding in 2015. Developers should contact the LLFA for further information to inform potential risk to the site associated with these incidents.
- The site is at potential residual risk from a breach of 18 reservoirs. However, only five reservoirs impact the site in the 'dry day' flood extent, namely Chellow Heights West, Lower Laithe, Stubden, Thornton Moor and Water Sheddles reservoirs. This indicates that the remaining 13 reservoirs are only modelled to impact the site based on the 'wet day' flood extent, which represents a prediction

of the credible worst case scenario, therefore it's unlikely that any actual flood would be this large.

- 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.
- Given the historic sewer flooding in the area, developers should contact Yorkshire Water directly to check specific details at the FRA stage.

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 100 years for residential development. Based on the available information documented within this Level 2 SFRA, this site should be able to pass the exception test provided development is directed to the areas of the site within Flood Zone 1, including for climate change.

6.2 Recommendations, FRA requirements, and further work

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

- It should be possible to develop this site for more vulnerable uses.
- There should be no development within the existing area of functional floodplain present on site.
- Development should be directed away from the northwestern corner of the site modelled to be at fluvial flood risk.
- Consultation should be had with the reservoir owners that may be affected by the development of this site.
- Given the historic sewer flooding in the area, developers should contact Yorkshire Water directly to check specific details at the FRA stage.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA online guidance; the CBMDC Local Plan and national and local SuDS policy and guidelines.
- Throughout the FRA process, consultation should be carried out with the following, where applicable, the local planning authority; the lead local flood authority; emergency planning officers; the Environment Agency; Yorkshire Water; the highways authorities; and the emergency services.

⁵ Para 178 National Planning Policy Framework 2024

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Bradford Level 2 Strategic Flood Risk Assessment - Site H1060

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

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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 H1060. 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' (2025) and is therefore familiar with the terminology used in this report.

1.1 Site H1060

- Location: Bankfield Farm, Nabwood, Shipley
- Existing site use: Residential and greenfield
- Existing site use vulnerability: More vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 1.6 hectares
- Proposed development impermeable area: 1.4 hectares
- Watercourse: River Aire (main river)
- Environment Agency (EA) river model: Leeds FAS Kildwick to Esholt 2022
- Summary of requirements from scoping stage:
 - Level 1 SFRA recommendation was for withdrawal from allocation or more detailed assessment through Level 2 SFRA
 - Assessment of modelled fluvial flood depths, velocities and hazards
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk
 - Modelling of latest EA climate change allowances for peak river flows and peak rainfall intensities

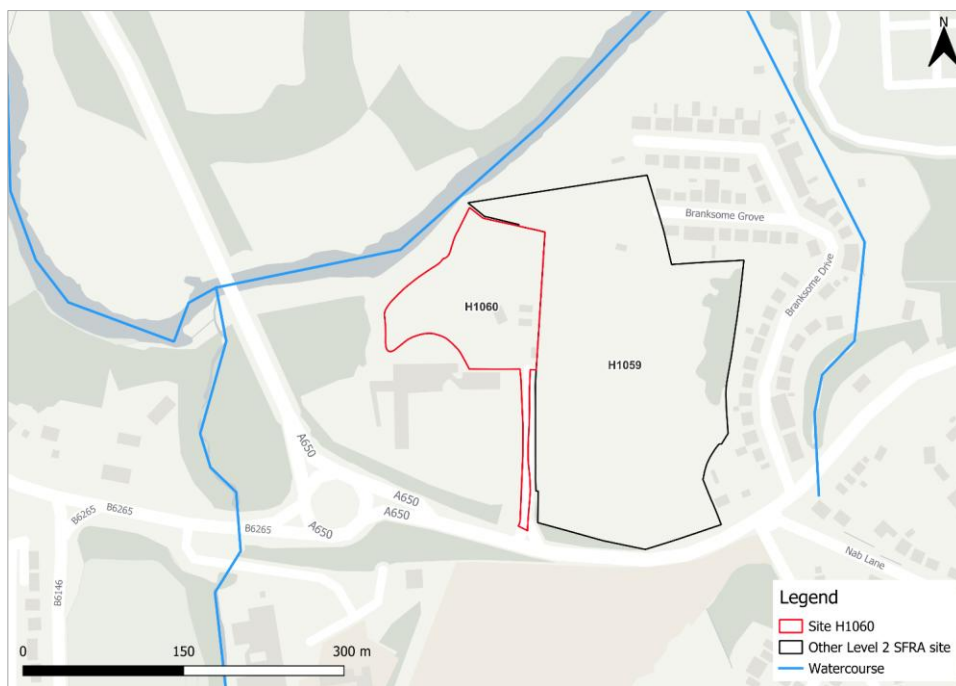


Figure 1-1: Existing site location boundary

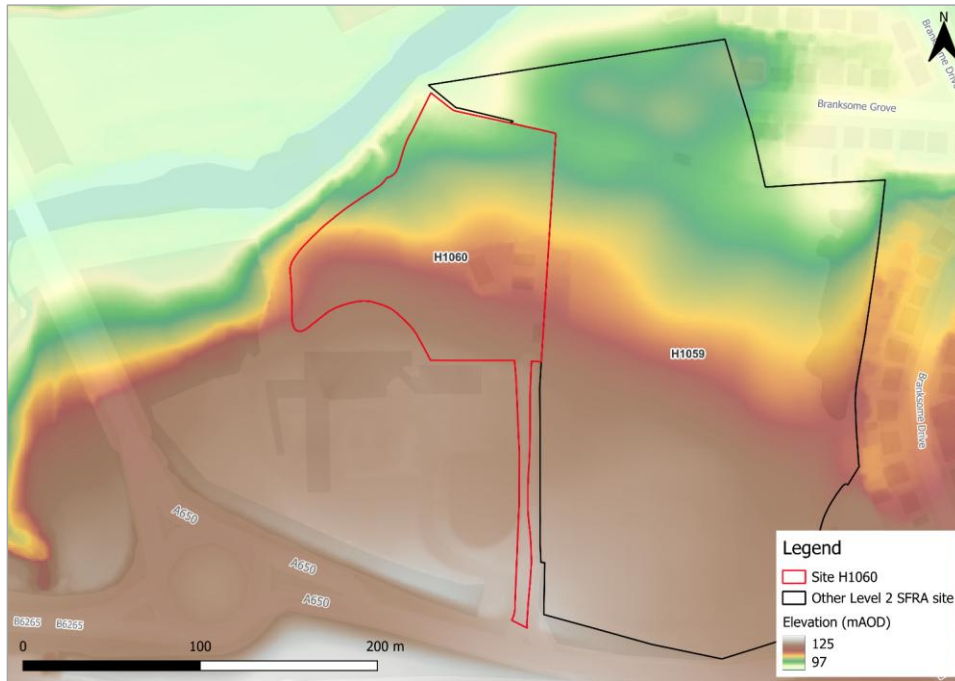


Figure 1-2: Topography

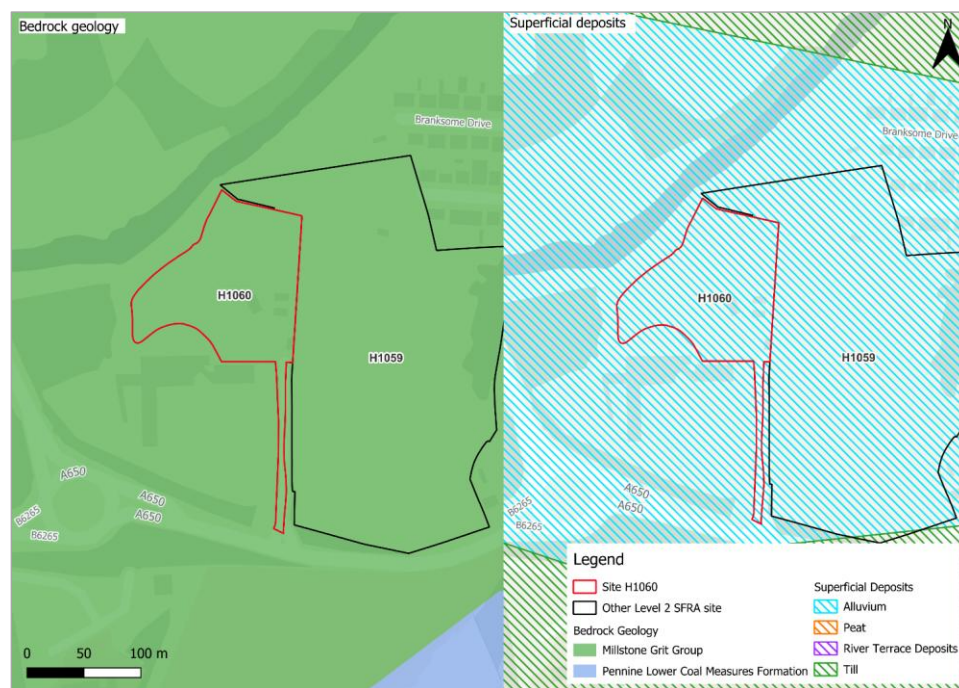


Figure 1-3: Soils and geology

2 Flood risk from rivers

2.1 Existing risk

2.1.1 Flood Map for Planning and functional floodplain

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

Fluvial flood risk to the site comes from the River Aire adjacent to the northwestern site boundary. The River Aire is designated main river. The northern corner of the site is situated within Flood Zone 2 and therefore at medium risk of flooding from rivers. The remaining area of the site is within Flood Zone 1 and therefore at low risk.

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

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



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

2.1.2 Leeds FAS Kildwick to Esholt 2022 model outputs

Figure 2-2 shows the modelled flood depths for the 0.1% AEP undefended event which is the event Flood Zone 2 of the Flood Map for Planning is based on. Modelled risk to the site is different to that shown by Flood Zone 2, impacting the northern site boundary rather than the northern corner of the site. This would indicate that Flood Zone 2 is based on different modelling to the 0.1% AEP flood event outline. Flood Zone 2 appears to be based on the EA's Historic Flood Map (HFM) dataset in this area, the HFM is shown in Figure 2-10. Maximum flood depths within the site are modelled to be <0.15 m. Modelled flood velocities are low across the area at risk (Figure 2-3), with velocity not exceeding 0.25 m³/s. This is reflected in the modelled flood hazard being 'very low hazard' across the area at risk (Figure 2-4). Safe access and escape routes should be achievable via the A650 during this event. Section 2.3.1 discusses the defended model outputs.

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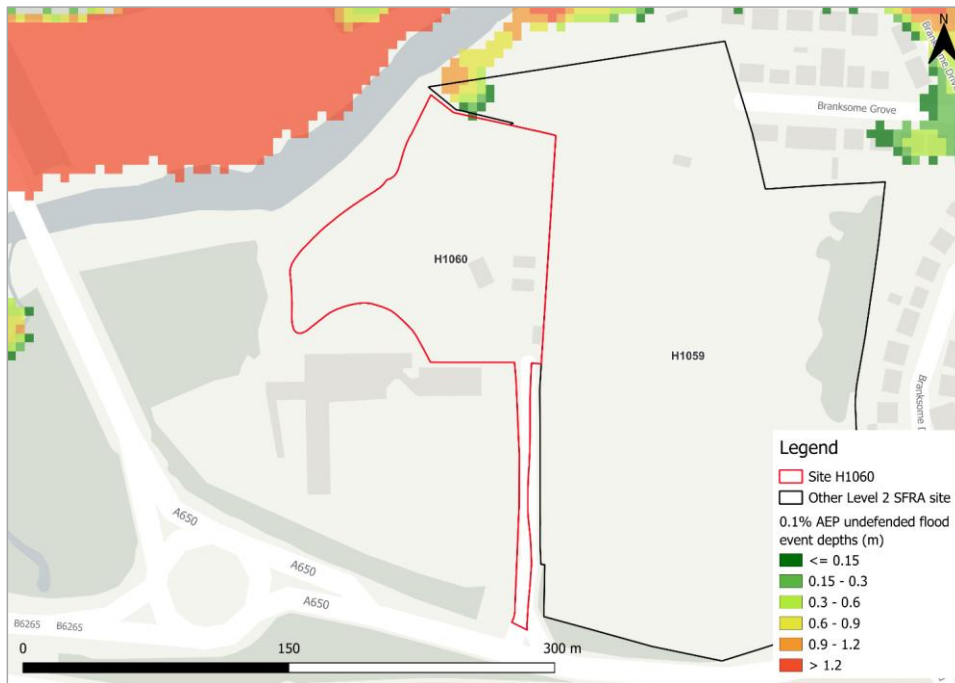


Figure 2-2: Flood depths for 0.1% AEP undefended flood event

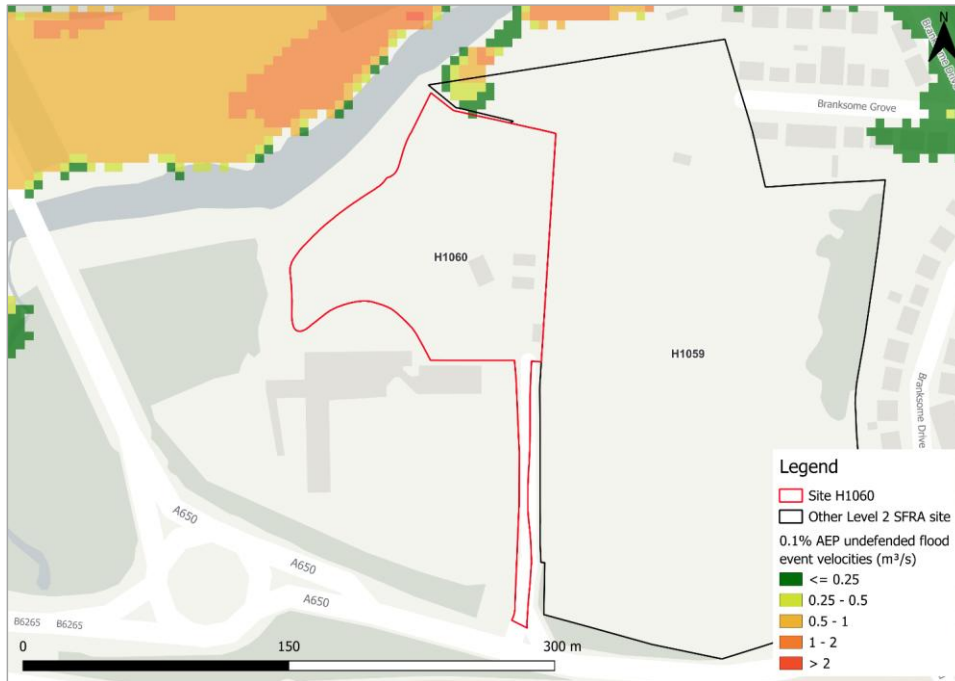


Figure 2-3: Flood velocities for 0.1% AEP undefended flood event

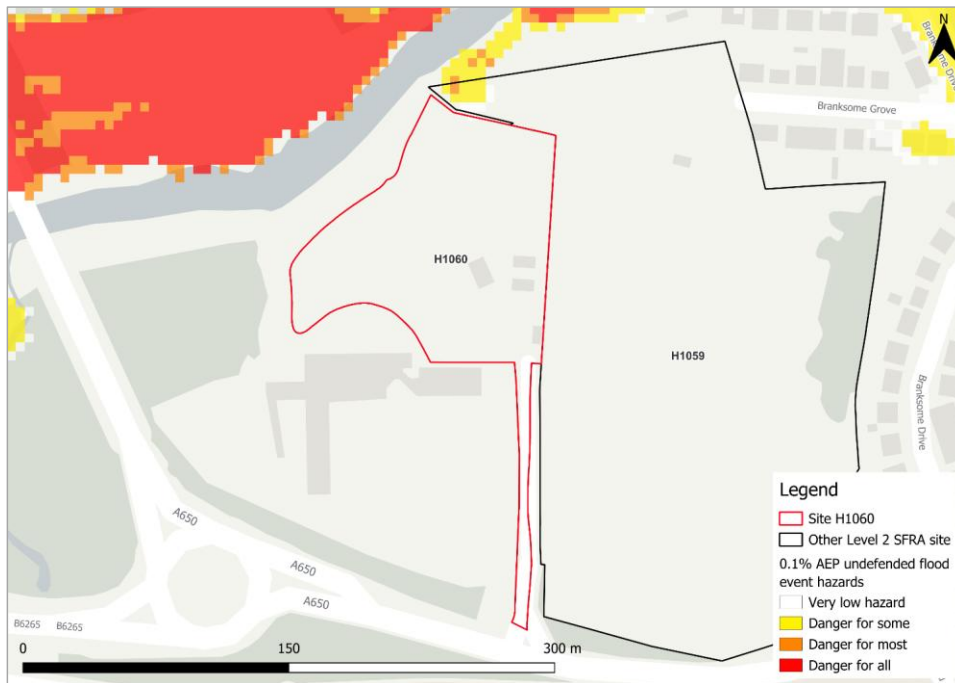


Figure 2-4: Flood hazard¹ for 0.1% AEP undefended flood event

2.2 Impacts from climate change

The impacts of climate change on flood risk from the River Aire have been modelled without flood defence infrastructure in place. This allows for direct comparison with the existing risk of the Flood Map for Planning. Section 2.3.1 discusses the defended model outputs.

With consideration of the EA's SFRA guidance, the latest climate change central and higher central allowances have been modelled as shown in

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. The EA's SFRA guidance states that SFRAs should assess the central allowance for less, more, and highly vulnerable development, and also water compatible development. The higher central should be assessed for essential infrastructure.

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

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

Figure 2-5 shows the modelled flood depths for the 0.1% AEP undefended event +23% for climate change. Risk is modelled to be greater in both extent and depth in comparison to present day conditions. Maximum depths within the area at risk remain low, between 0.15 and 0.3 m. Flood velocities are modelled to remain less than or equal to 0.25 m³/s (Figure 2-6). The modelled flood hazard within the area at risk is categorised as 'danger for some' (Figure 2-7). Safe access and escape routes should remain achievable via the A650 during the climate change event.

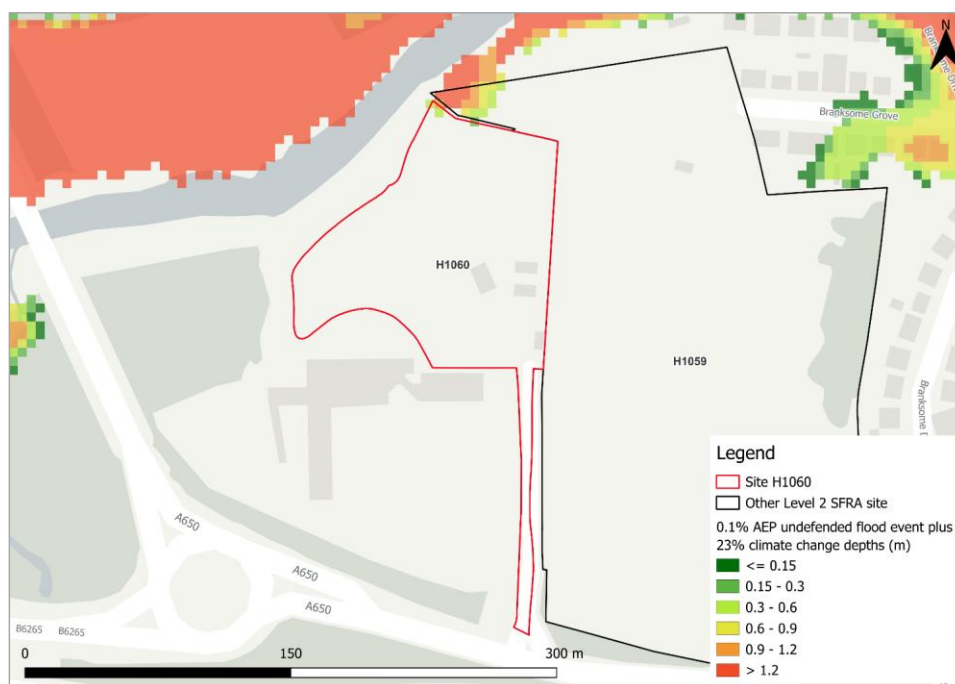


Figure 2-5: Flood depths for 0.1% AEP undefended flood event +23% (central climate change allowance)

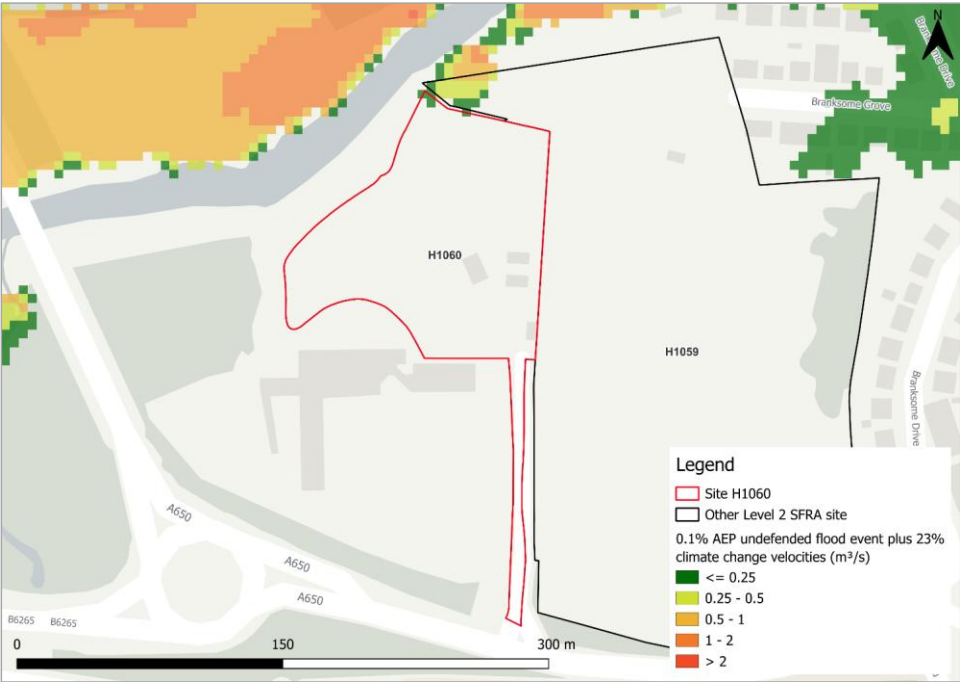


Figure 2-6: Flood velocities for 0.1% AEP undefended flood event +23% (central climate change allowance)

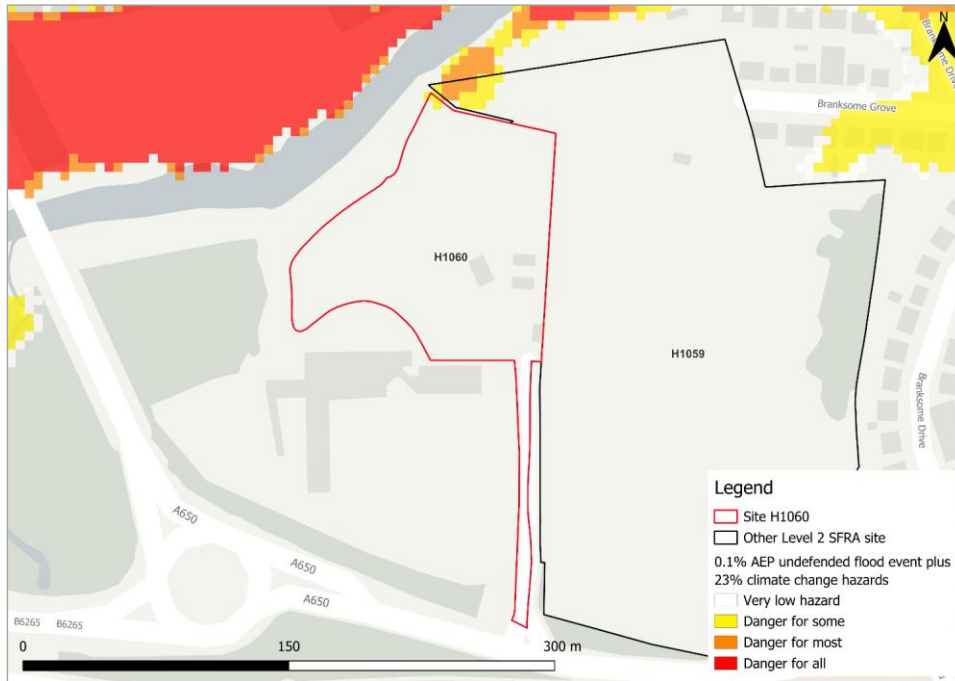


Figure 2-7: Flood hazard for 0.1% AEP undefended flood event +23% (central climate change allowance)

2.3 Flood risk management

2.3.1 Flood defences

The site does not benefit from any formal engineered flood defences, according to the EA's spatial flood defences dataset. This is reflected in the defended modelled flood extent and depths being very similar to the undefended event within the site (Figure 2-8). This is consistent with the modelled climate change events.

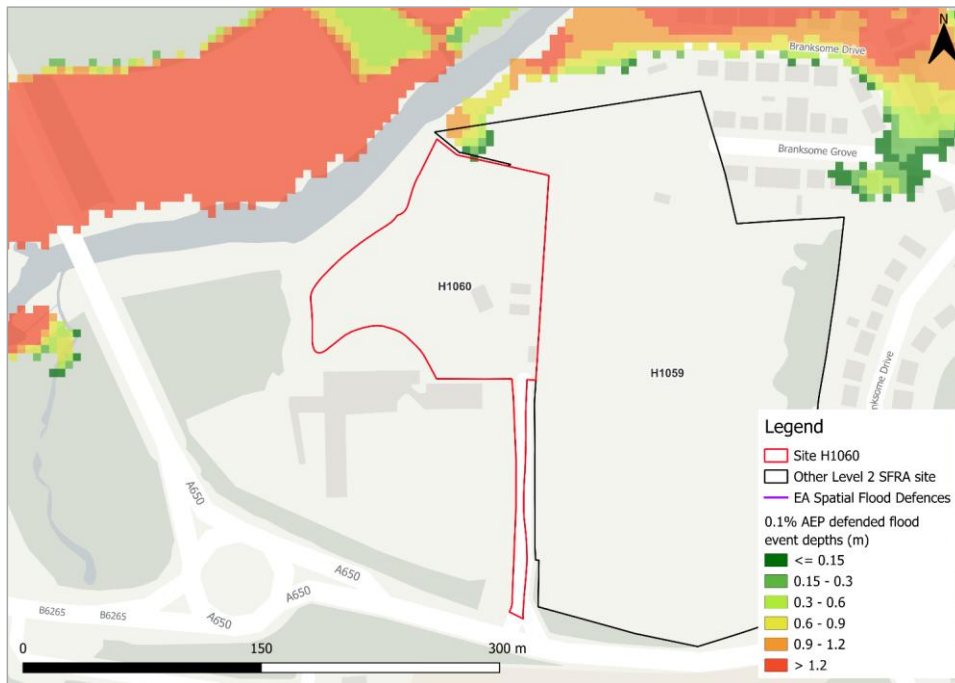


Figure 2-8: Flood depths for 0.1% AEP defended flood event

2.3.2 Working with Natural Processes

The EA's Working with Natural Processes (WwNP) dataset has been interrogated to identify opportunities for Natural Flood Management (NFM) that may help to reduce flood risk to the site and surrounding areas. At the northern corner of the site, there is potential for tree planting indicating locations where woodland planting may be possible and effective to attenuate flooding. There is also an area at the northern corner of the site where there is potential for floodplain reconnection. 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.

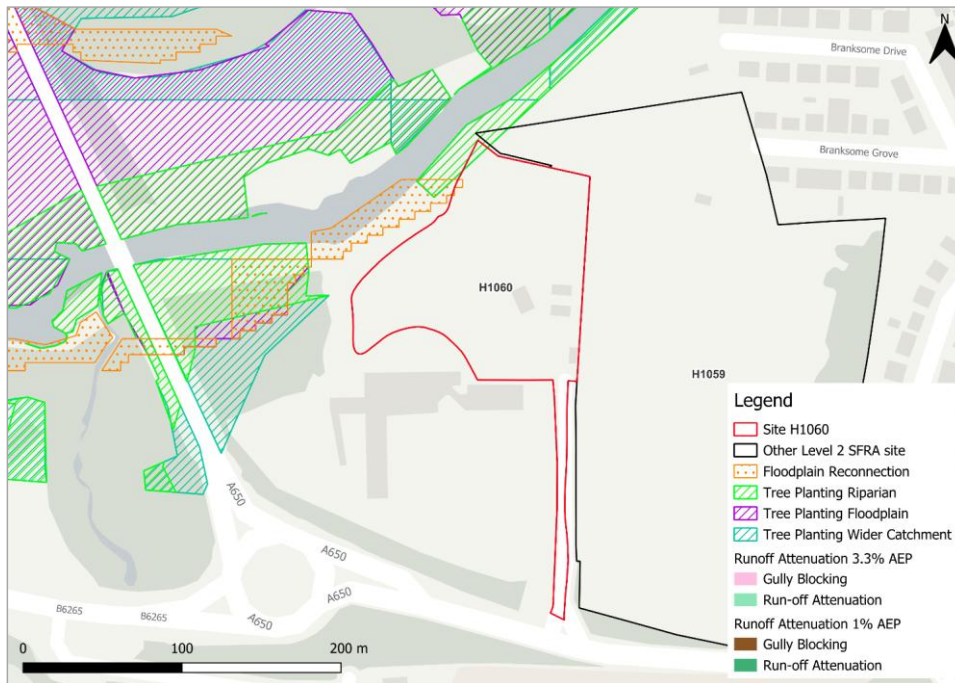


Figure 2-9: Natural Flood Management (NFM) potential mapping

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) has been considered and mapped in Figure 2-10 which shows the northern corner of the site has been subject to flooding in the past. The RFO dataset indicates that a historic flood event occurred as a result of the channel capacity of the River Aire being exceeded in October 2002.

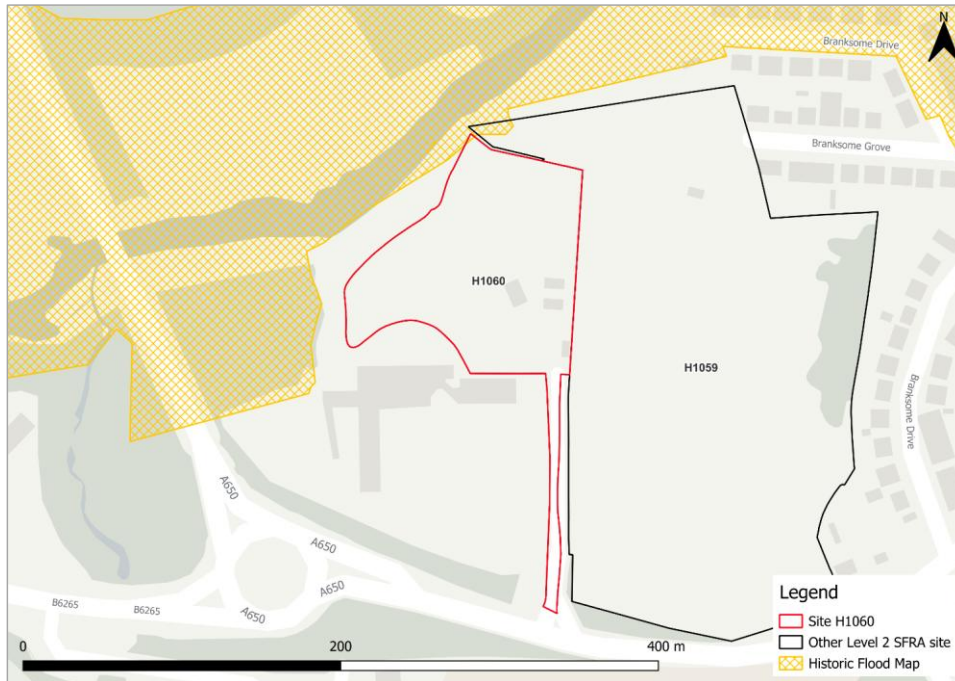


Figure 2-10: Recorded historic flood events onsite and around the site

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

Based on available information, safe access and escape routes should be achievable during a flood event, via the A650, south of the site.

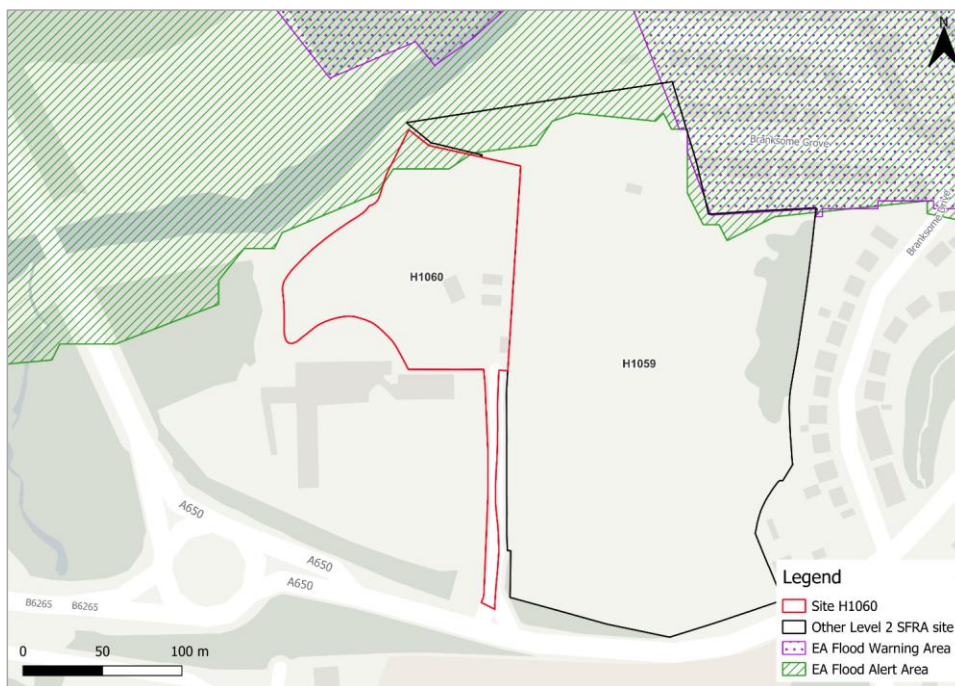


Figure 2-11: EA Flood Warning Areas and Flood Alert Areas

2.6 Observations, mitigation options and site suitability - fluvial

- The site is modelled to be within Flood Zone 2.
- If the development of the site involves any activity within 8 metres of the River Aire, a flood risk activity permit may be required from the EA in addition to planning permission. For non-tidal main rivers, a flood risk activity permit may be required if the development of the site is within 8 metres of a riverbank, flood defence structure or culvert.
- The northern corner of the site is modelled to be at risk from fluvial sources (according to the Leeds FAS Kildwick to Esholt 2022 model) in the 0.1% AEP undefended scenario, the remainder of the site is within Flood Zone 1.
- Based on 0.1% AEP flood depths and hazard ratings, it should be possible for more vulnerable development to take place within this site.
- Given the site is at medium risk from the River Aire, and future risk with climate change is modelled to be slightly greater, it is recommended that the northern corner of the site is not redeveloped for more vulnerable uses. This area should remain as open greenspace.
- EA flood alerts should continue to be in place along the River Aire.

- Given the proximity of this site to neighbouring site H1059, it would be prudent to formulate a strategy to develop these sites in tandem and for consultation between each developer to take place to ensure a joined-up approach for sustainable development is in place.

3 Flood risk from surface water

3.1 Existing risk

Based on the EA's national scale Risk of Flooding from Surface Water (RoFSW) map (November 2024), surface water risk to the site is very low. 100% of the site is located in the very low risk zone, as shown in Table 3-1.

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)
100	0	0	0

3.2 Observations, mitigation options and site suitability - surface water

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

4 Risk from groundwater

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

The majority of the site is located within an area where there is no risk of groundwater emergence. The southern half of the access road to the site is located within an area where there is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely. Groundwater conditions may therefore be suited to infiltration SuDS.

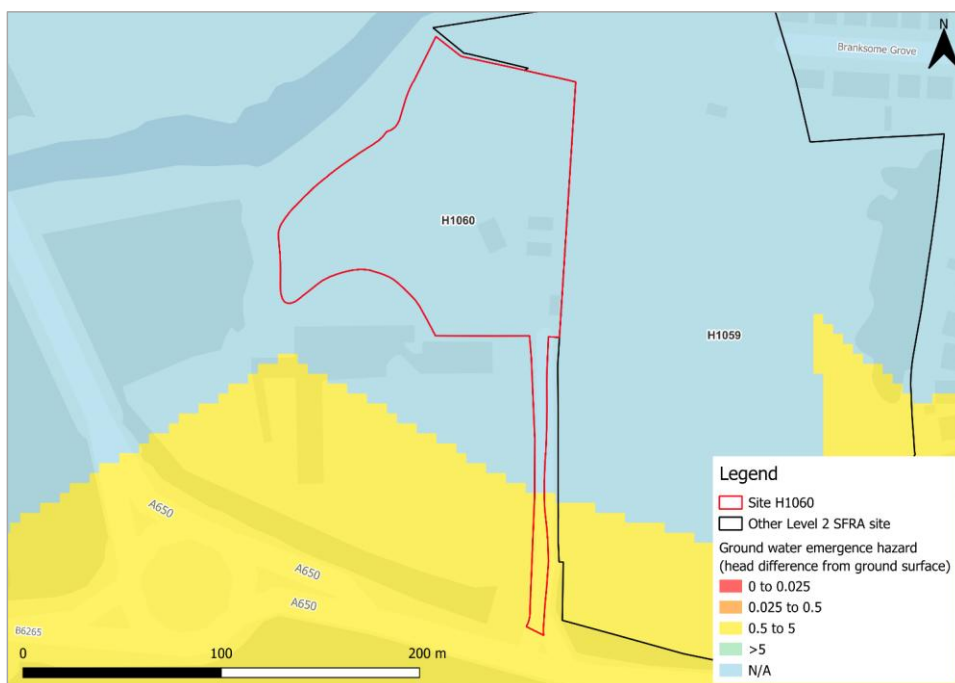


Figure 4-1: JBA 5m Groundwater Emergence Map

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 reservoirs

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

The site is potentially at risk from 16 reservoirs. Of these 16 reservoirs, 12 are located within Bradford, three located within North Yorkshire and one located within Lancashire. These are operated by either Yorkshire Water Services Ltd, the National Trust or the Canal & River Trust.

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.

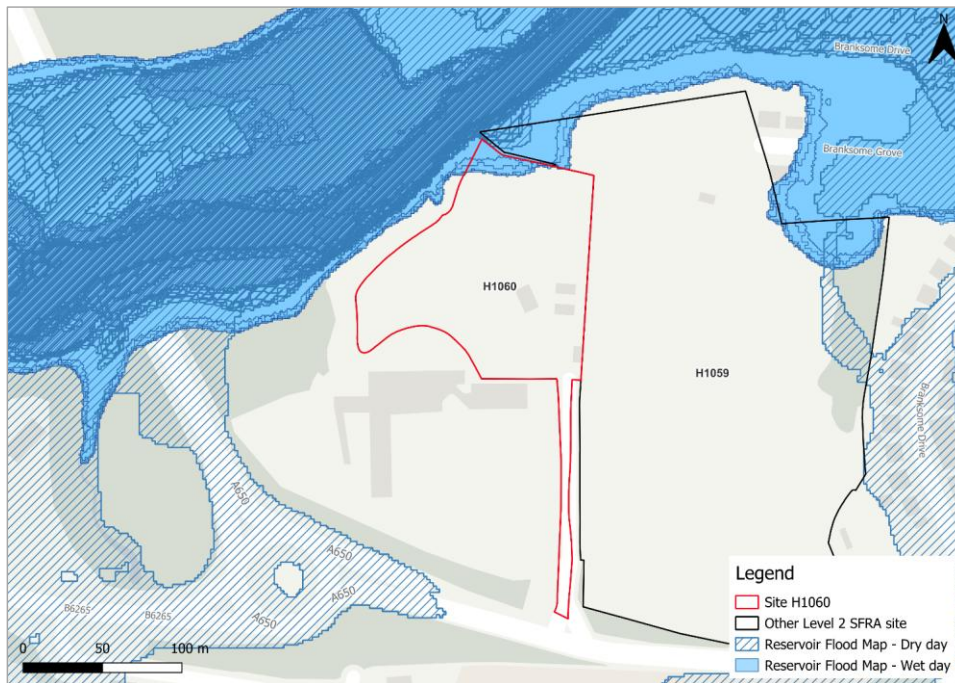


Figure 5-1: Flood risk from reservoirs

5.2 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.

5.3 Observations, mitigation options and site suitability - residual risk

- The site is at potential residual risk from a breach of 16 reservoirs. However, only one reservoir impacts the site in the 'dry day' flood extent, namely Thornton Moor reservoir, located within Bradford. This indicates that the remaining 15 reservoirs are only modelled to impact the site based on the 'wet day' flood extent, which represents a prediction of the credible worst case scenario, therefore it's unlikely that any actual flood would be this large.

- Given the potential reservoir risk to the site, developers should consider³:
 - Consulting with the local resilience forum for advice on emergency planning,
 - Consulting with relevant reservoir owners to understand the impact development may have on their reservoirs, and
 - Using this Level 2 SFRA to understand whether any proposed development will be safe throughout its lifetime.
- Given the historic sewer flooding in the area, developers should contact Yorkshire Water directly to check specific details at the FRA stage.

³ [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 not required to pass part b) of the exception test⁴, given it is proposed for more vulnerable uses and is not located within Flood Zone 3a.

6.2 Recommendations, FRA requirements, and further work

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

- Given the site as at medium risk from the River Aire, and future risk with climate change is modelled to be slightly greater, it is recommended that the northern corner of the site is not redeveloped for more vulnerable uses. However, this site should be permitted for residential development on flood risk grounds.
- Consultation should be had with the reservoir owners that may be affected by the development of this site.
- Given the historic sewer flooding in the area, developers should contact Yorkshire Water directly to check specific details at the FRA stage.
- Any FRA must further consider the safe access and escape routes to the site.
- 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.

⁴ Para 178 National Planning Policy Framework 2024

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Bradford Level 2 Strategic Flood Risk Assessment - Site H1061

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Prepared for:



City of
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Contract

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

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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 H1061. 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 H1061

- Location: Aire Queens Road / Ferncliffe Road, Saltaire
- Existing site use: Brownfield
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Residential
- Proposed site use vulnerability: More vulnerable
- Site area: 0.93 hectares
- Proposed development impermeable area: 0.41 hectares (assumed 85% impermeable area)
- 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
 - Assess present day and future surface water depths, hazards
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk
 - Modelling of latest EA climate change allowances for peak rainfall intensities



Figure 1-1: Existing site location boundary

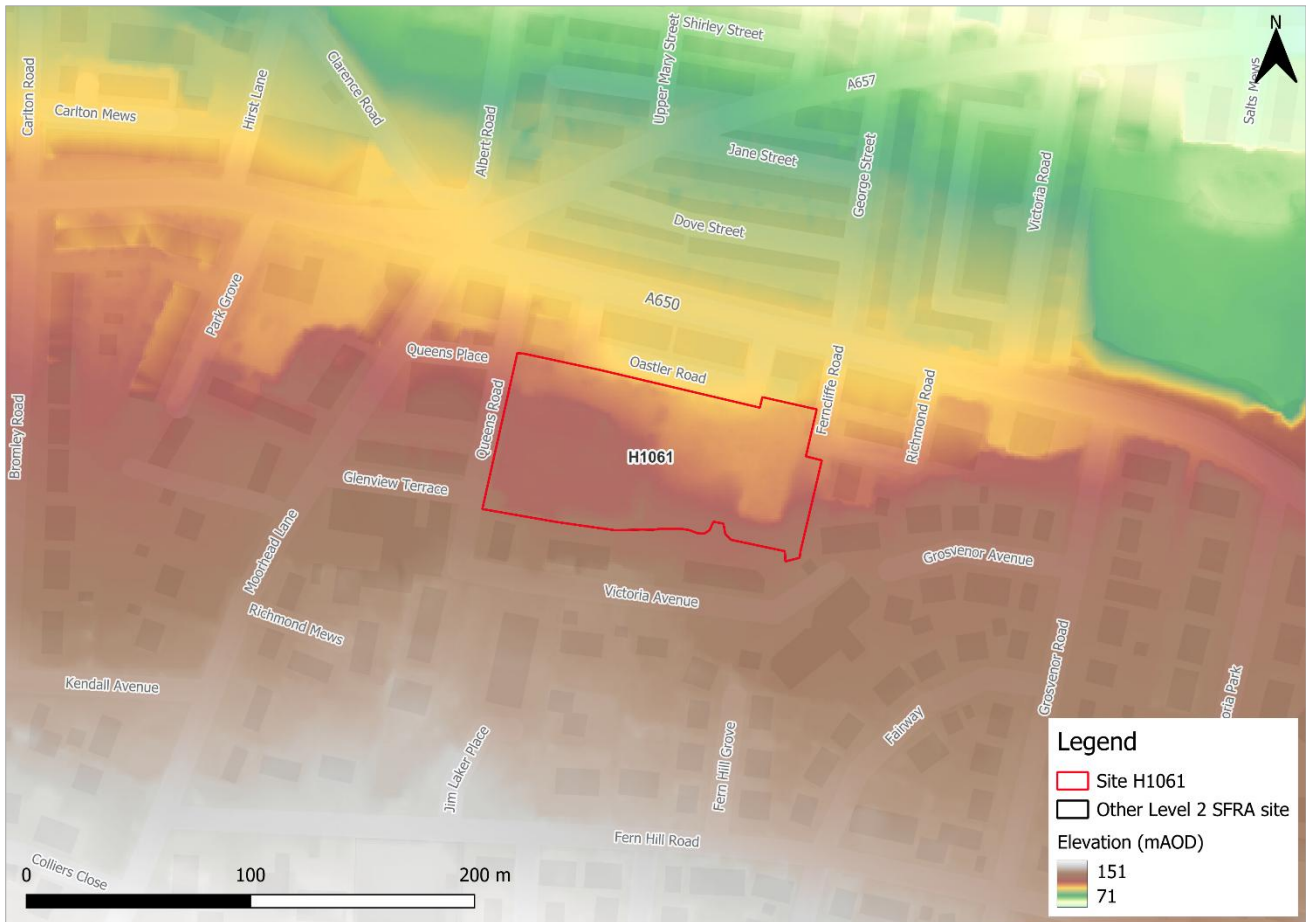


Figure 1-2: Topography



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 modelled to be 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. The WwNP mapping is broadscale and indicative. Further investigation is required for any land shown to have potential for WwNP. The site does not offer opportunities for natural flood management.

2.3 Historic flood incidents

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

2.4 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 Flood Warning Area.

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

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

2.5 Observations, mitigation options and site suitability - fluvial

- The site is located wholly 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, 85% of the site is at very low surface water risk, 7% at low risk, 4% at medium risk and a further 4% at high surface water risk, as shown in Table 3-1.

In the medium risk event, surface water risk is located within the south-western corner and eastern side of the site. There is also risk to Oastler Road, adjacent to the northern site boundary. In the low risk event, there is a greater risk of surface water within the site as the ponding on Oastler Road links to flooding within the site, forming a flow path through the eastern side of the site. There is also substantial flooding to Ferncliffe Road and the A650 during the low risk event.

Greatest flood depths within the site in the medium risk event are between 0.3m and 0.6m (Figure 3-1), with a small area of significant hazard (Figure 3-2).

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)
85	7	4	4

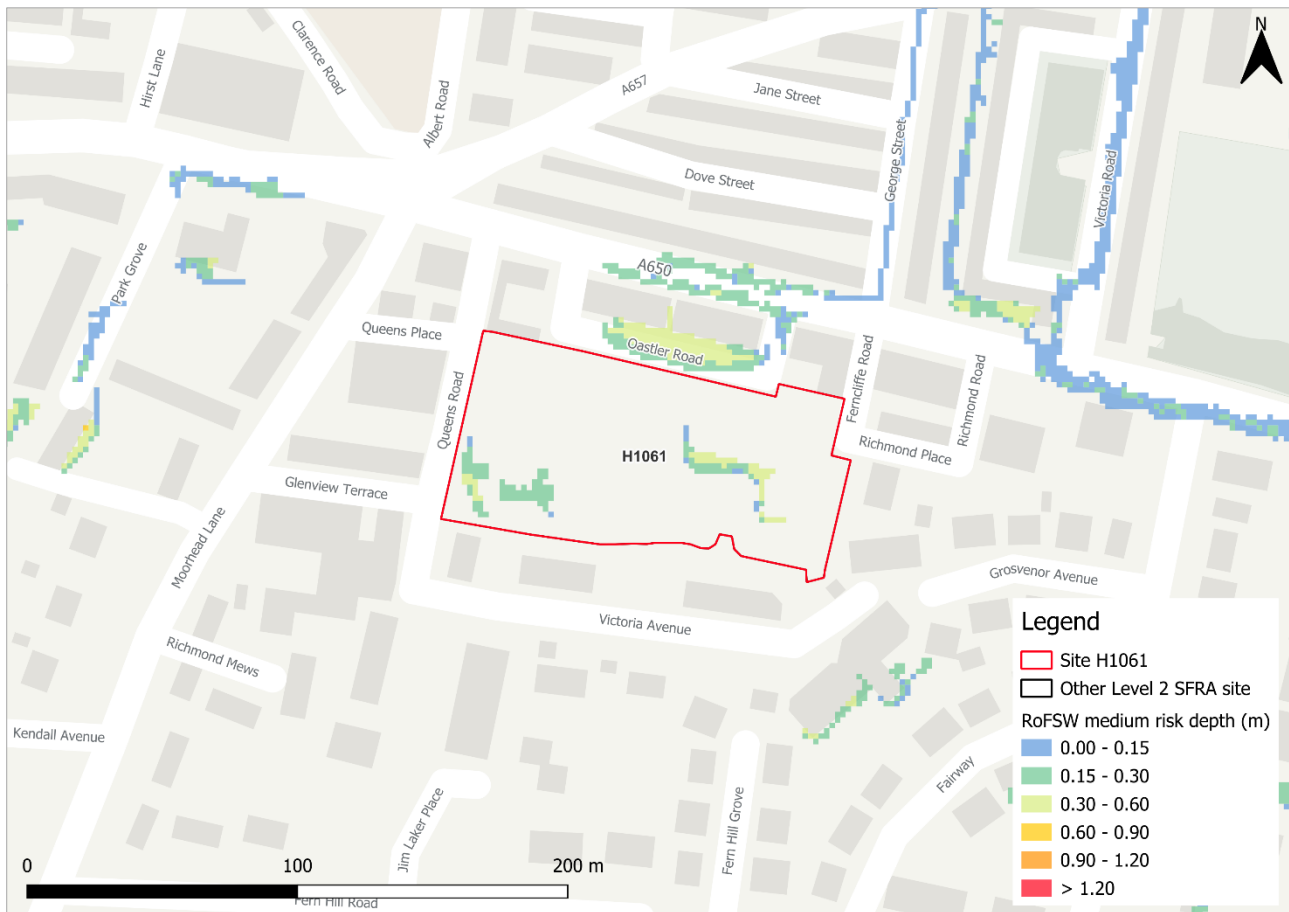


Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

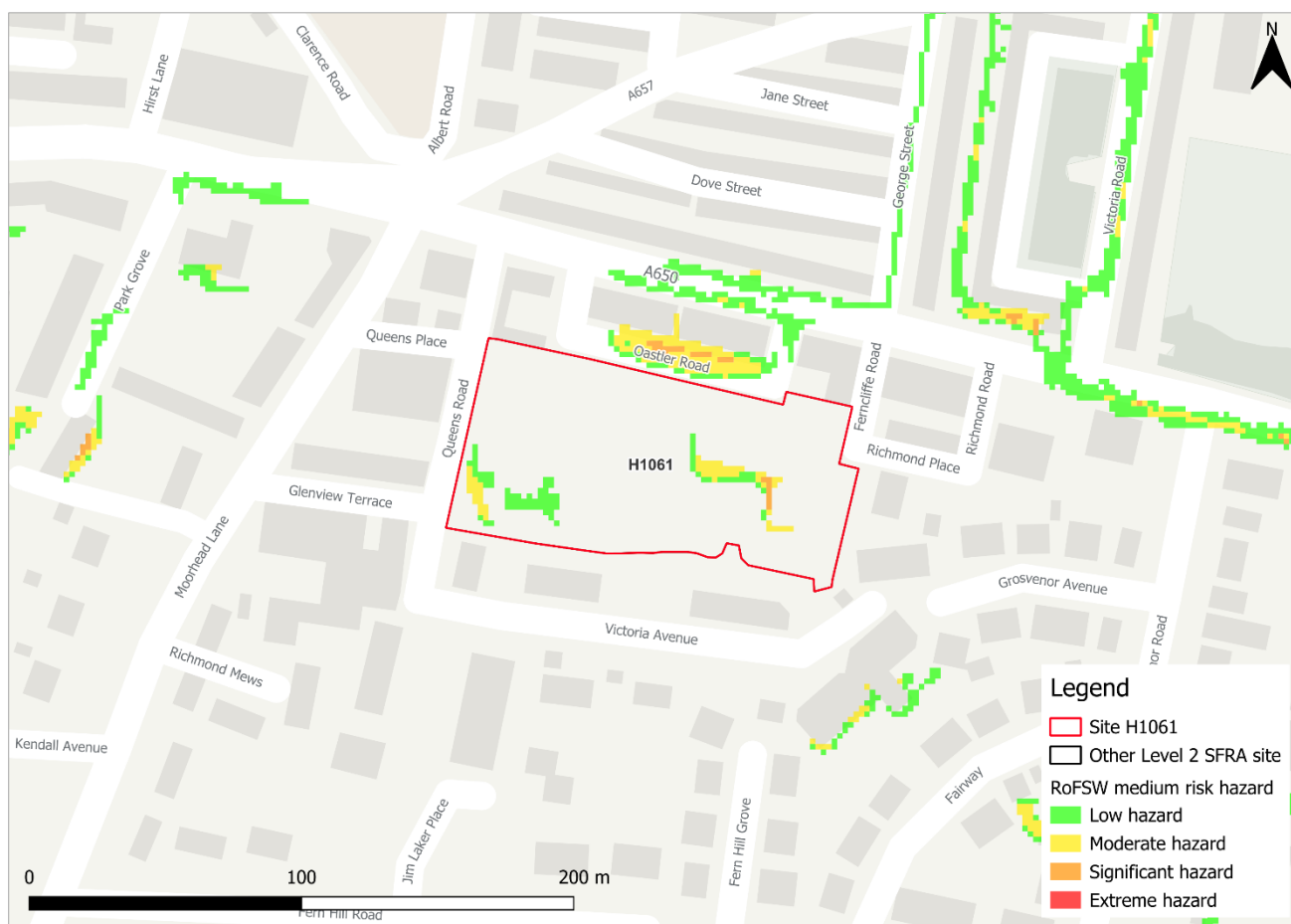


Figure 3-2: Medium risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

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 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 level of risk to the present day low risk event. Maximum flood depths increase to between 0.6 and 0.9m with further areas of significant flood hazard within the site. Safe access and escape may be achievable via Queens Road onto Moorhead Lane where flood risk is modelled to be low during this event.

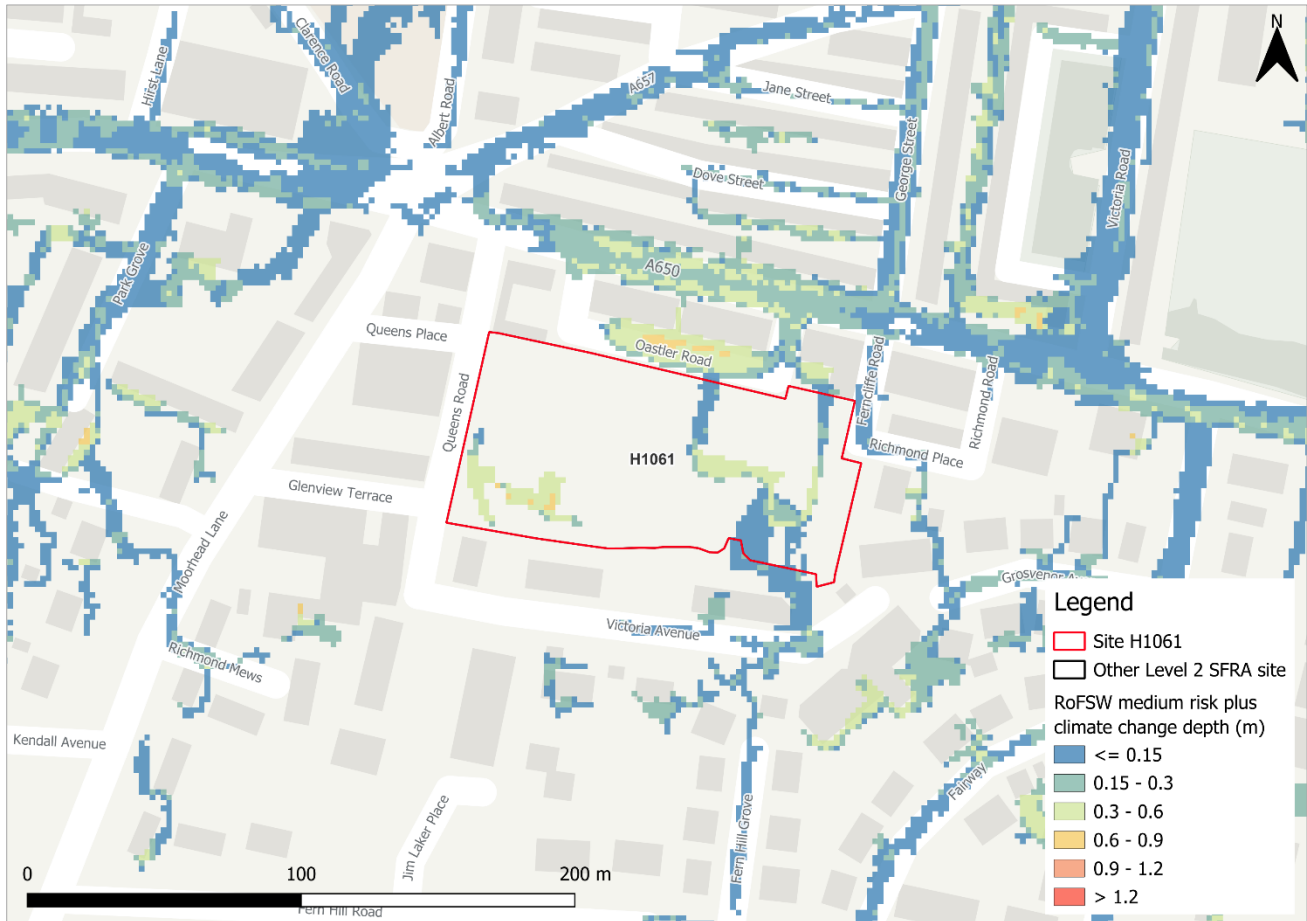


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)

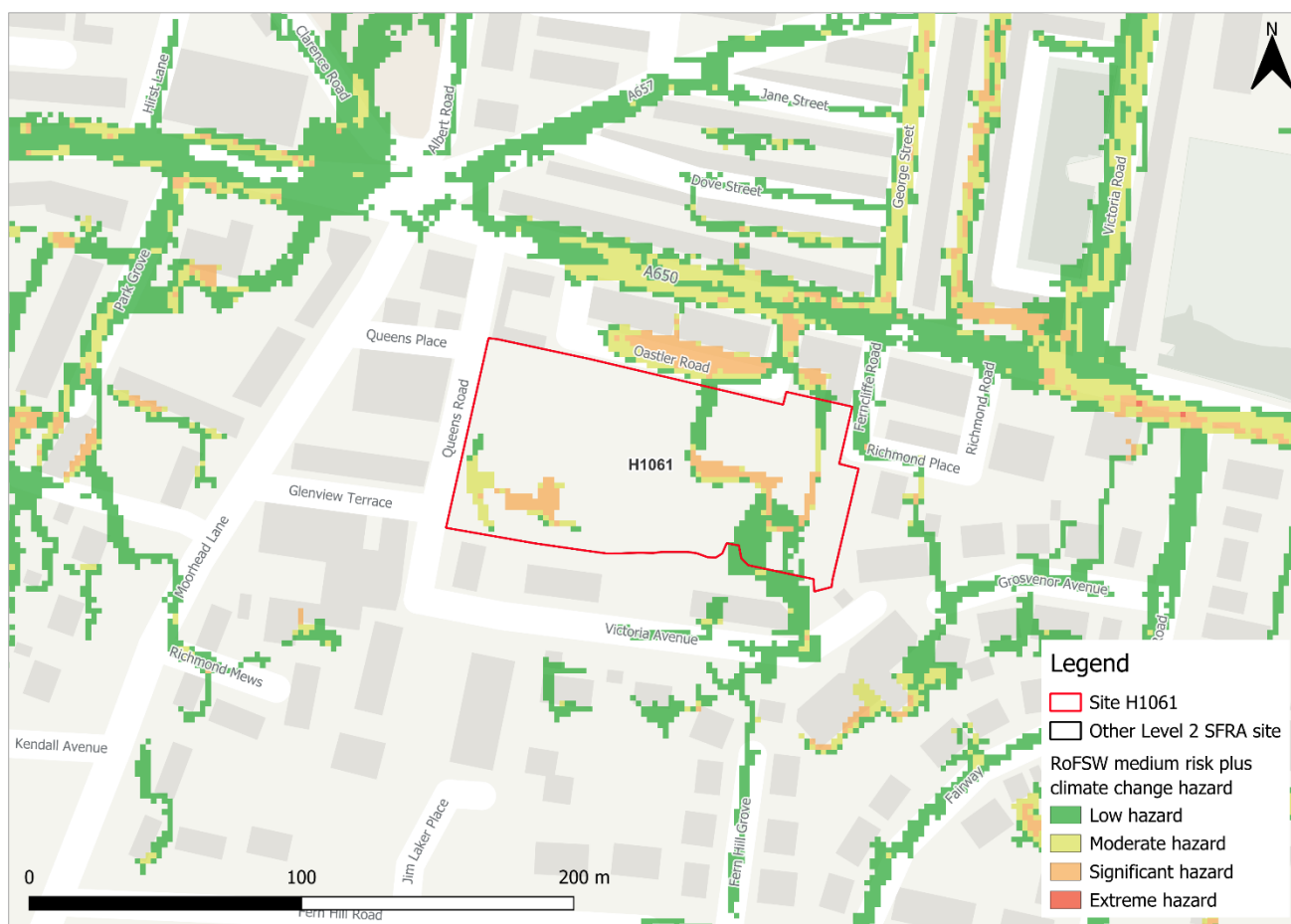


Figure 3-4: Medium risk event surface water flood hazards plus 45% climate change (based on Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk is predominantly very low. During the medium risk event, modelled risk is confined to the southwestern corner and eastern side of the site. Topographic 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 for like for like volumes to ensure risk is contained safely onsite for the lifetime of development.
- Safe access and escape routes would likely be achievable via Queens Road in all events.
- 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, the RoFSW map is not suitable for identifying whether an individual property will flood and is therefore indicative. The RoFSW map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

4 Risk from groundwater

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

The site is in an area where flooding from groundwater is not likely. Groundwater conditions may therefore be suited to infiltration SuDS within these areas.

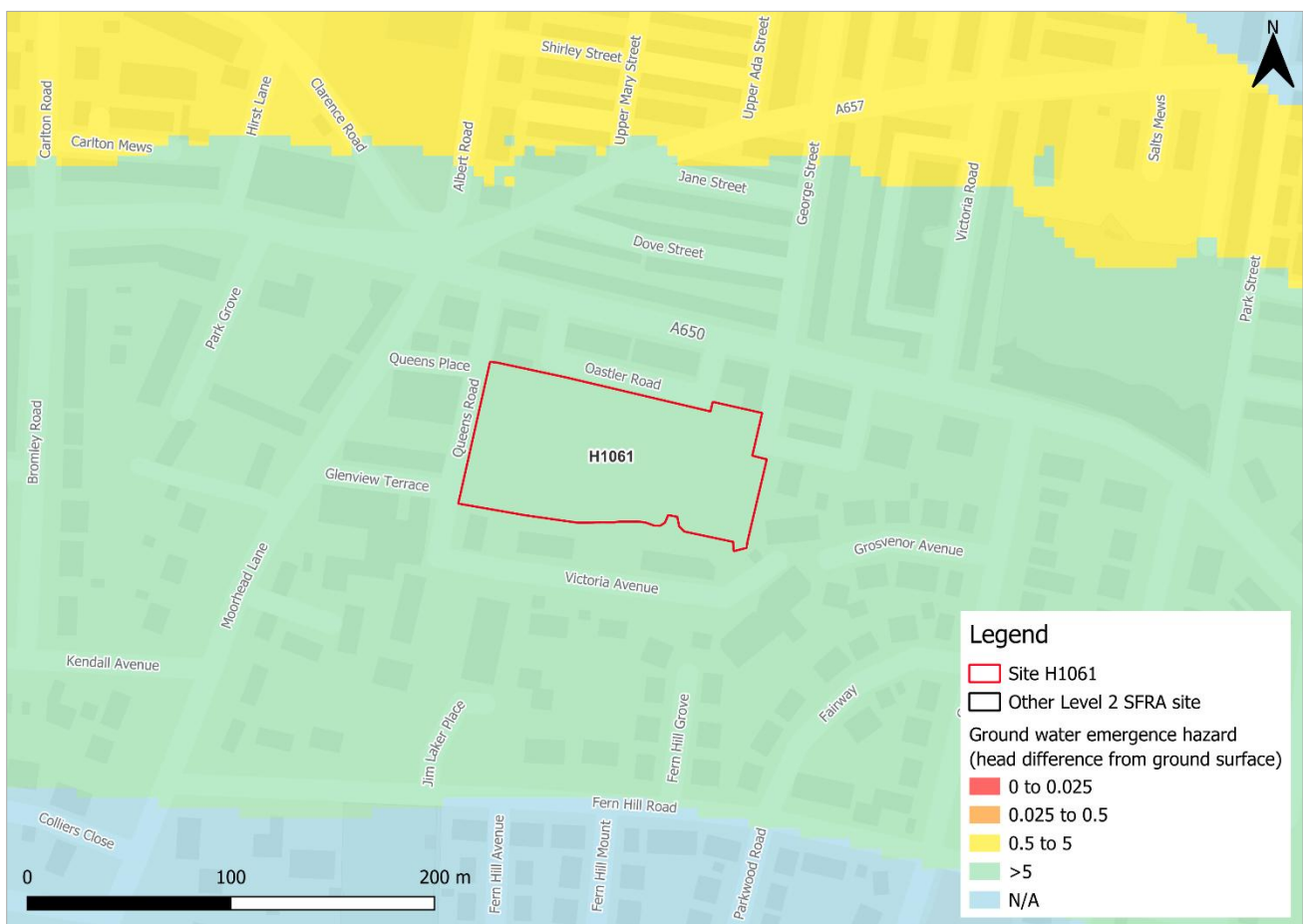


Figure 4-1: JBA 5m Groundwater Emergence Map

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 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 of 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.

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.

5.4 Observations, mitigation options and site suitability - residual risk

- Given the historic sewer flooding in the area, developers should contact Yorkshire Water directly to check specific details at the FRA stage.
- 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).

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:

- Based on current information, it should be appropriate to develop this site for more vulnerable purposes given its location in Flood Zone 1.
- Any FRA must further consider the safe access and escape routes to the site.
- 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 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 H1163

Final Draft

July 2026

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

www.jbaconsulting.com

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1 Background

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1.1 Site H1163

- Location: Between Clayton Lane and Lister Arms
- Existing site use: Brownfield
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 0.5 hectares
- Proposed development impermeable area: 0.47 hectares
- Watercourse: Bowling Beck
- Environment Agency (EA) river model: N/A
- Summary of requirements from scoping stage:
 - Level 1 SFRA recommendation was for withdrawal from allocation or more detailed assessment through Level 2 SFRA
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk



Figure 1-1: Existing site location boundary

There are higher ground elevations within the southwest of the site, sloping towards the northeast (Figure 1-2).

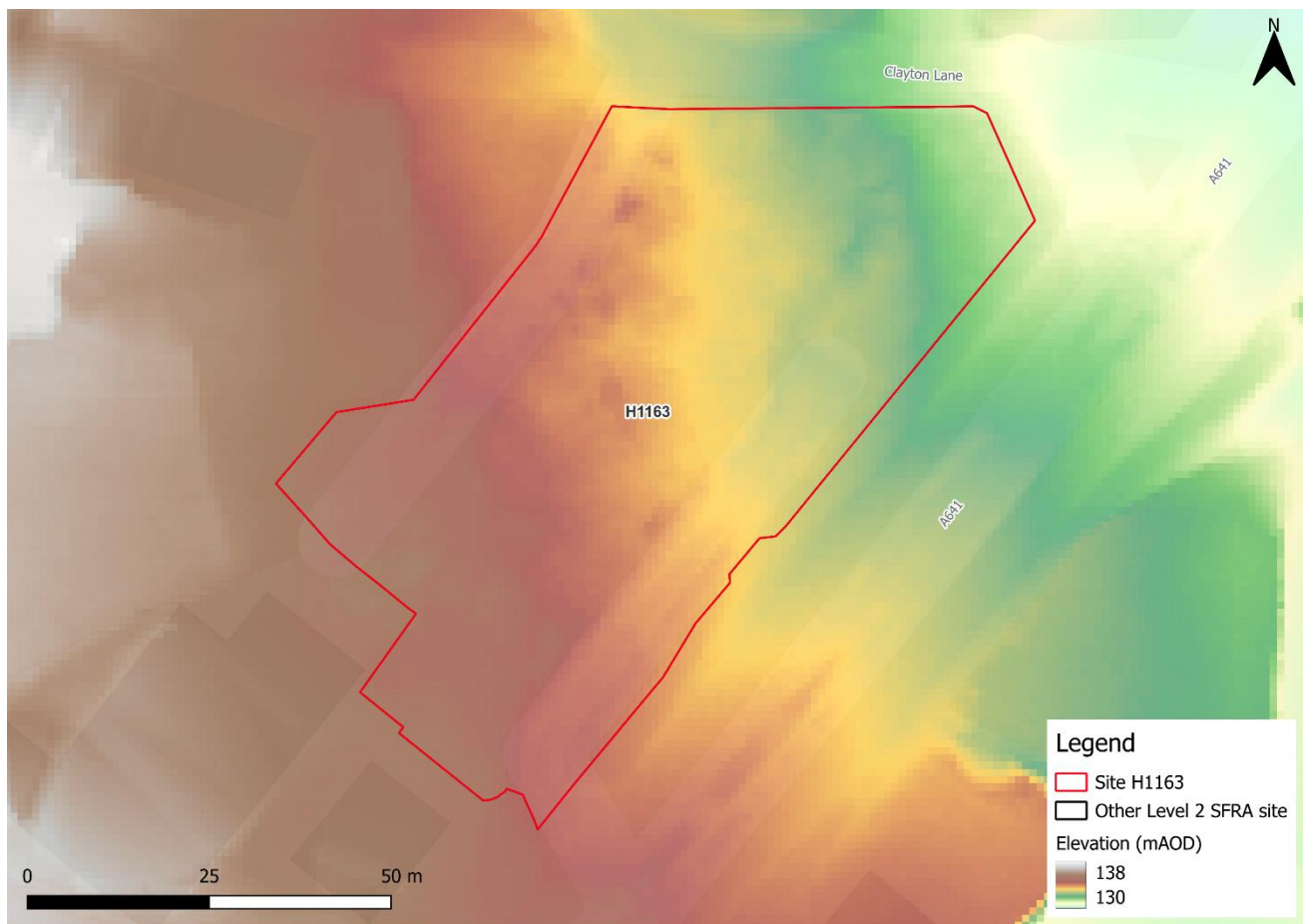


Figure 1-2: Topography

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.

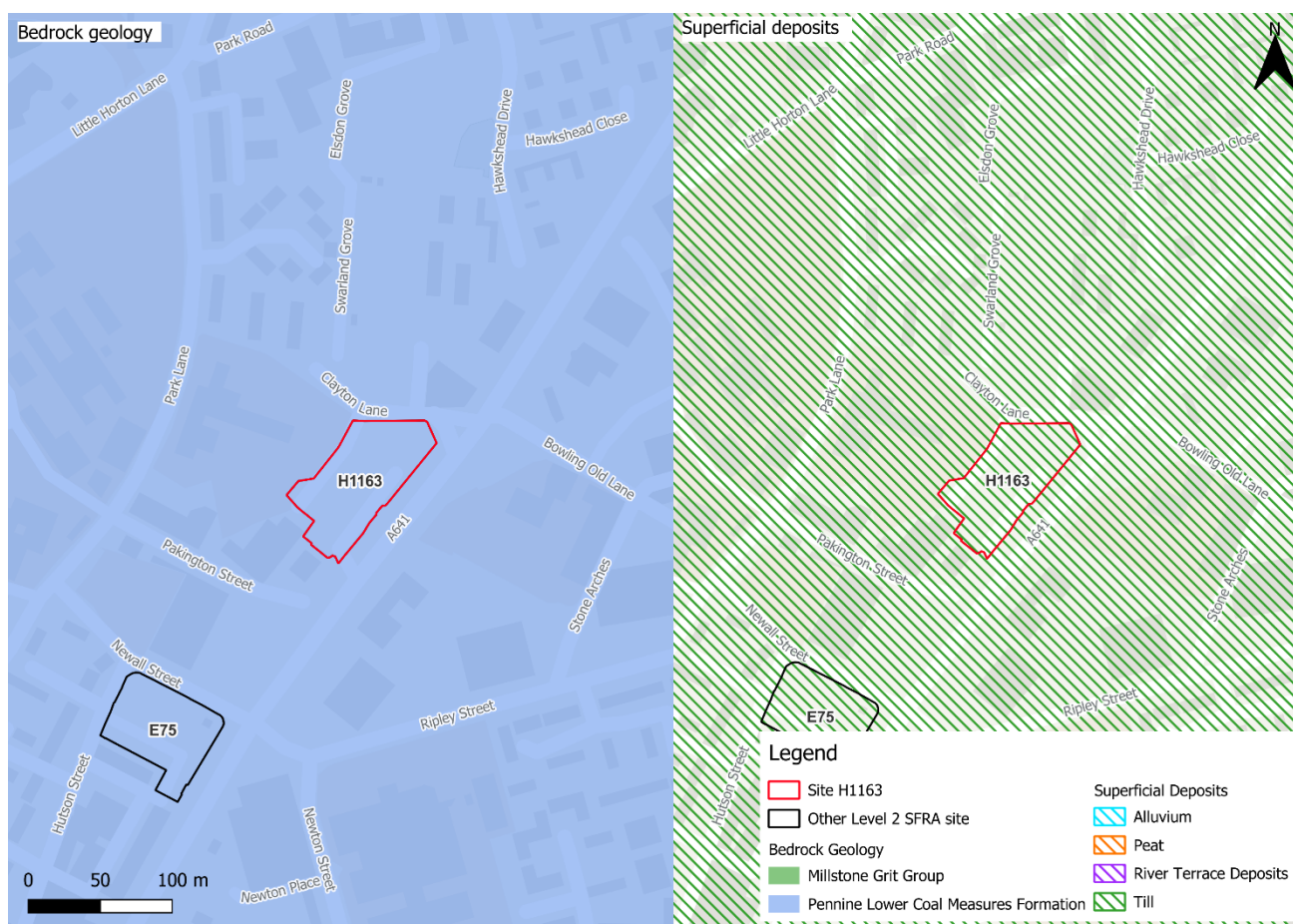


Figure 1-3: Soils and geology

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).

Fluvial flood risk to the site comes from Bowling Beck which is culverted to the east of the site. The eastern boundary of the site is situated within Flood Zone 2 and is therefore at medium risk of fluvial flooding. The remaining area of the site is within Flood Zone 1 and therefore at low risk.

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

Flood Zone 1 (% area)	Flood Zone 2 (% area)	Flood Zone 3a (% area)	Flood Zone 3b (% area)
94	6	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 reach of the watercourse present to the east of the site. Therefore, flood depth, hazard and velocity data cannot be considered as part of this Level 2 SFRA. Any site-specific FRA should produce a detailed model of the reach of Bradford Beck within the vicinity of 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: 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, the Bradford Beck 2026 model does not cover the site. Therefore, detailed climate change modelling is unavailable for consideration.

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). The impact of climate change must be modelled using the EA's latest allowances for peak river flows to inform whether the site can be safe for its lifetime. Any site-specific FRA should produce a detailed model of the reach of Bowling Beck within the vicinity of the site, including for the most up to date climate change allowances (Table 2-2).

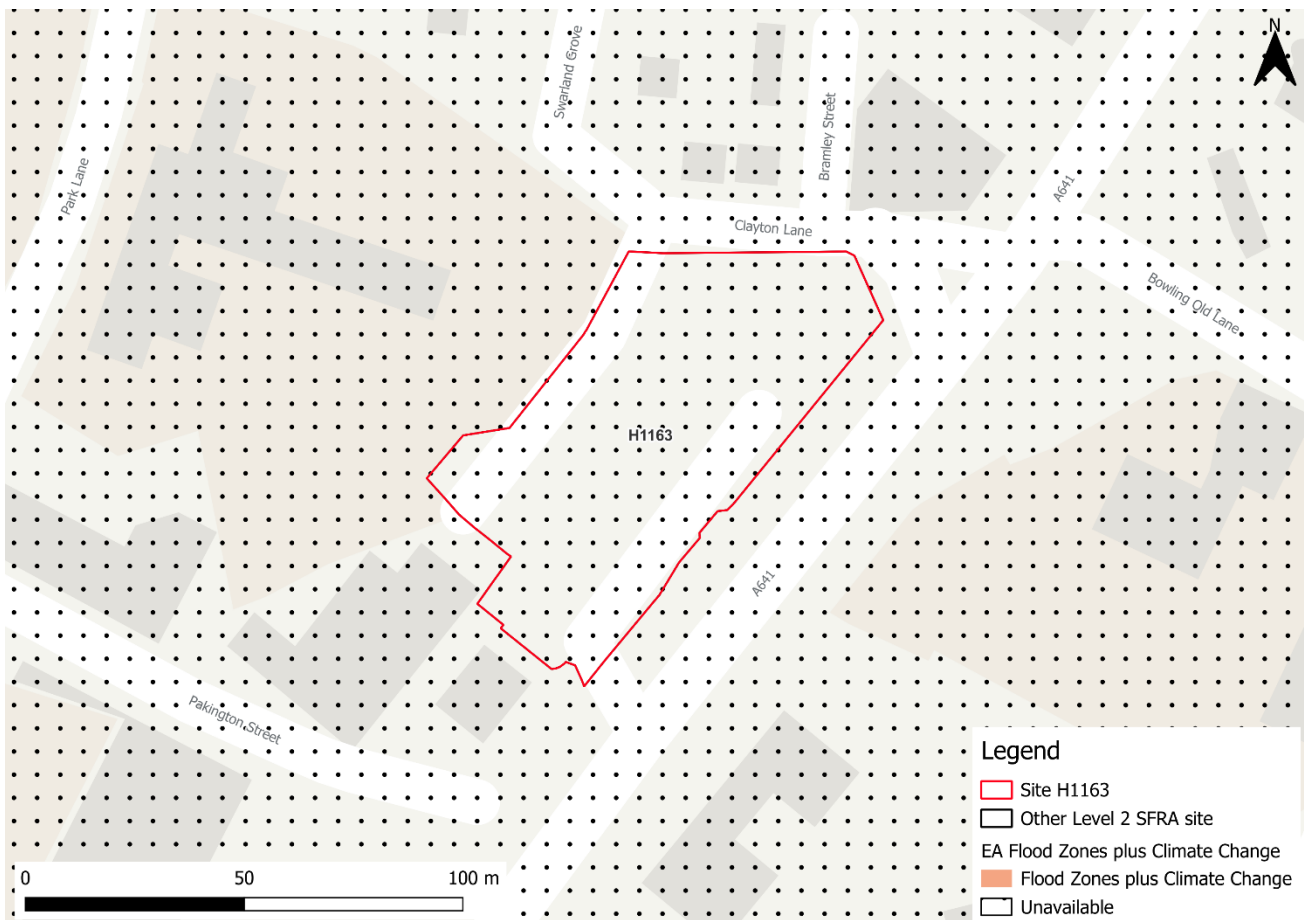


Figure 2-2: EA Flood Zones plus Climate Change

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 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 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 eastern boundary of the site is located within a FWA, namely 123FWF785 - Bradford Beck and tributaries at Bradford.

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



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

2.5.2 Access and escape routes

Based on available information, safe access and escape routes may be achievable via Clayton Lane to the north of the site during a fluvial flood event (Figure 2-4). However, this is shown to be inundated to the east of the site. Modelled flood depths, velocities and hazards along this route should be confirmed as part of a site-specific FRA.

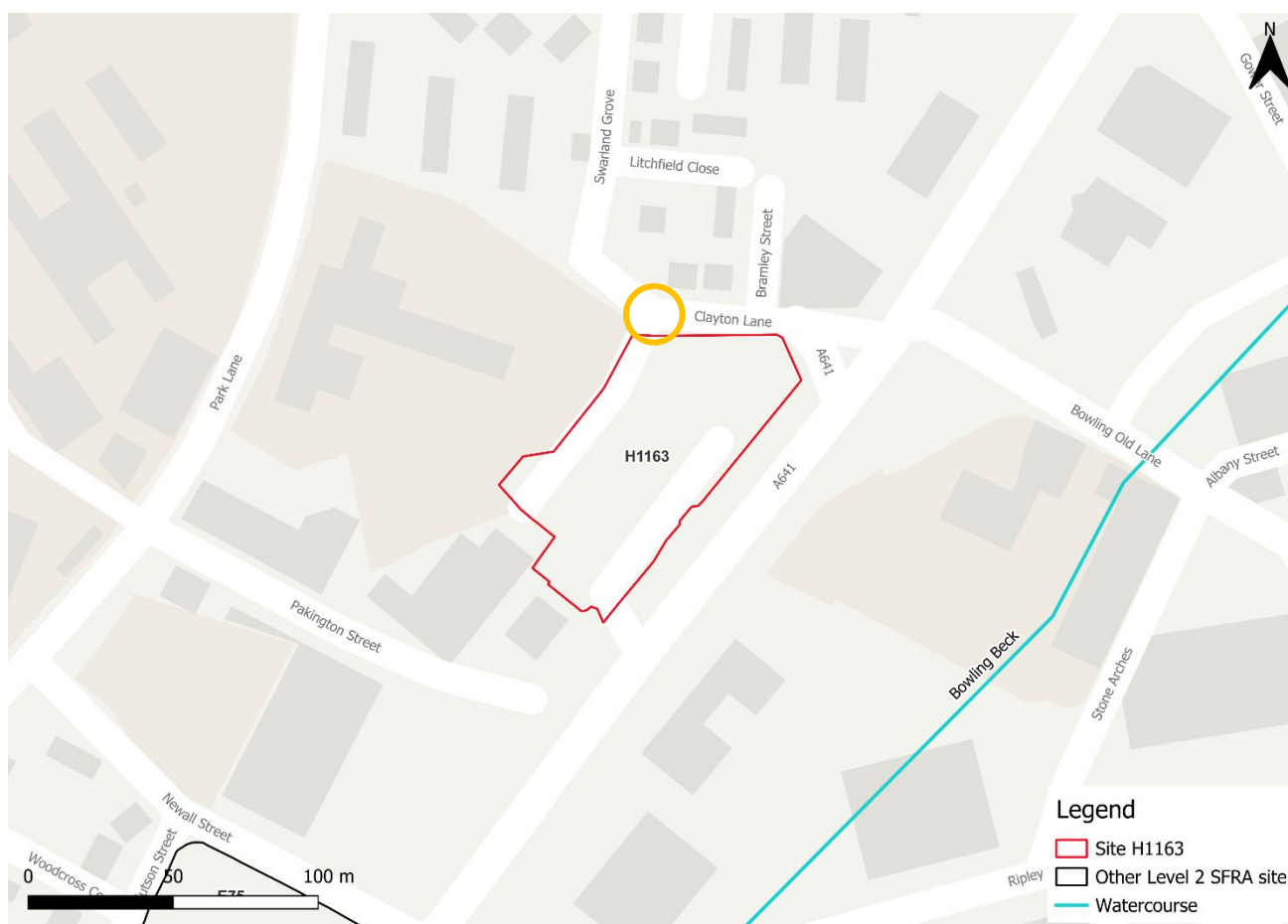


Figure 2-4: Potential access and escape routes

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 water compatible to less 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 partially located within Flood Zone 2 of the EA's Flood Map for Planning, along the eastern boundary of the site.
 - Ideally, all development would be directed to the area of the site within Flood Zone 1. The area shown to be within Flood Zone 2 could be used as a blue green corridor offering multifunctional benefits.
 - However, there are no detailed model outputs available to confirm onsite flood depths, hazard and velocities, as the Bradford Beck 2026 model does not cover the reach of watercourse to the east of the site.

- Any site-specific FRA should produce a detailed model of the reach of Bowling Beck within the vicinity of the site assessing both present day and future risk to the site.
- Mitigation:
 - EA flood warnings and 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 available via Clayton Lane to the north of the site. However, the viability of this route should be confirmed based on modelled flood depths, velocities and hazards.

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 Risk of Flooding from Surface Water (RoFSW) map (January 2026), surface water risk to the site is predominantly very low, as shown in Table 3-1.

Surface water risk is confined to an area of ponding within the centre of the site in the low risk event, with a surface water flow path adjacent to the eastern boundary of the site adjacent to the A641 (Figure 3-1). Safe access and escape routes may need to be considered further given the modelled surface water flood risk to available routes.

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)
95	5	0	0

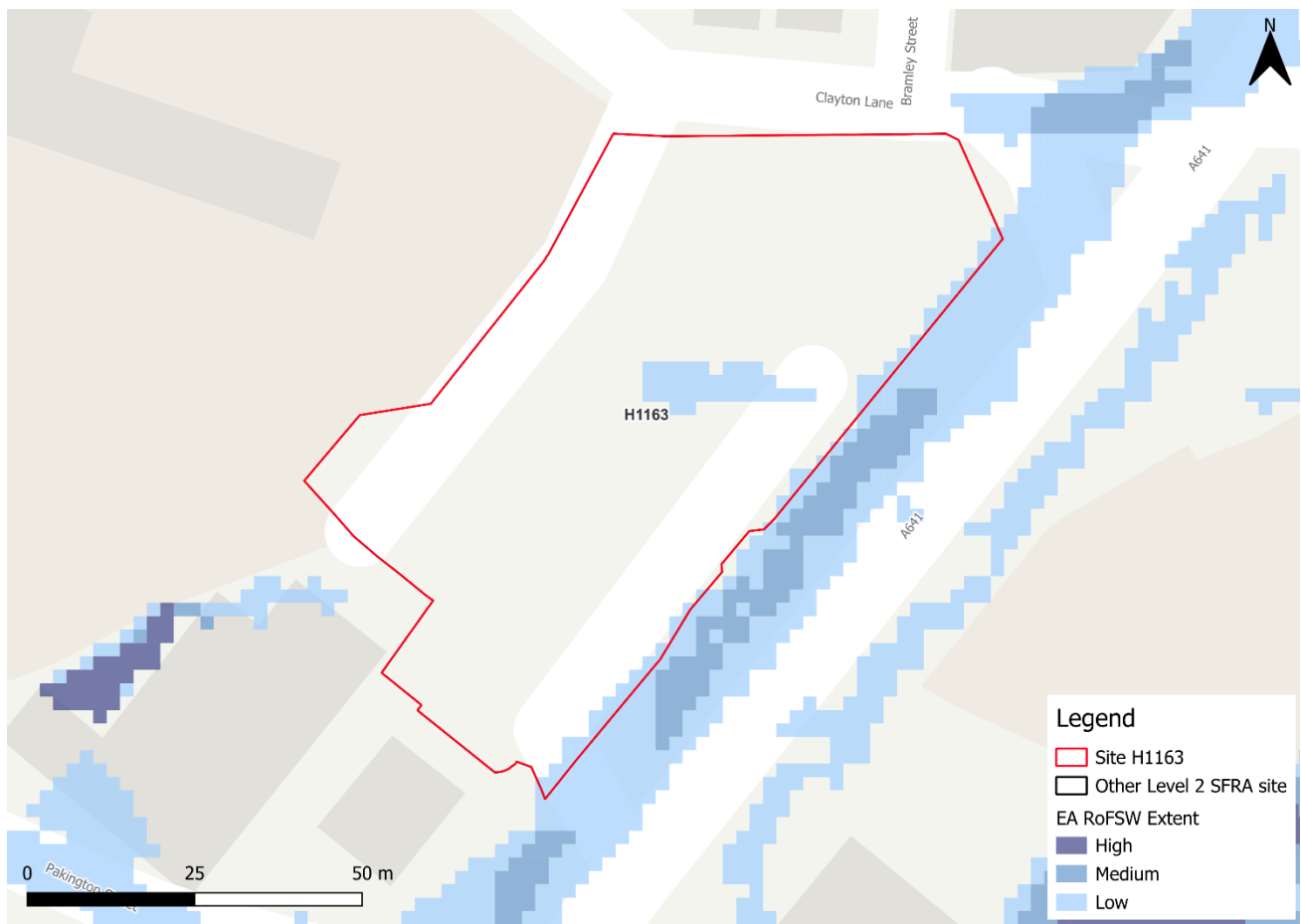


Figure 3-1: Surface water flood extents (NaFRA2 - Risk of Flooding from Surface Water map)

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

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

There are clear 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.

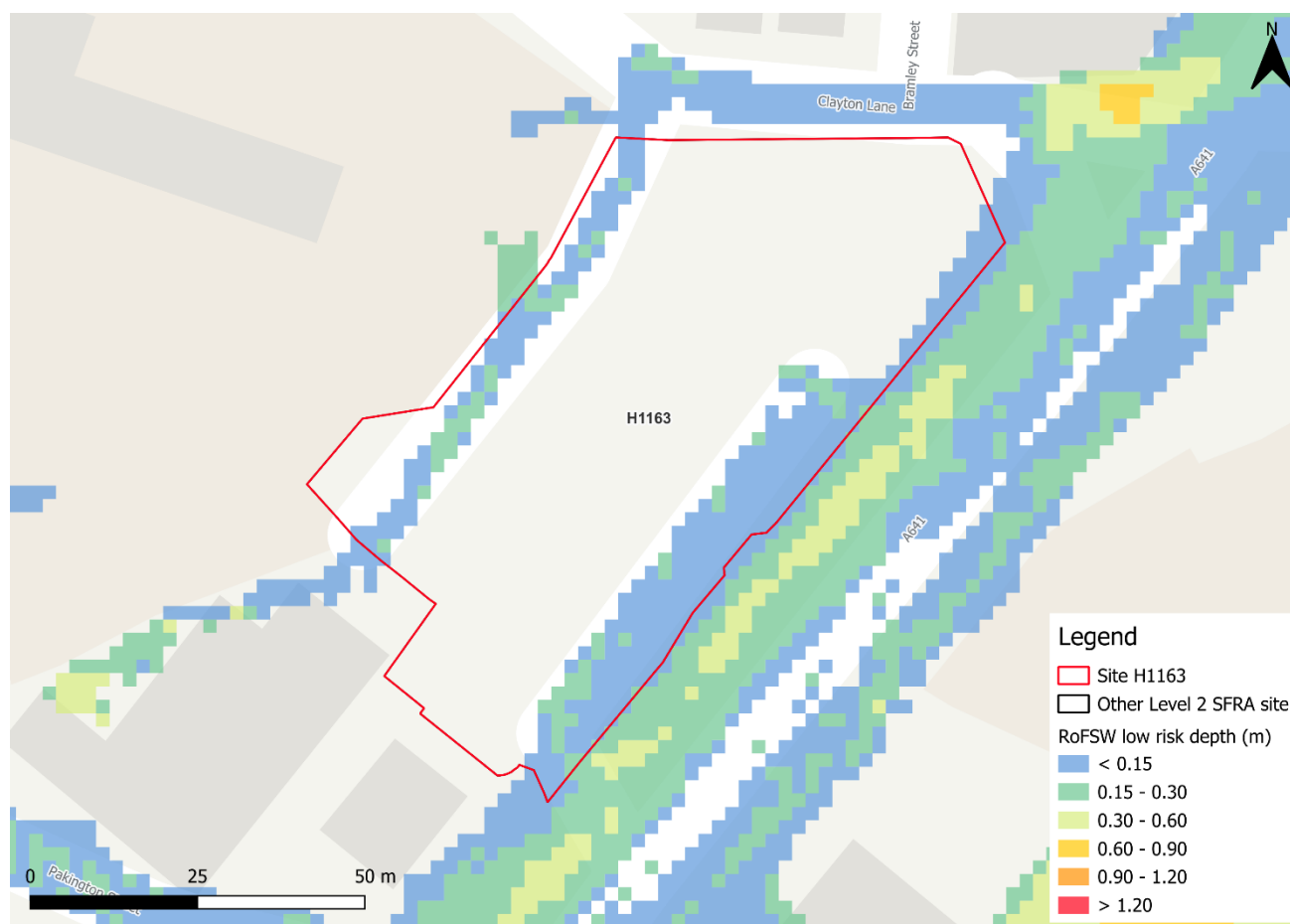


Figure 3-2: Low risk event surface water flood depths (Risk of Flooding from Surface Water map)

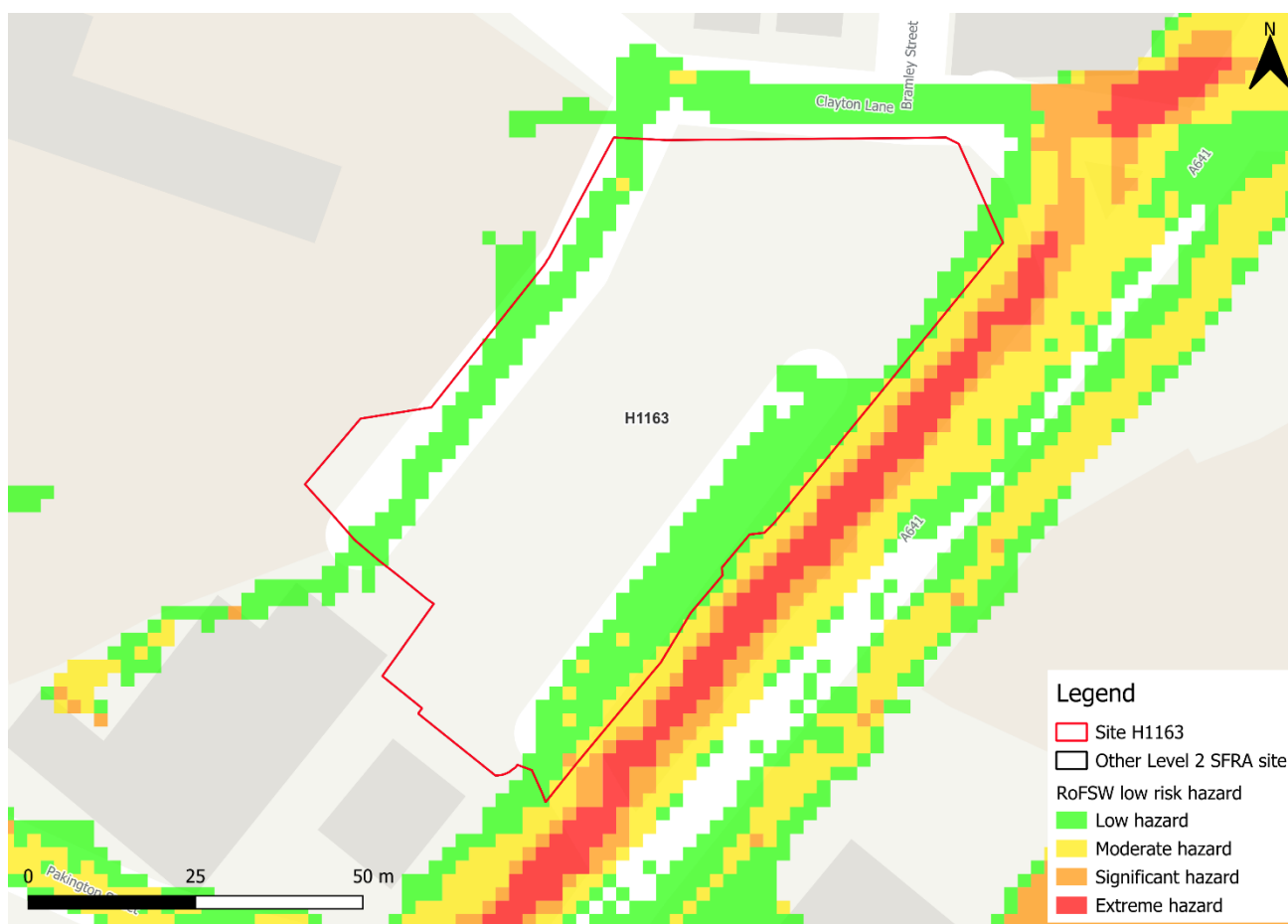


Figure 3-3: Low risk event surface water flood hazard¹ (Risk of Flooding from Surface Water map)

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, the medium risk surface water event is likely to increase in extent within the site when accounting for climate change (Figure 3-4). Greatest flood depths within the site in the low risk event are between 0.15 and 0.3 m (Figure 3-2), with some areas of hazard categorised as 'moderate' (Figure 3-3). Safe access and escape routes may need to be considered further given the modelled surface water flood risk to available routes.

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

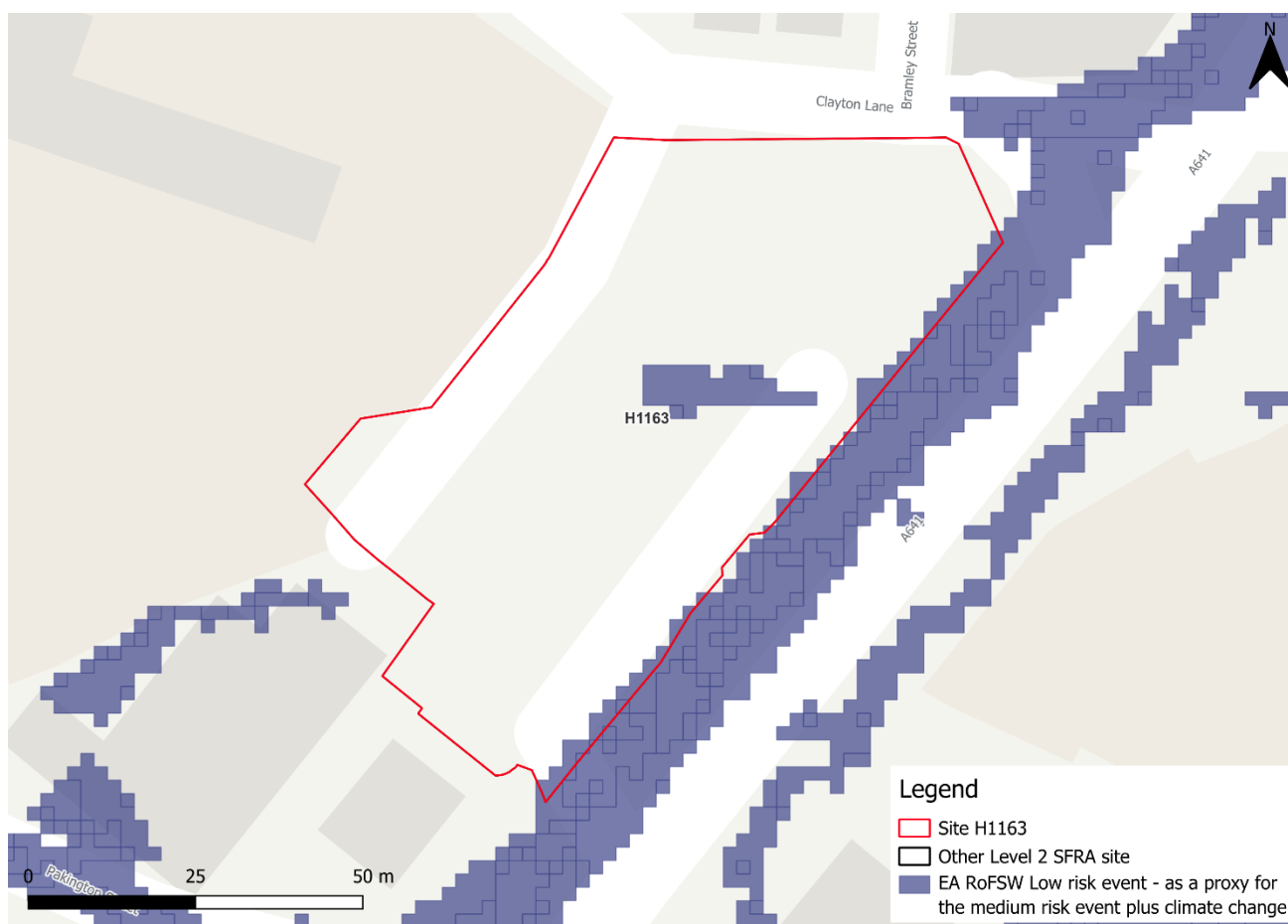


Figure 3-4: Low risk event surface water flood extent, as a proxy for the medium risk event plus climate change (NaFRA2 - Risk of Flooding from Surface Water map)

3.3 Observations, mitigation options and site suitability - surface water

- Current risk to the site is predominantly very low, with 95% of the site being at very low surface water flood risk. Surface water risk in the low risk event is confined to an area of ponding within the centre of the site, and along the eastern boundary adjacent to the A641.
- 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 addition to the area of ponding within the centre of the site, there is a flow path along the eastern boundary of the site.
- Topographic flow paths 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.
- Safe access and escape routes should be considered further as part of a site-specific FRA. Surface water depths and hazards along Clayton Lane and the A641 should be confirmed to determine whether these can be used as access and escape routes.

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

4 Risk from groundwater

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

The entire site is located within an area where there is no risk of groundwater emergence. 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.	

'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 flooding from reservoirs.

5.3 Observations, mitigation options and site suitability - residual risk

- The site is at potential residual risk from a blockage or structural failure of the Bowling Beck culvert to the east of the site. The site-specific FRA could consider modelling a blockage scenario to understand whether there would be any additional risk to the site as a result of a blockage.
- 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).

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 largely within Flood Zone 1 and nominal surface water flood risk.
- Ideally, all development would be directed to the area of the site within Flood Zone 1. However, detailed flood modelling of Bowling Beck would be required at the site-specific FRA to confirm onsite flood depths, velocities and hazards for present day and accounting for climate change.
- Were this site to be allocated based on current information, the LPA must make it clear that this site cannot be developed until the required information detailed in this SFRA on existing and future flood risk from Bowling Beck is fully ascertained.
- Safe access and escape routes should be considered further through the site-specific FRA to ensure site users can evacuate during a flood event.

6.3 Site-specific FRA requirements and further work

- Full detailed flood modelling of Bowling Beck to assess up to date risk to the site, including for the impacts of climate change. This should also include for culvert blockage scenarios.
- Further modelling to understand the impacts of climate change on surface water flood risk to the site.
- A condition and capacity assessment of the Bowling Beck culvert to the east the site.
- 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.

³ Para 178 National Planning Policy Framework 2024

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Bradford Level 2 Strategic Flood Risk Assessment - Site H1243

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. Laura Thompson 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 H1243. 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 H1243

- Location: Canterbury Youth Centre, Dawnay Road, Canterbury
- Existing site use: Brownfield, previously leisure uses
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Residential
- Proposed site use vulnerability: More vulnerable
- Site area: 0.5 hectares
- Proposed development impermeable area: 0.44 hectares
- Environment Agency (EA) 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
 - Modelling of latest EA climate change allowances for peak rainfall intensities



Figure 1-1: Existing site location boundary

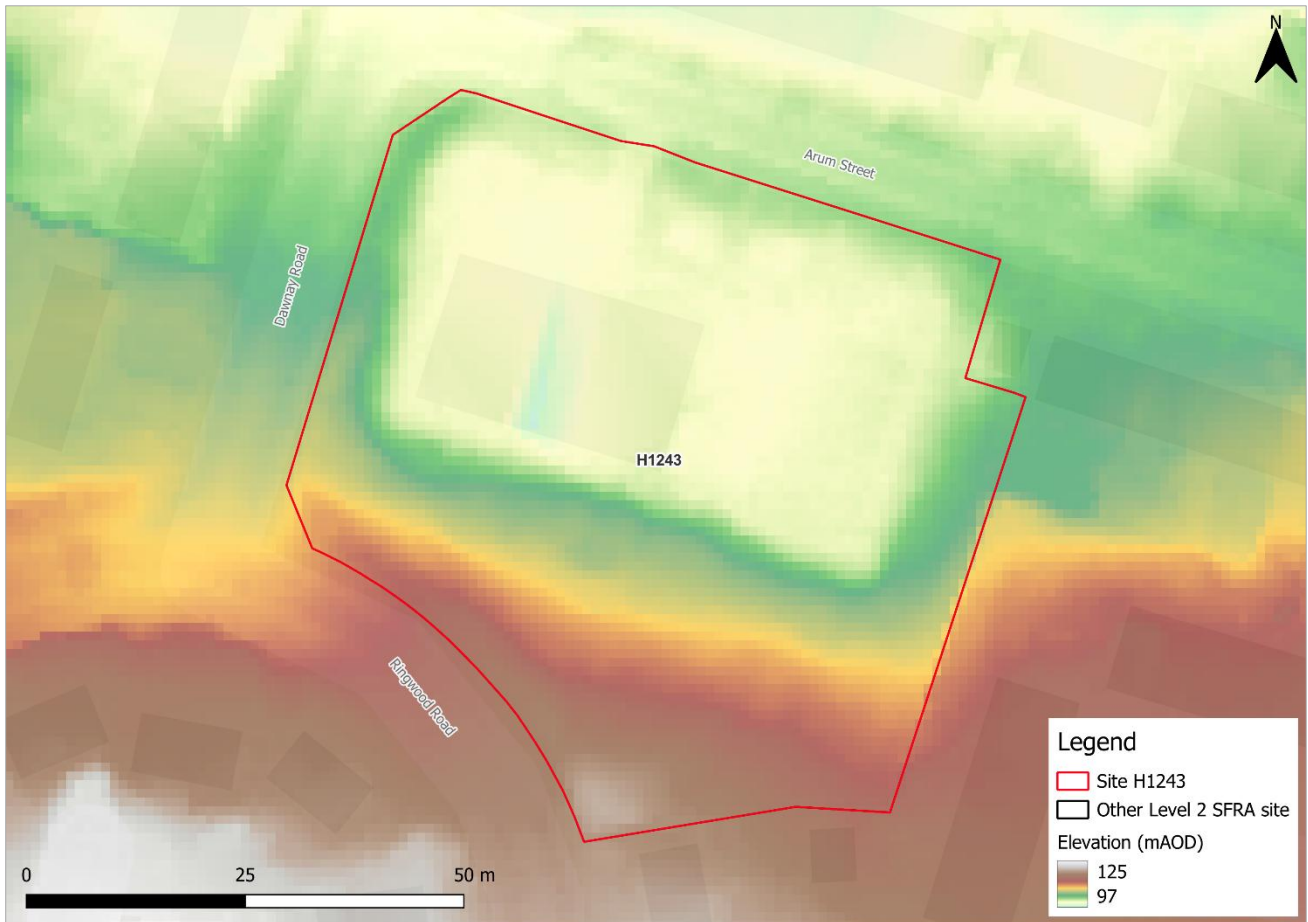


Figure 1-2: Topography



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. There are no applicable areas that could benefit the site.

2.3 Historic flood incidents

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

2.4 Flood warning and access and escape routes

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

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

Based on available information, safe access and escape routes could likely be achieved during a flood event via Dawnay 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 and therefore 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 12% of the site is within the medium risk surface water flood zone. A further 17% of the site is at low surface water risk, as shown in Table 3-1.

In the medium risk event, surface water risk is confined to areas of shallow ponding within topographic low spots within the centre of the site. In the low risk event, the area of ponding within the centre of the site increases in both depth and extent, covering a large area of the north of the site. Surface water risk is clearly constrained by the existing development within the site as mapped.

Greatest flood depths in the medium risk event are between 0.15 and 0.3 m (Figure 3-1) with some areas of moderate hazard (Figure 3-2). Dawnay Road is inundated in all events, however given the low depths along the road safe access and escape routes should be possible via this route.

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 knocked down. 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)
71	17	12	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 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 slightly greater level of risk than the low risk present day event. Maximum depths are between 0.3 and 0.6 m with some areas of significant hazard (Figure 3-4). Safe access and escape routes should remain achievable via Dawnay Road.

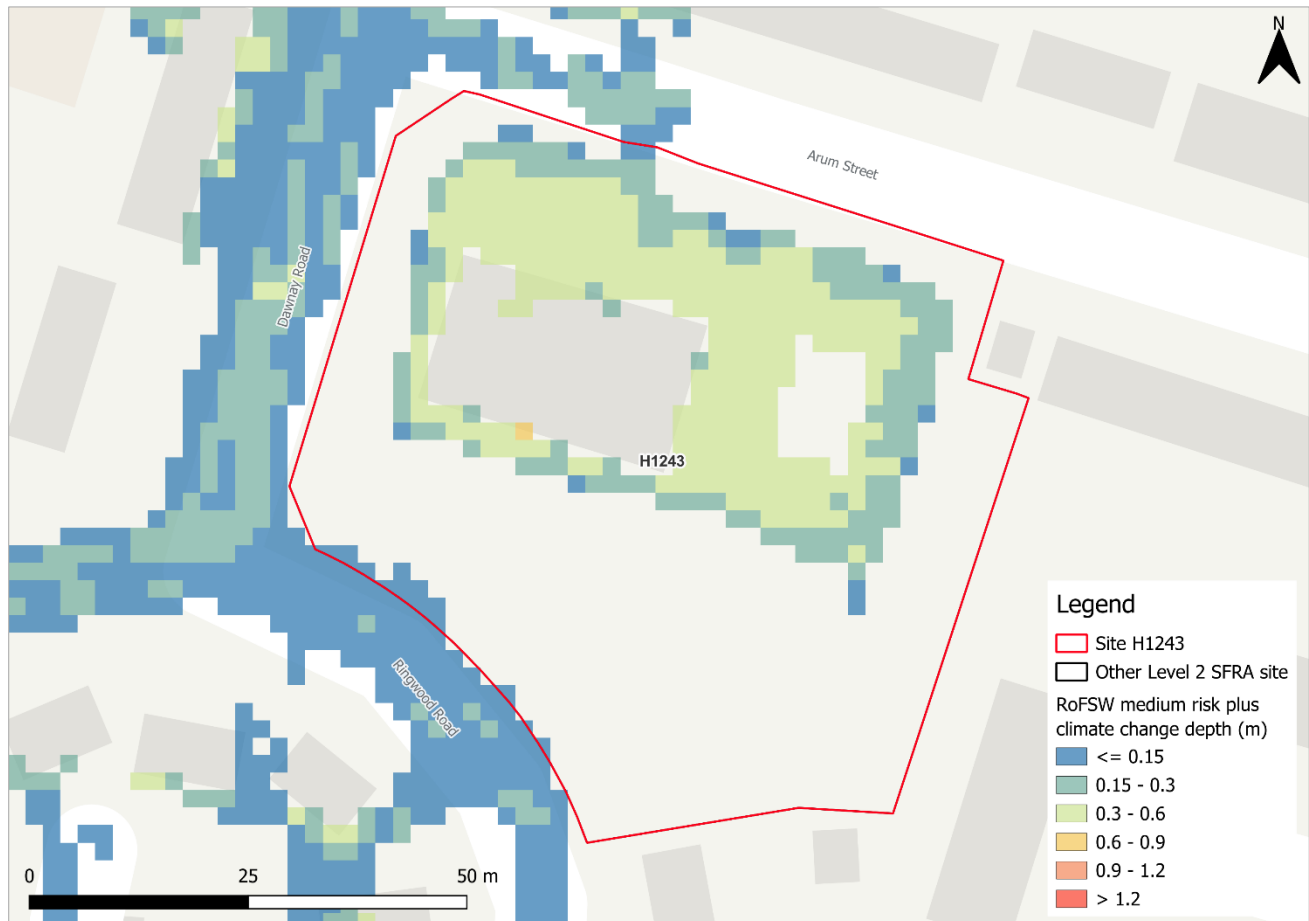


Figure 3-3: Medium risk event surface water flood depths plus 45% climate change (based on Risk of Flooding from Surface Water map)



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

3.3 Observations, mitigation options and site suitability - surface water

- Current risk is significant within the area of lower elevation towards the north of the site.
- 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.
- 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. This will require surface water modelling based on layout plans and detailed design and 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.

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

4 Risk from groundwater

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

The majority of the site is within an area where there is no risk of groundwater emergence. Groundwater conditions in these areas may therefore be suited to infiltration SuDS. Along the southern boundary of the site, there is the possibility of groundwater emerging at the surface locally. Ground investigations will be required within the south of the site through the site-specific FRA to ascertain groundwater levels and conditions.

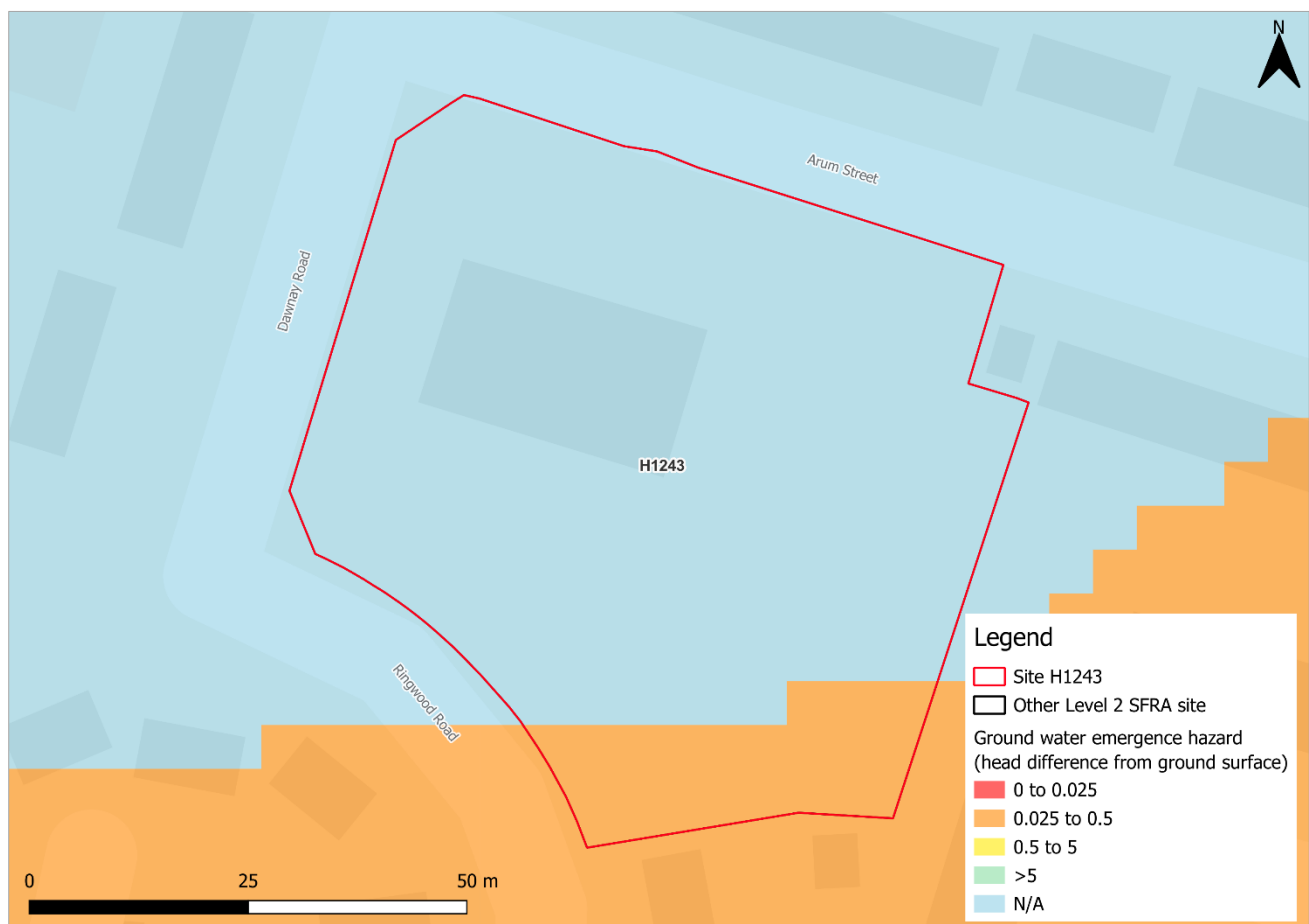


Figure 4-1: JBA 5m Groundwater Emergence Map

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, 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 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.
- 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.
- 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 suitably across the majority of the site.
- Groundwater conditions in the south of 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 178 National Planning Policy Framework 2024

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Bradford Level 2 Strategic Flood Risk Assessment - Site H1250

Final Draft

July 2026

Prepared for:



City of
BRADFORD
METROPOLITAN DISTRICT COUNCIL

www.jbaconsulting.com

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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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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 H1250. 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 H1250

- Location: Dirkhill Road
- Existing site use: Brownfield
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Residential
- Proposed site use vulnerability: More vulnerable
- Site area: 0.7 hectares
- Proposed development impermeable area: 0.66 hectares
- Watercourse: West Brook
- Environment Agency (EA) river model: N/A
- Summary of requirements from scoping stage:
 - Level 1 SFRA recommendation was for withdrawal from allocation or more detailed assessment through Level 2 SFRA
 - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
 - Assessment of all other sources of flood risk



Figure 1-1: Existing site location boundary

The topography of the site is considerably varied, with the highest elevations present in the southwest of the site, sloping steeply down towards the northeast (Figure 1-2). The area of lowest elevation in the east of the site is approximately 12m lower than the area of highest elevation in the southwest.

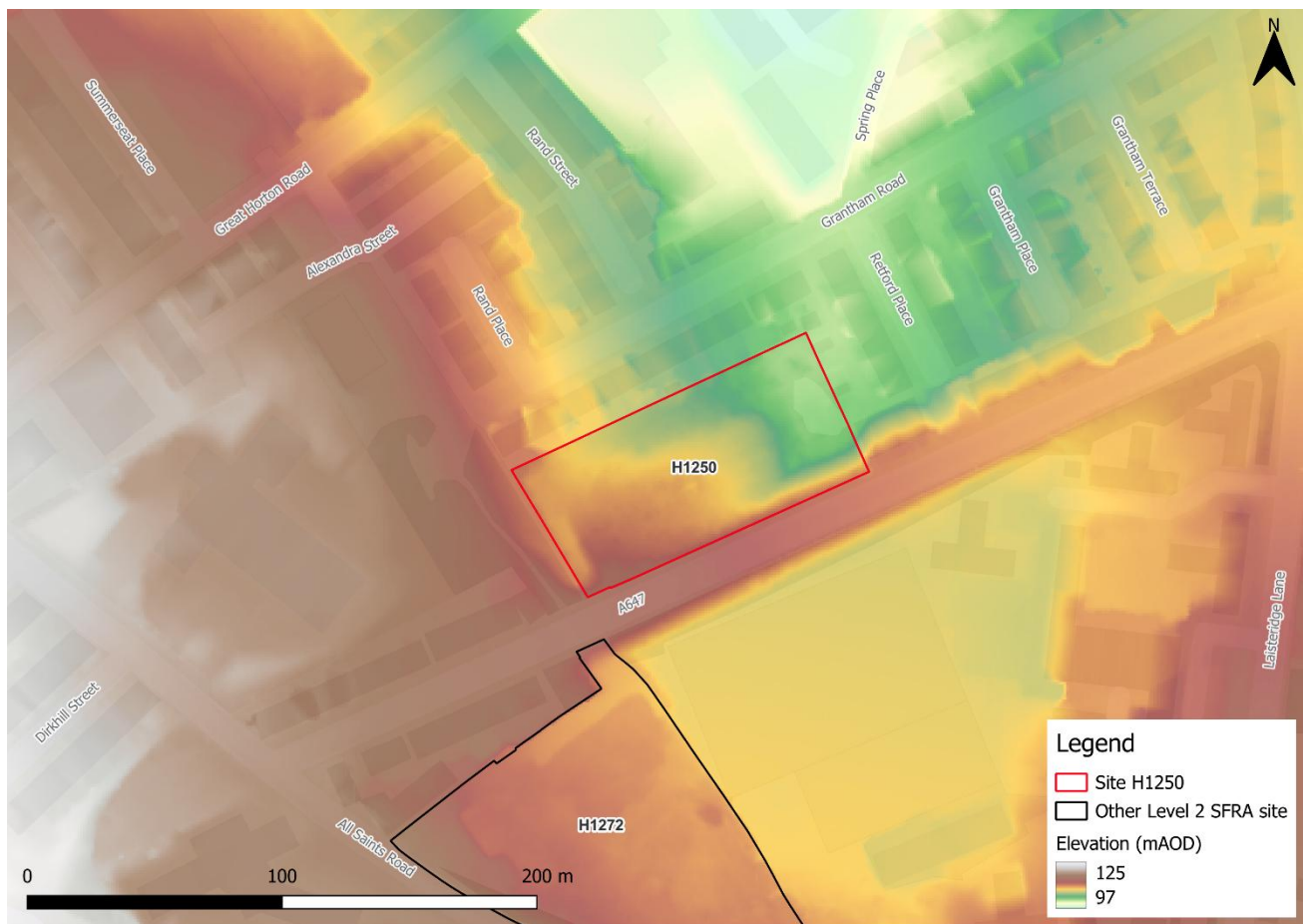


Figure 1-2: Topography

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).

Fluvial flood risk to the site comes from West Brook which is culverted near the site. A small area of functional floodplain is present in the southeast corner of the site. However, this is based on an 8m buffered polygon of the West Brook channel to indicate the potential presence of the watercourse beneath the site. The mapped watercourse location may not represent the actual location of the culverted channel. Noting that, functional floodplain policy applies to the path of the culvert beneath the site and not the mapping functional floodplain, where these differ. The path of the culverted channel should be confirmed through a survey as part of the site-specific FRA. The majority of the site is located 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)
99	0	0	1



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 reach of the watercourse present to the east of the site. Therefore, flood depth, hazard and velocity data cannot be considered as part of this Level 2 SFRA. Any site-specific FRA should produce a detailed model of the reach of West Brook within the vicinity of 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).

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

As documented in Section 2.1.2, the Bradford Beck 2026 model does not cover the site. Therefore, detailed climate change modelling is unavailable for consideration.

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 2-2.

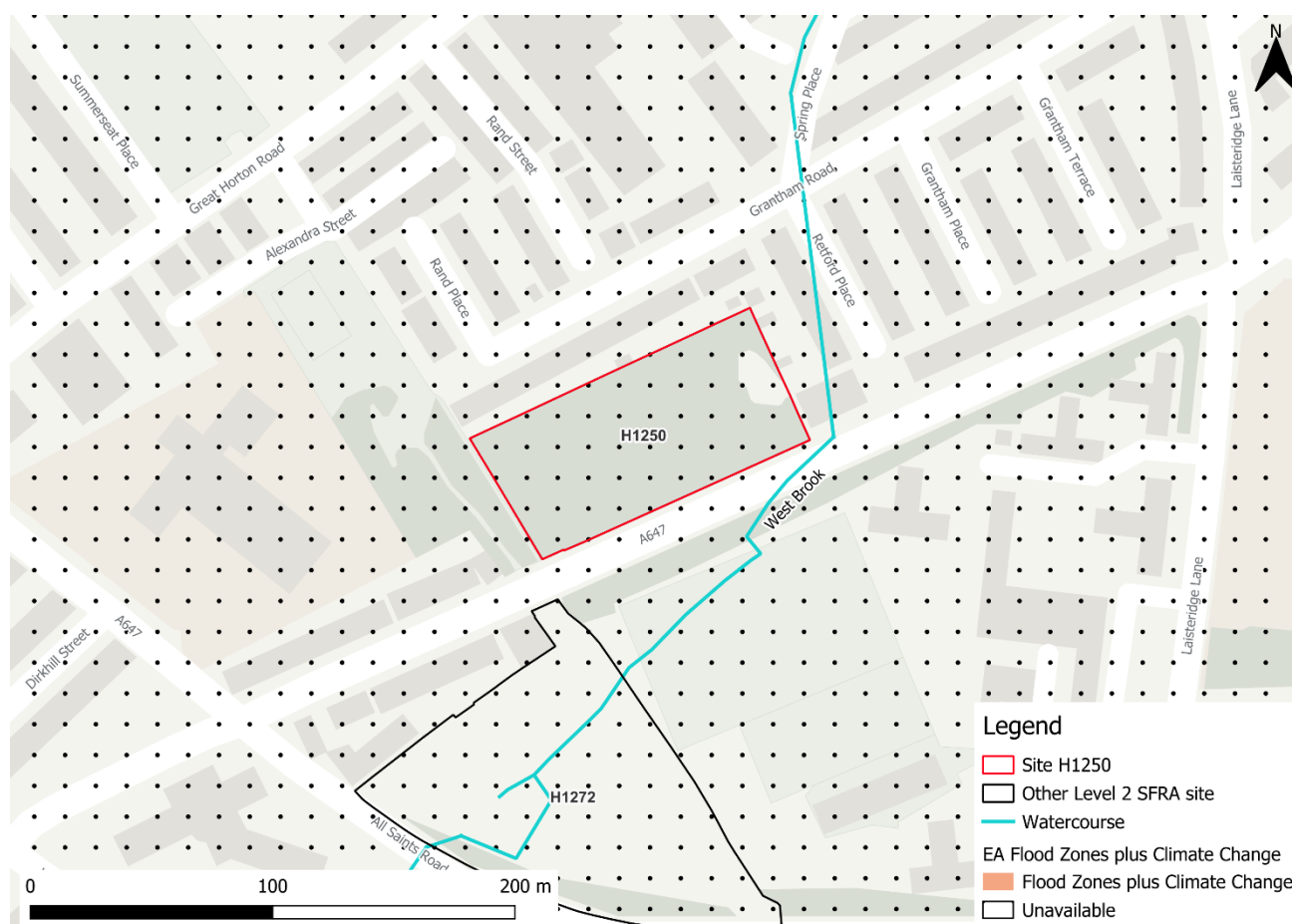


Figure 2-2: EA Flood Zones plus Climate Change

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) that may help 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 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 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, though an FAA, namely 123WAF961 - Middle River Aire catchment, is located adjacent to the south of the site.



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

2.5.2 Access and escape routes

Based on available information, safe access and escape routes would likely be achievable via the A647 (Dirkhill Road) at the south of the site, travelling west (Figure 2-4).



Figure 2-4: Potential access and escape routes

2.6 Observations, mitigation options and site suitability - 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 majority of the site is located with Flood Zone 1, putting it at low risk of fluvial flooding.
 - A small area of the site is modelled to be within the functional floodplain in the southwest corner of the site, representing the culverted West Brook watercourse to the east of the site. Consideration should be given as to whether de-culverting and daylighting this section of culvert is feasible, supported by detailed modelling.
 - If West Brook remains culverted, there should be no development above the culvert. The location and course of the culvert should be confirmed through survey.

- If works are proposed on or near East Brook, 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.
- EA flood alerts should continue to be in place to ensure early evacuation of site users before an extreme flood event occurs.
- There may be opportunities to deculvert and daylight the West Brook culvert to the east of the site which could impact flood risk on the site. Any site-specific FRA should produce a detailed model of the reach of West Brook to confirm modelled flood extents and depths within the site.
- 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 would likely be achievable via Dirkhill Road to the south 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 high and medium risk events is confined to a small area of ponding in the northwest of the site in a topographic low spot (Figure 3-1). In the low risk event, surface water risk extends to include a flow path in the north of the site, flowing west to east towards the low spot.

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)
84	13	1	2

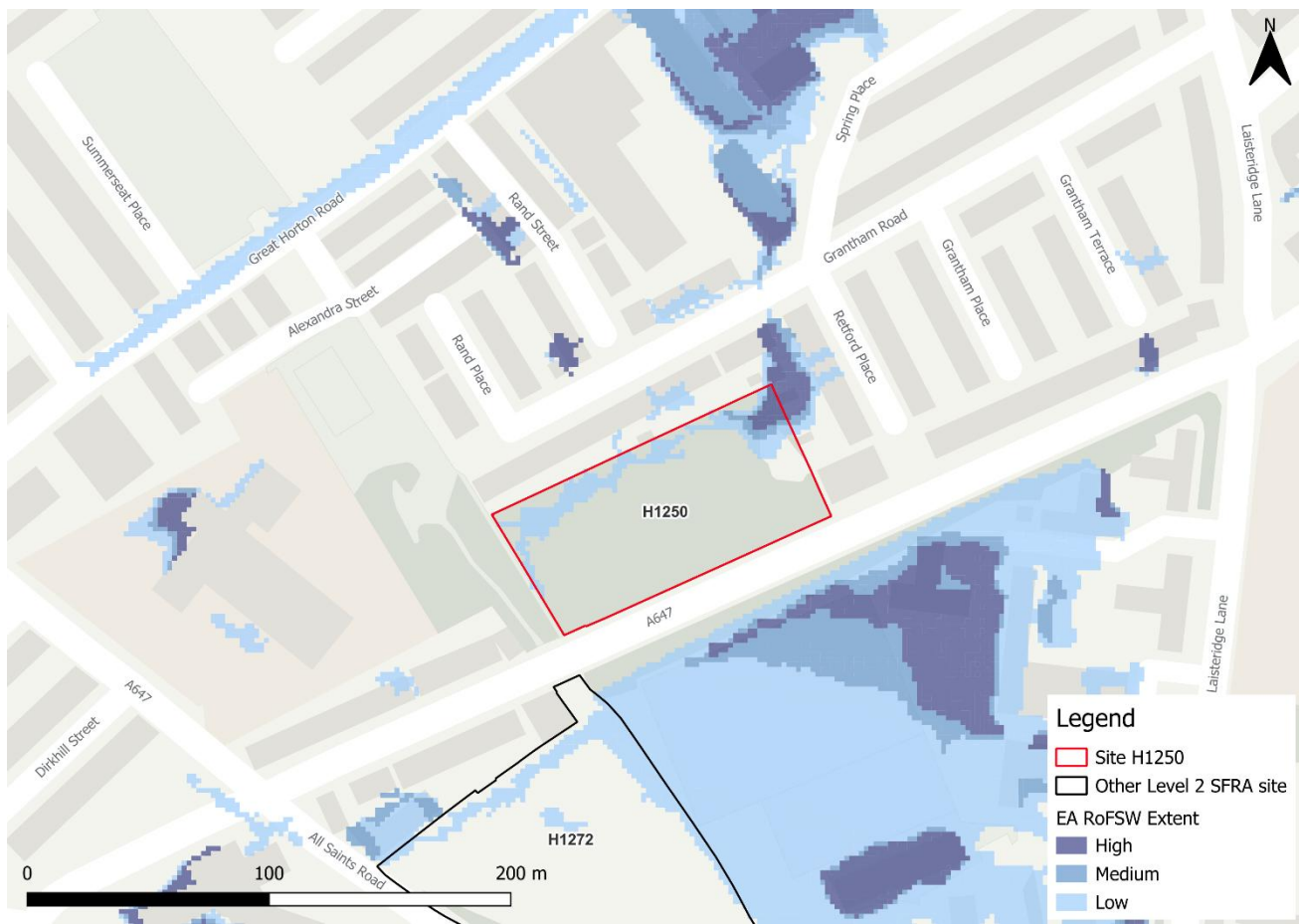


Figure 3-1: Surface water flood extents (NaFRA2 - Risk of Flooding from Surface Water map)

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 in the medium risk event are shallow between 0.15 and 0.30m (Figure 3-2) within the northeast of the site, with hazard categorised as 'low' (Figure 3-3).

Safe access and escape routes remain available via Dirkhill Road at the south of the site due to no modelled surface water risk in the medium event.

There are small 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 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, the medium risk surface water event is likely to increase in extent within the site when accounting for climate change (Figure 3-4), extending to include a flow path along the northern boundary of the site. The third generation map indicates maximum flood depths are likely to increase to between 0.30 and 0.60m (Figure 3-5), with areas of hazard categorised as 'significant' (Figure 3-6).

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

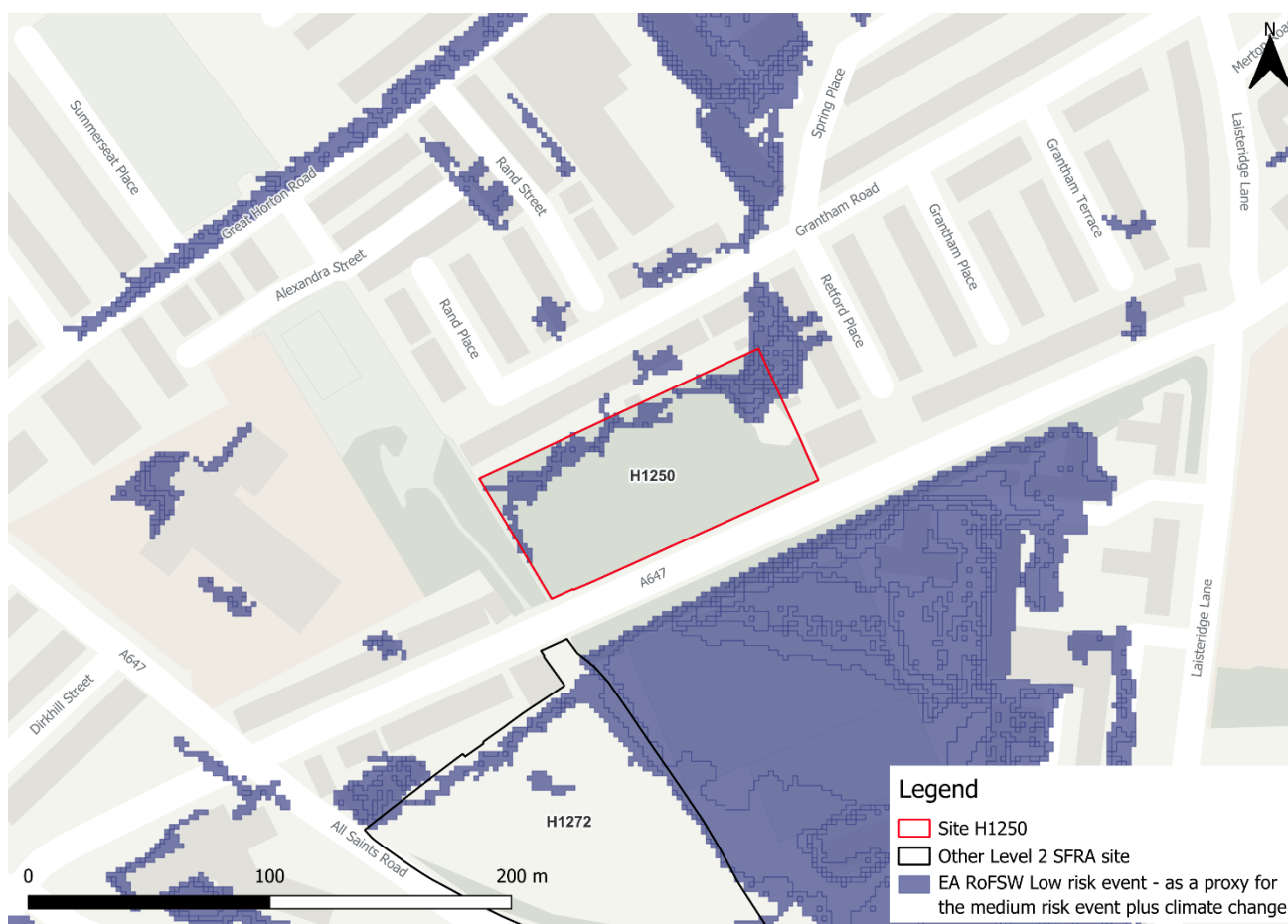


Figure 3-4: Low risk event surface water flood extent, as a proxy for the medium risk event plus climate change (NaFRA2 - Risk of Flooding from Surface Water map)

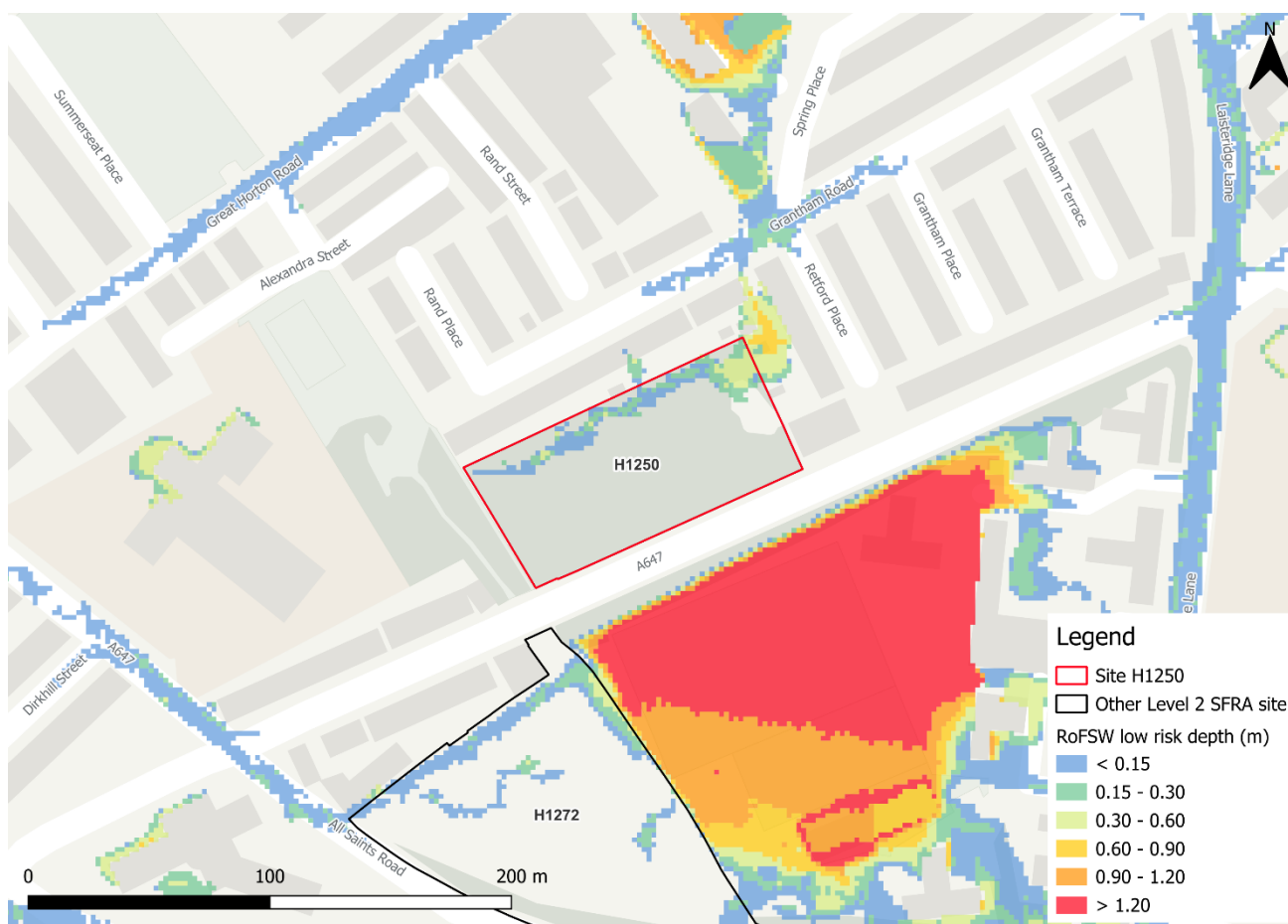


Figure 3-5: Low risk event surface water flood depths, as a proxy for the medium risk event plus climate change (Third generation - Risk of Flooding from Surface Water map)



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 84% of the site being at very low surface water flood risk. Surface water in the present day medium risk event is confined to a small area of ponding in the northeast of the site.
- Topographic 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 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. Surface water flood risk in this event is confined to areas of ponding within topographic low spots across the site.
- Safe access and escape routes should be possible via the A647 (Dirkhill Road) during all events.
- 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 Guide². Figure 4-1 shows the map covering this site and the surrounding areas and. Table 4-1 explains the risk classifications.

The majority of the site is in an area where there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots. Groundwater conditions are therefore unlikely to be suited to infiltration SuDS, which is reflected in the bedrock geology largely being comprised of lower permeability rock (Figure 1-3). A drainage strategy must include for ground and infiltration surveys and further investigation into groundwater levels are recommended.

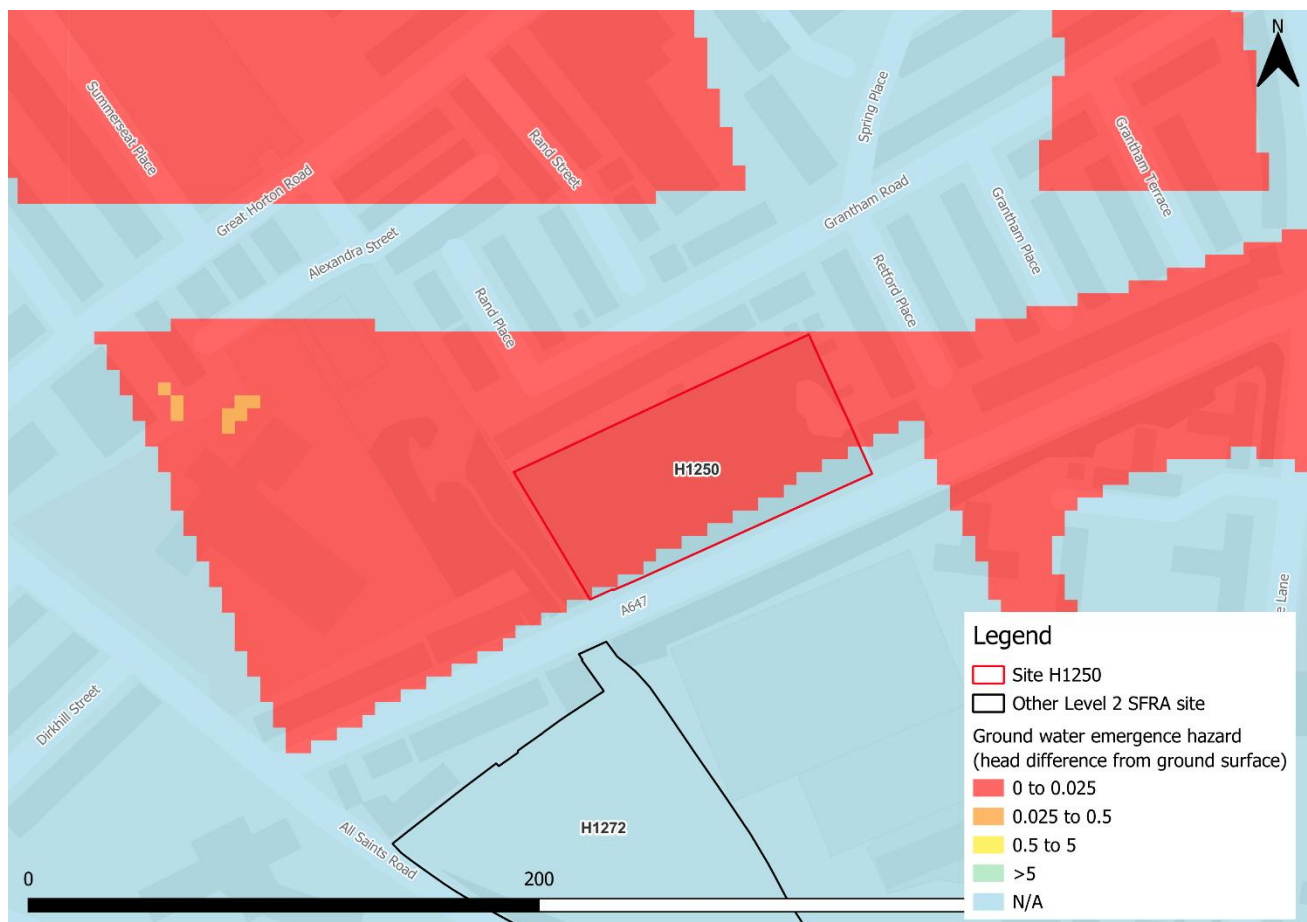


Figure 4-1: JBA 5m Groundwater Emergence Map

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 blockage or structural failure of the culverted channel to the east of the site.

5.1 Potential blockage

A blockage or structural failure of the West Brook culvert to the east of the site may cause water in the channel to overtop and cause flooding to the site, depending on the severity of the blockage and the magnitude of the flood event. The inlet of the culvert is marked on Figure 5-1.

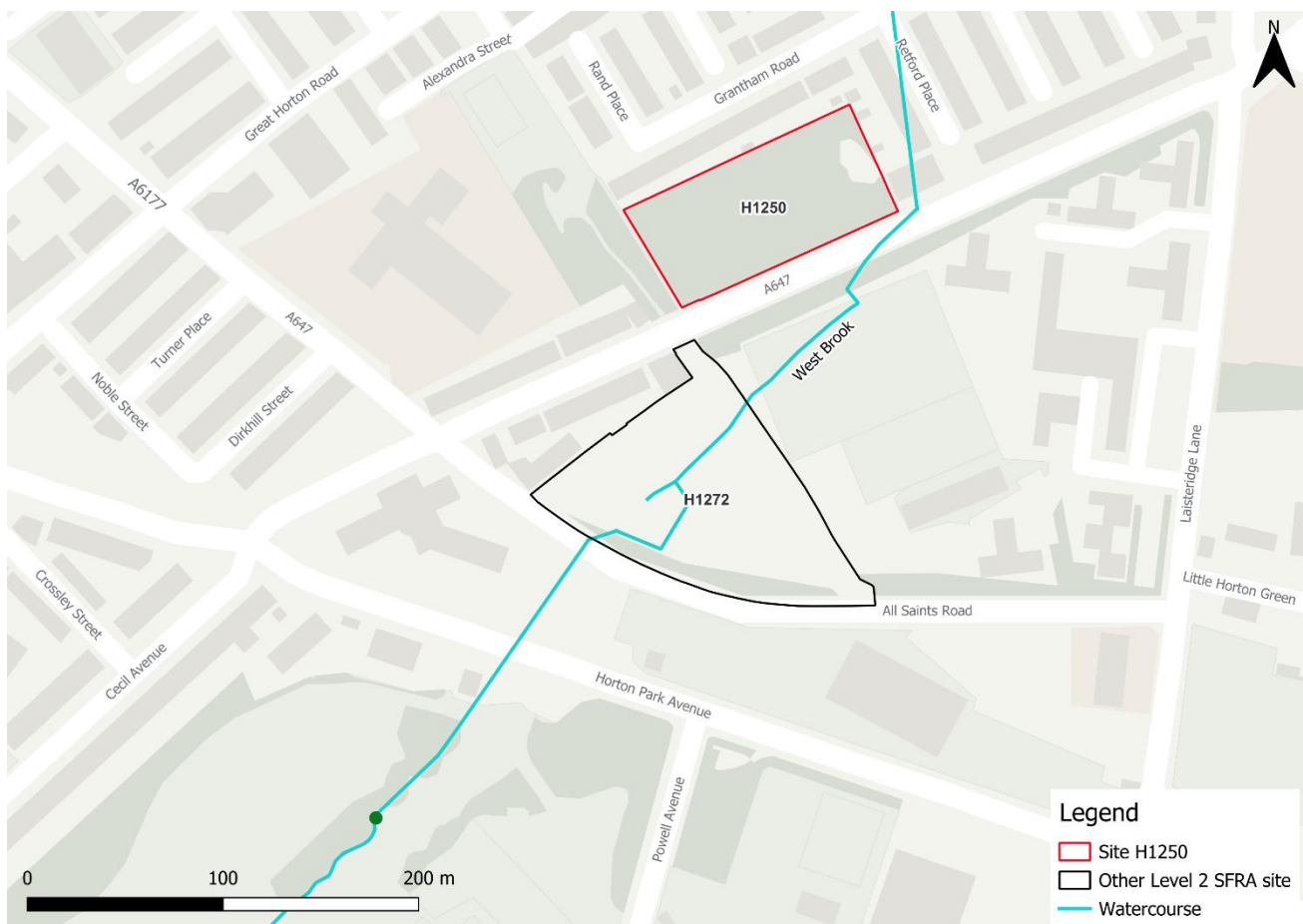


Figure 5-1: Potential blockage location

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

- The site is at potential residual risk from a blockage or structural failure of the West Brook culvert to the east of the site. The site-specific FRA could consider modelling a blockage scenario to understand whether there would be any additional risk to the site as a result of a blockage.
- 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).

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, given it is not located within Flood Zone 3a. It must however 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:

- There should be no development above the West Brook culvert which runs to the east of the site. The location and path of this culvert should be confirmed through a survey as part of the site-specific FRA.
- Development should be directed to the areas of the site within Flood Zone 1.
- There may be opportunities to deculvert and daylight the West Brook culvert which could impact on flood risk to the site and the surrounding area.
- Modelled flood depths, velocities and hazards have therefore not been considered as part of this Level 2 SFRA. Updated present day and climate change modelling of West Brook should be used to update this Level 2 SFRA at the earliest opportunity to provide an up-to-date strategic assessment of flood risk to this site and the surrounding areas in order to allocate the site. This should also include for culvert blockage and daylighting scenarios.

6.3 Site-specific FRA requirements and further work

At the planning application stage, the following should be considered

- Full detailed modelling of West Brook to understand up to date risk to the site including for climate change, including for de-culverting scenarios.
- Further modelling to understand the impacts of climate change on surface water flood risk to the site.
- A condition and capacity assessment of the West Brook culvert to the east of the site.
- Consideration of safe access and escape routes to the site.
- The 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.

³ Para 178 National Planning Policy Framework 2024

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Final Draft

July 2026

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City of
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