Sheffield Level 2 Strategic Flood Risk Assessment Update - Site S04101

Final

May 2025

Prepared for:

Sheffield City Council

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Contract

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This report describes work commissioned by Sheffield City Council (SCC) by an instruction dated 23 January 2025. The Client's representative for the contract was Chris Hanson of SCC. Laura Thompson of JBA Consulting carried out this work.

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Acknowledgements

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 Sheffield City Council (SCC) Local Plan Site S04101. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'SCC Level 1 SFRA' (2022) and read the 'SCC Level 2 SFRA Main Report' (2024) and is therefore familiar with the terminology used in this report.

1.1 Site S04101

- Location: Land to the south of the M1 Motorway Junction 35, S35 1QP
- Existing site use: Agriculture and greenfield
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Employment
- Proposed site use vulnerability: Less vulnerable
- Site area: 35.6 hectares
- Proposed development impermeable area: 22 hectares
- Watercourse: Blackburn Brook
- Environment Agency (EA) river model: Blackburn Brook 2018
- Summary of requirements from scoping stage:
    - 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 potential residual risk
    - Assessment of all other sources of flood risk

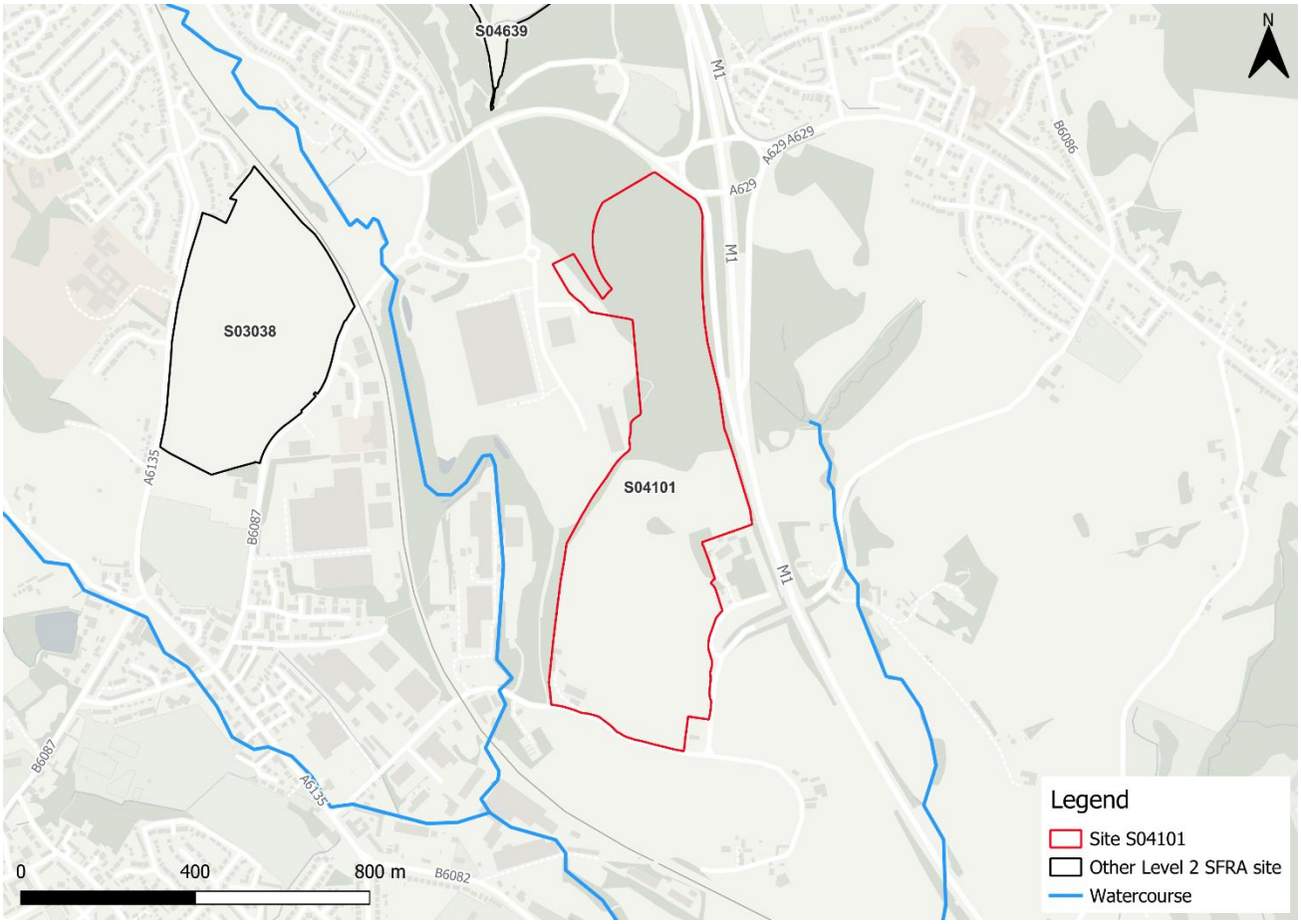

Figure 1-1: Existing site location boundary

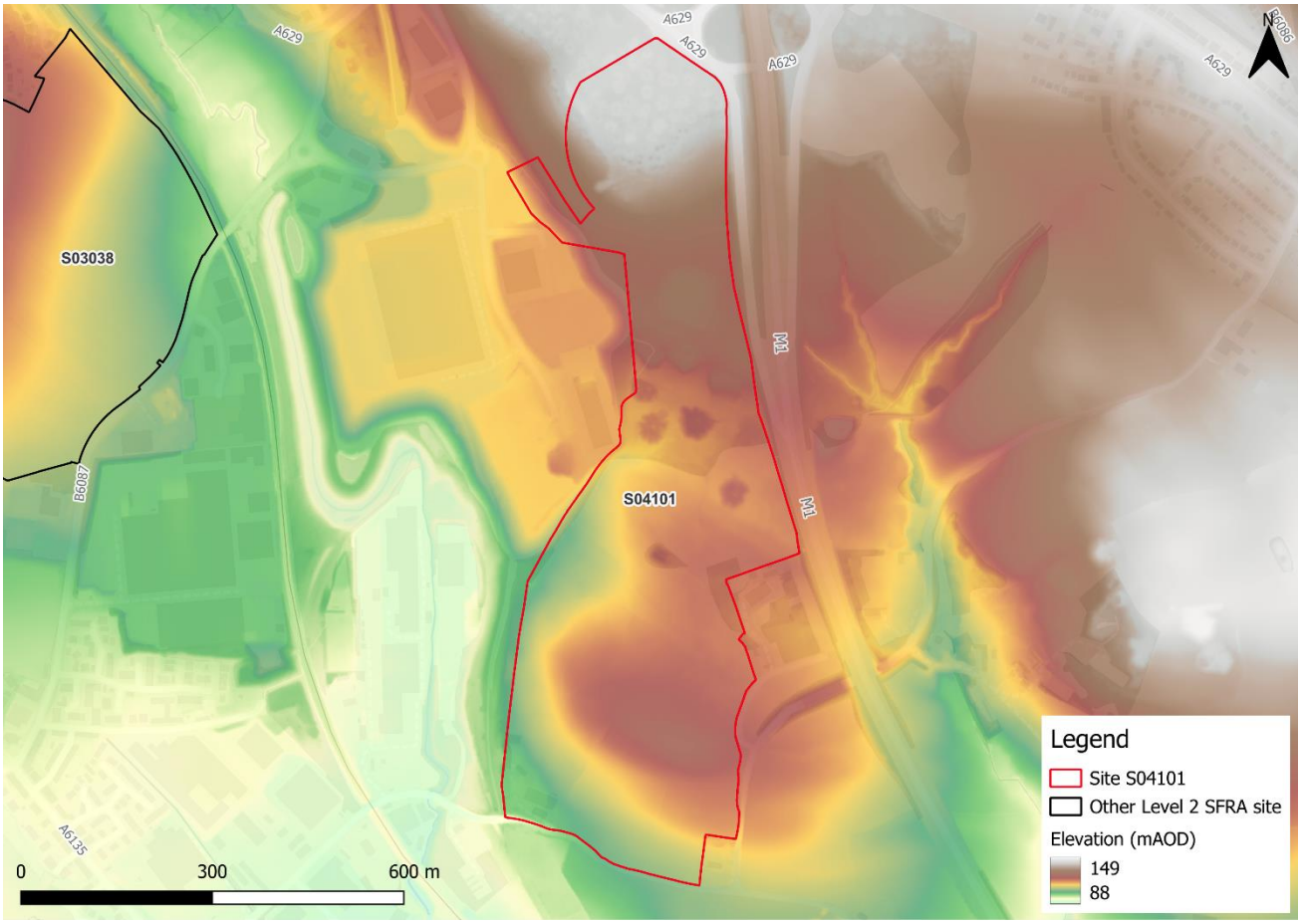

Figure 1-2: Topography

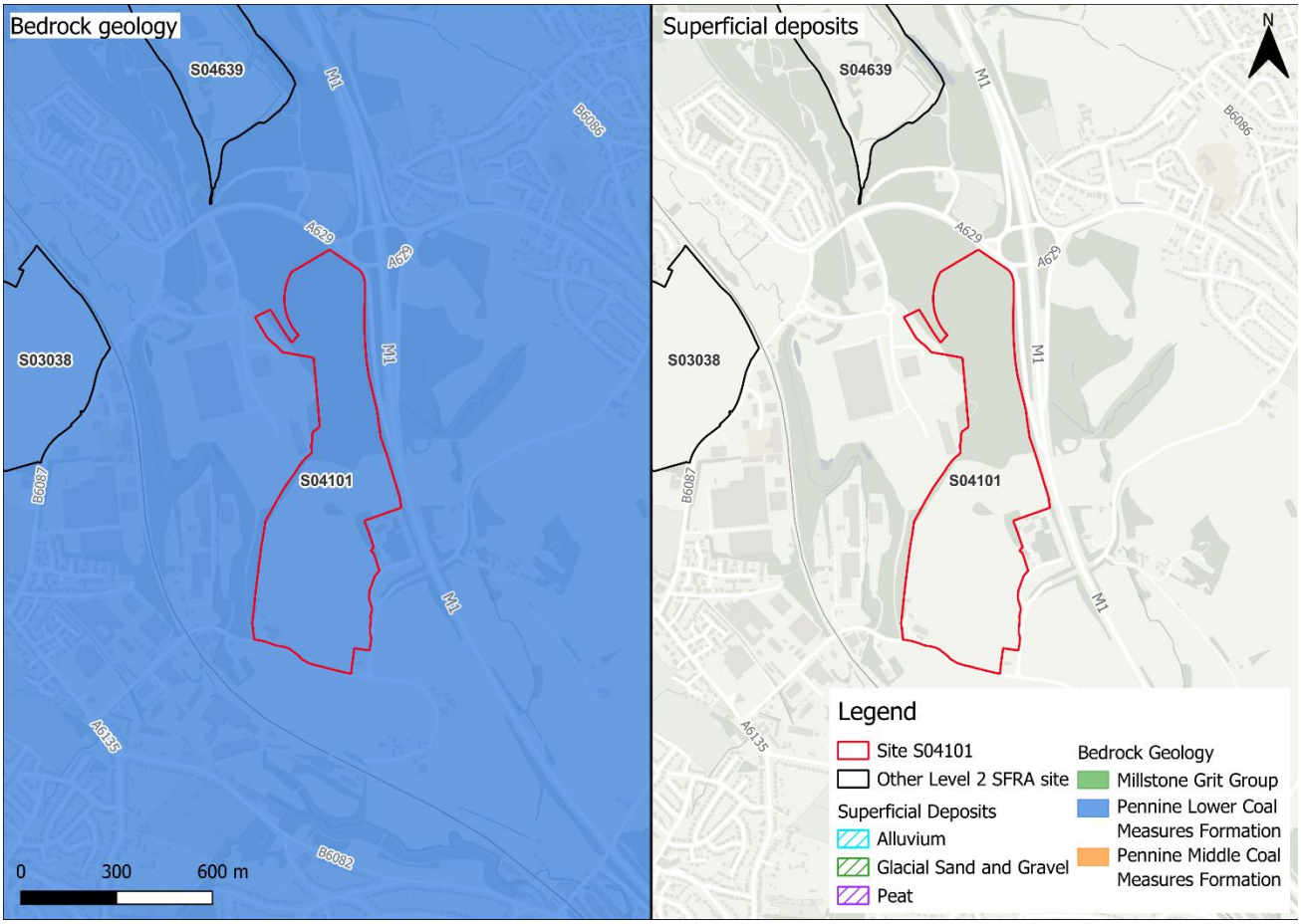

Figure 1-3: Soils and geology

2 Flood risk from rivers

2.1 Existing risk

2.1.1 Flood Map for Planning and functional floodplain

Based on the EA's Flood Map for Planning (February 2025) and Flood Zone 3b (functional floodplain), as updated in the Level 2 SFRA finalised in 2024, 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 0) or the impacts of climate change (Section 2.2).

The site is partially located within Flood Zone 2 and therefore at medium risk. Flood Zone 2 in this location appears to be based on historic flood events from the EA's Historic Flood Map (HFM) rather than the Blackburn Brook model.

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)
98	2	0	0

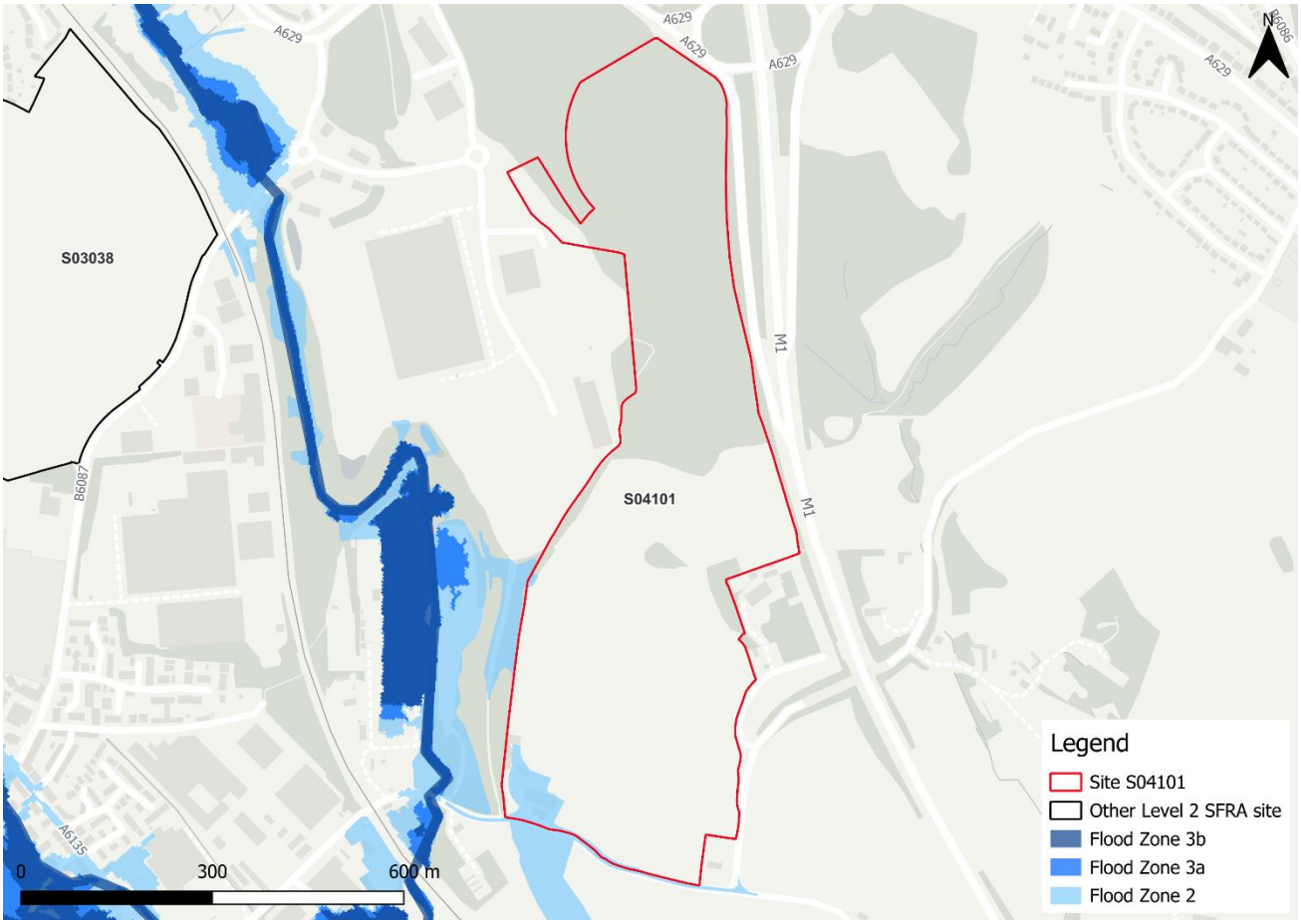

Figure 2-1: Existing risk from rivers to the site

2.1.2 Blackburn Brook 2018 undefended 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 should be based on. However, the Flood Map for Planning is different to the Blackburn Brook outputs in this location and will therefore mean recommendations on development may also be different when accounting for the Flood Map for Planning or the Blackburn Brook model. As discussed, this is because Flood Zone 2 is based on the HFM and not the modelled 0.1% AEP event of the Blackburn Brook model. There is no modelled risk to the site in this event.

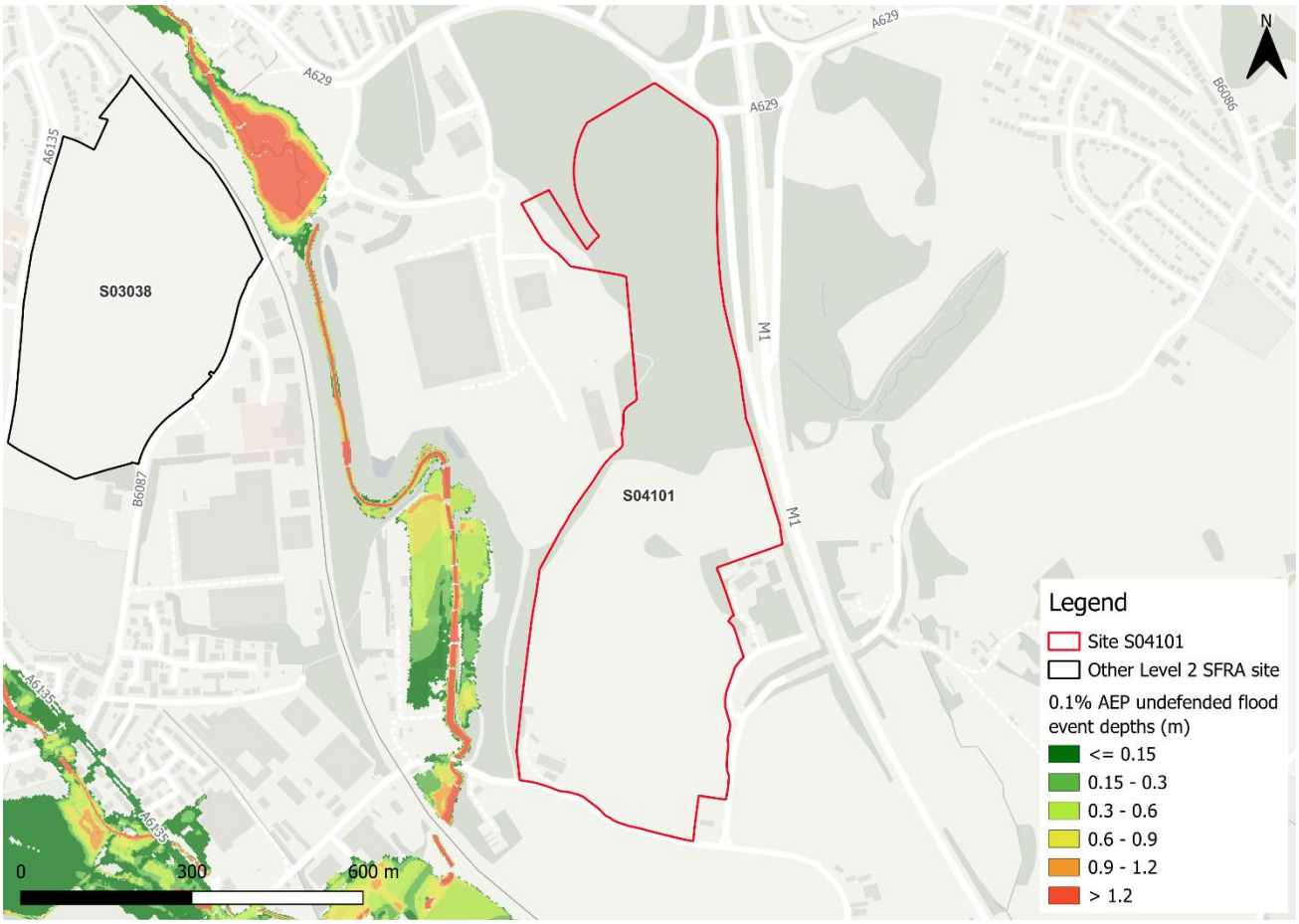

Figure 2-2: Flood depths for 0.1% AEP undefended flood event

2.2 Impacts from climate change

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

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

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

Return period (AEP event)	Central allowance 2080s (% increase)	Higher central allowance 2080s (% increase)	Upper end allowance 2080s (% increase)
3.3% (functional floodplain)	28%	38%	60%
1%	28%	38%	60%

Figure 2-3 shows the onsite modelled flood depths for the 0.1% AEP undefended event +38% (higher central) for climate change. The site is not modelled to be at risk when accounting for climate change.

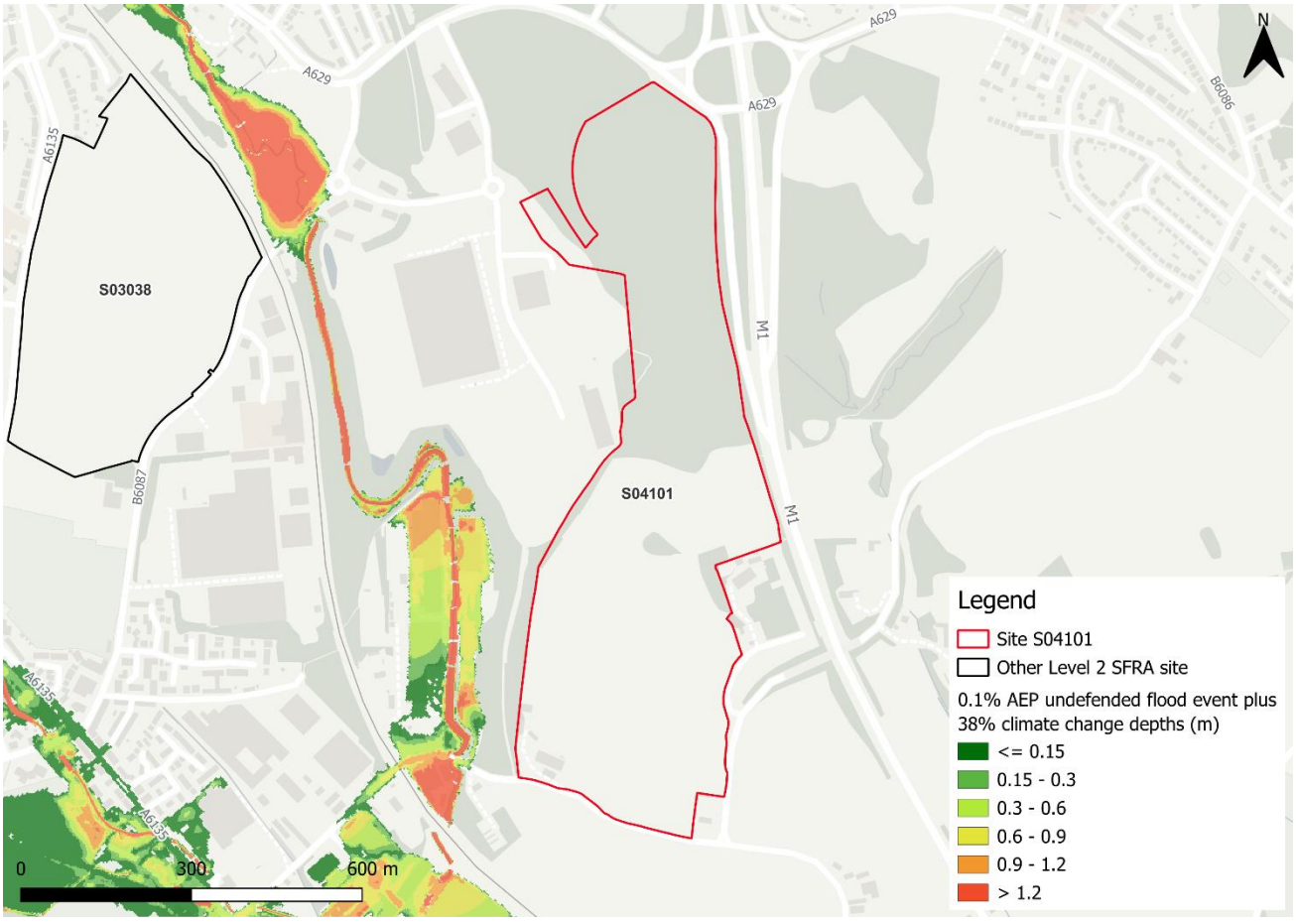

Figure 2-3: Flood depths for 0.1% AEP undefended flood event +38% (higher central climate change allowance)

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. There are however areas of natural high ground adjacent to the banks of Blackburn Brook.

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 site, there are opportunities for runoff attenuation features to temporarily store water and attenuate flooding during high flows. Adjacent to Blackburn Brook, there is potential for floodplain reconnection where it may be possible to establish reconnection between a watercourse and its natural floodplain during high flows. These areas are shown on Figure 2-4. The WwNP mapping is broadscale and indicative. Further investigation is required for any land shown to have potential for WwNP.

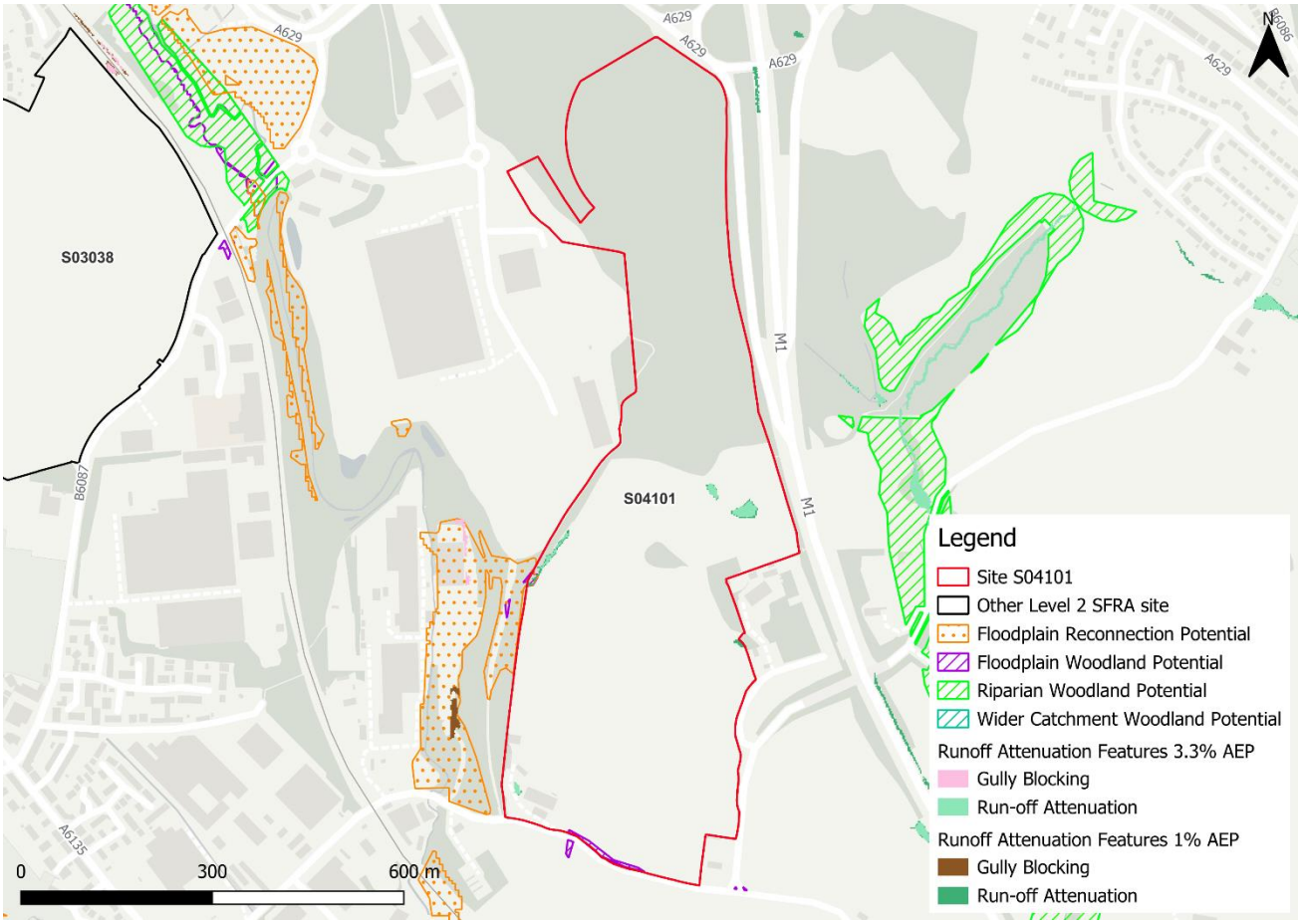

Figure 2-4: Natural Flood Management (NFM) potential mapping

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) has been considered and mapped in Figure 2-5 which shows an area within the south of the site has been subject to flooding in the past. The Recorded Flood Outline (RFO) dataset indicates that this historic incident occurred as a result of the channel capacity of Blackburn Brook being exceeded in June 2007. The HFM in this area has been included within Flood Zone 2.

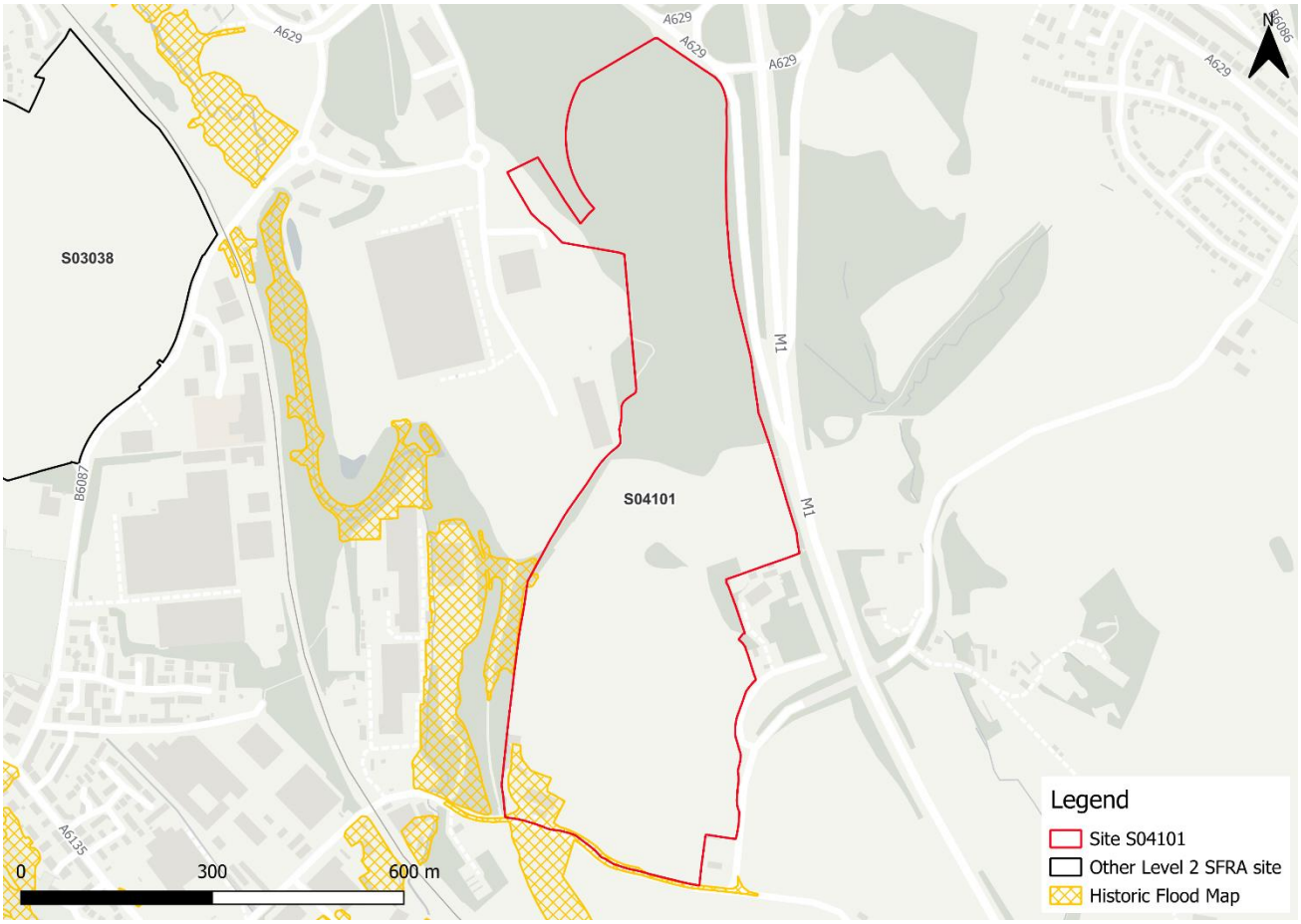

Figure 2-5: Recorded historic flood events onsite and around the site

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 site is partially located within a FAA, namely 123WAF987 - Blackburn Brook.

Based on the Blackburn Brook 2018 model, safe access and escape routes would likely be achievable via Loicher Lane to the south of the site during a fluvial flood event. When accounting for Flood Zone 2 of the Flood Map for Planning, safe access and escape routes would need to be made available via Jumble Lane to the east of the site.

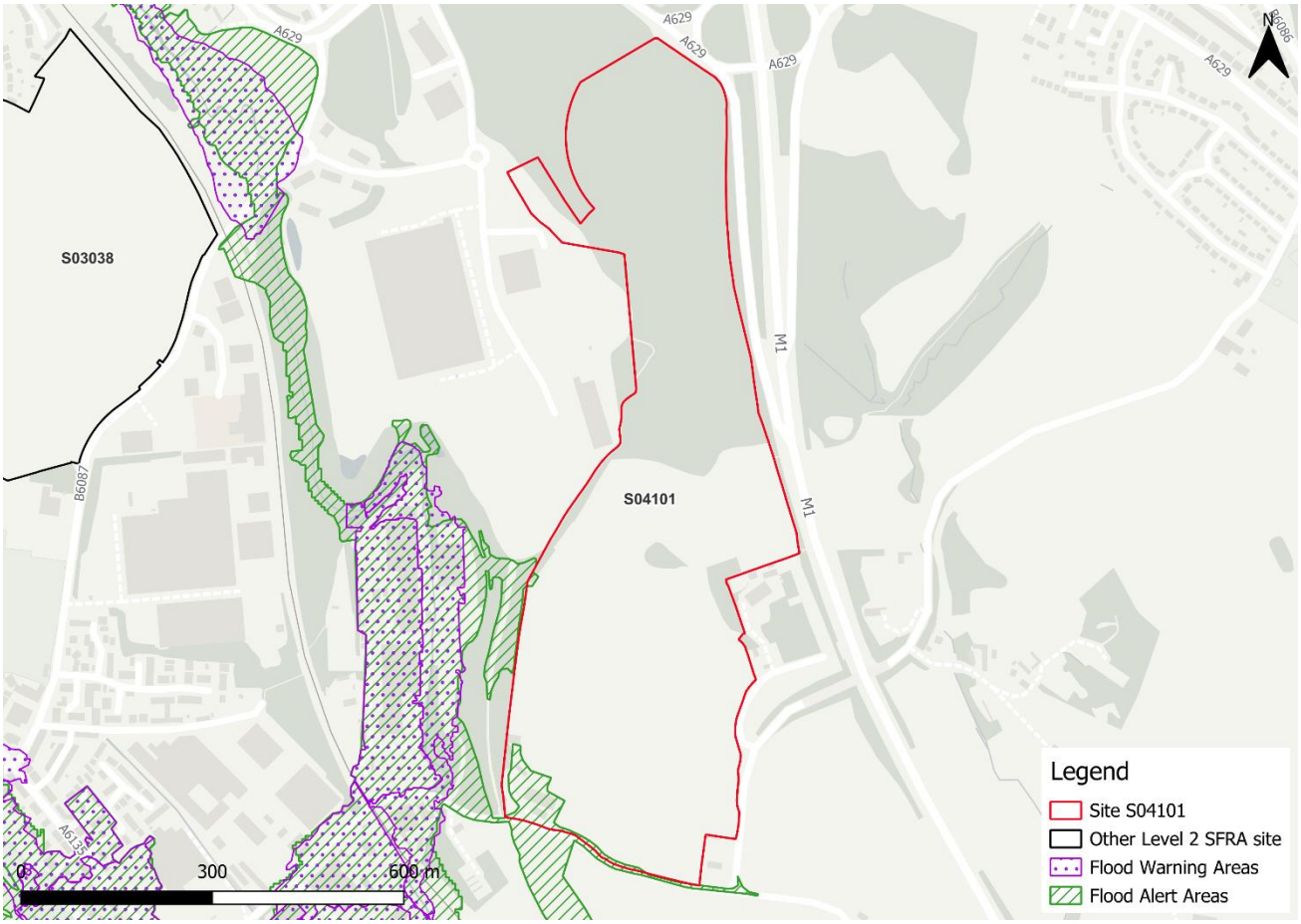

Figure 2-6: EA Flood Warning Areas and Flood Alert Areas

2.6 Observations, mitigation options and site suitability - fluvial

- The site is partially within Flood Zone 2 of the Flood Map for Planning, however this is based on the HFM and not modelled outputs.
- The 0.1% AEP undefended flood event (Blackburn Brook 2018 model) indicates that the site is at low risk of flooding from rivers. Risk to the site is not modelled to increase when accounting for climate change.

3 Flood risk from surface water

3.1 Existing risk

Based on the EA's national scale third generation Risk of Flooding from Surface Water (RoFSW) map (November 2023), surface water risk to the site is predominantly very low. Approximately 2% 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 small areas of scattered ponding within topographic low spots across the site. These areas are modelled to increase slightly in extent in the medium risk event. In the low risk event, a shallow flow path develops along the western boundary of the site. The area of ponding along the western boundary becomes deeper and there are a number of additional areas of scattered ponding.

Greatest flood depths within the site in the medium risk event are between 0.6 and 0.9 m (Figure 3-1) with some areas of hazard categorised as 'significant' (Figure 3-2). Safe access and escape routes should be possible via Loicher Lane to the south of the site in all events.

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

Very low risk (% area)	Low risk (% area)	Medium risk (% area)	High risk (% area)
96	2	1	1

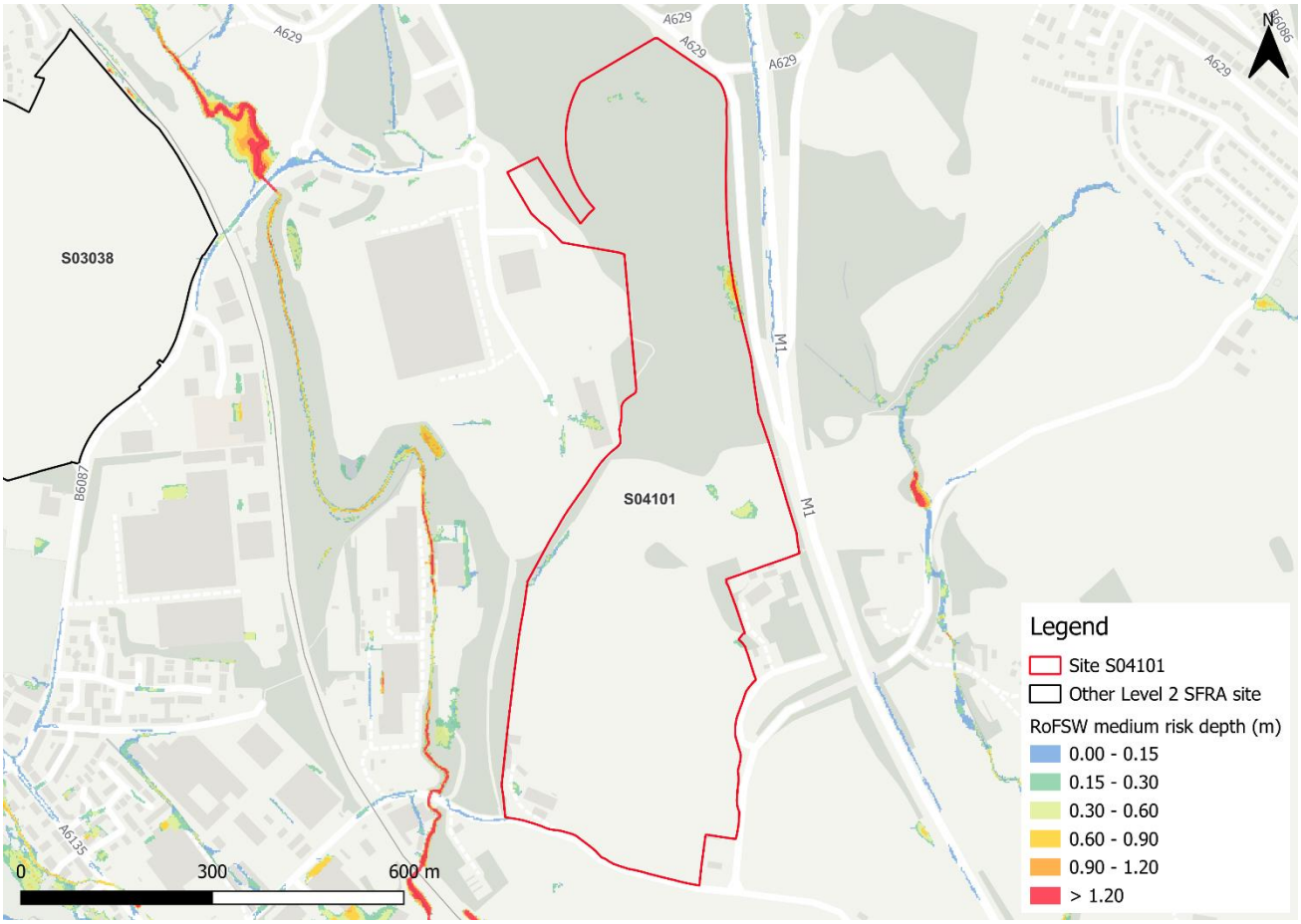

Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

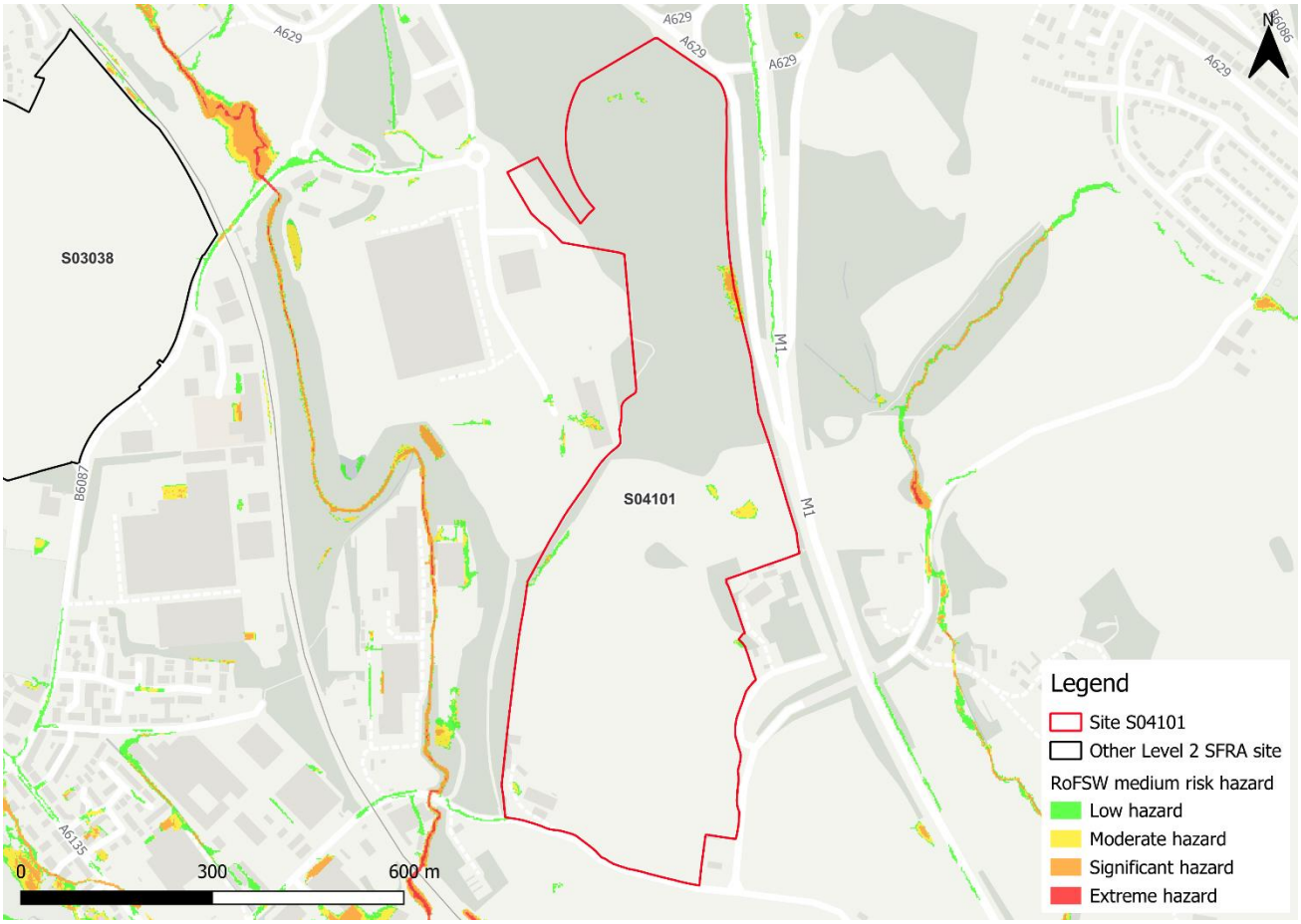

Figure 3-2: Medium risk event surface water flood hazard[1] (Risk of Flooding from Surface Water map)

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 Don and Rother management catchment

Return period	Central allowance 2070s (% increase)	Upper end allowance 2070s (% increase)
3.3% (high risk)	25%	35%
1% (medium risk)	25%	40%

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 3-3 shows the modelled surface water flood depths for the medium risk event plus 40% climate change. Risk is modelled to be greater than for present day conditions, with the medium risk climate change event showing a similar level of risk to the present day low risk event. Maximum flood depths onsite are modelled to increase to > 1.2 m with some areas of extreme hazard (Figure 3-4). Safe access and escape routes should remain possible via Loicher Lane to the south of the site.

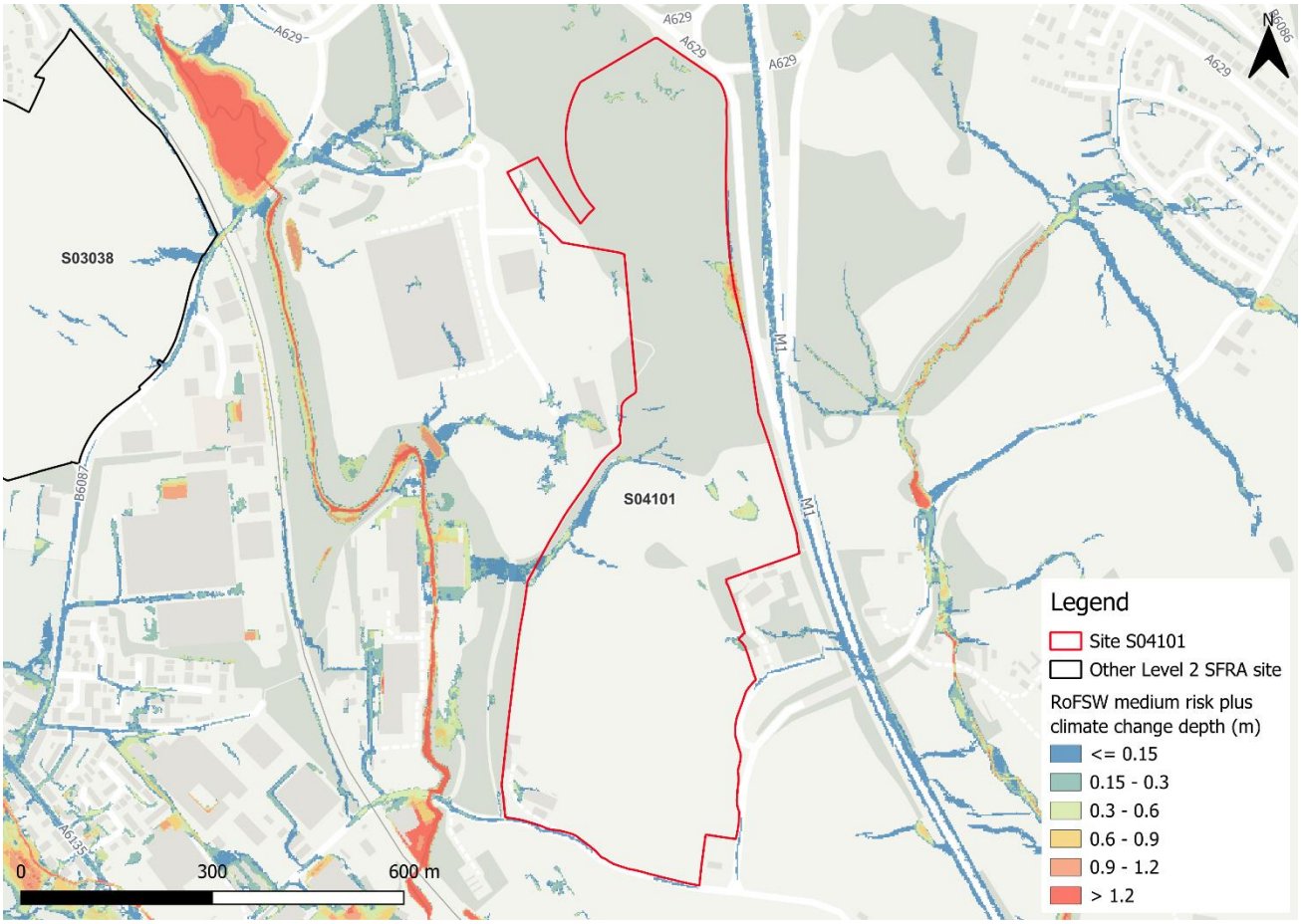

Figure 3-3: Medium risk event surface water flood depths plus 40% climate change (based on Risk of Flooding from Surface Water map)

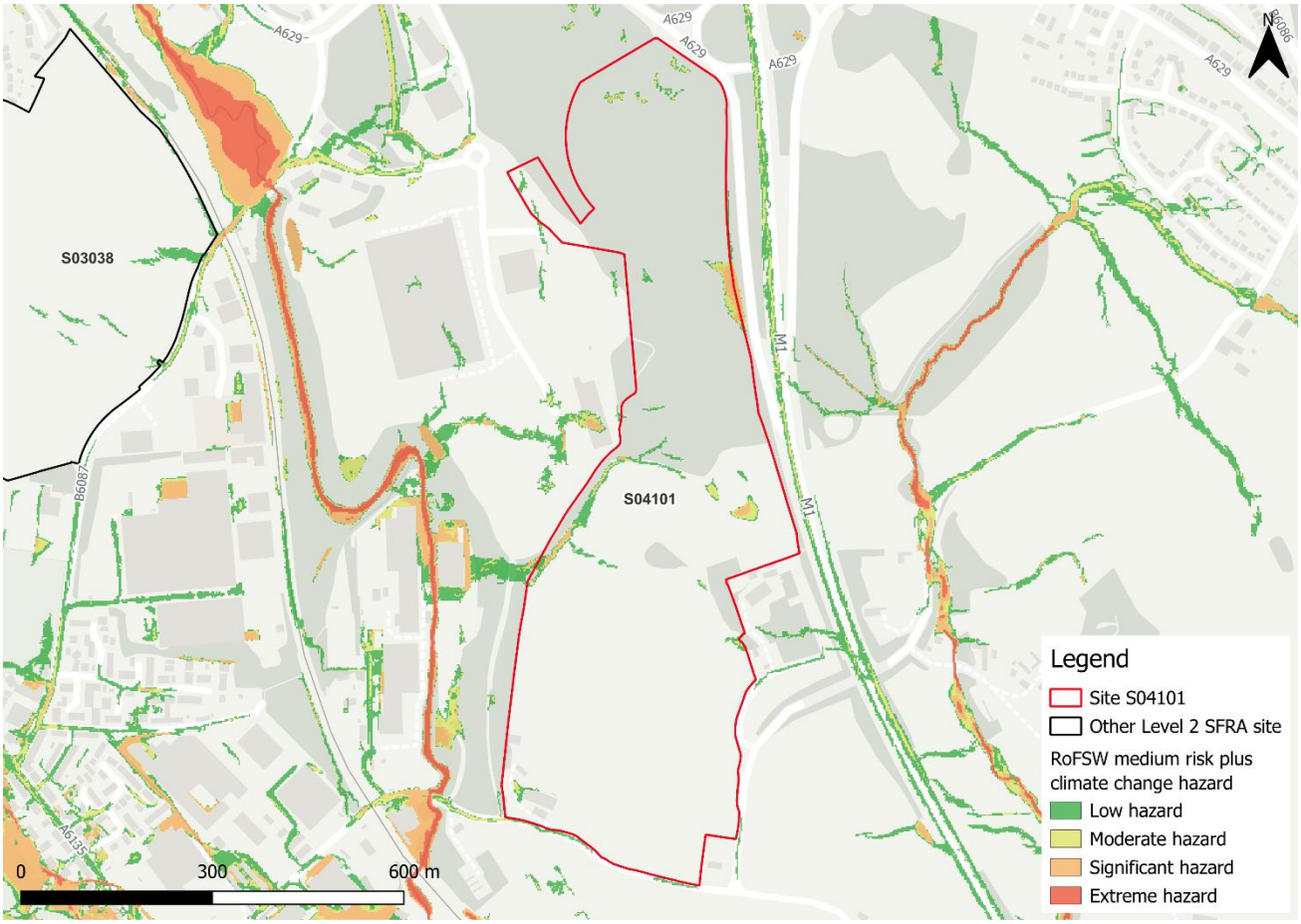

Figure 3-4: Medium risk event surface water flood hazards plus 40% climate change (based on Risk of Flooding from Surface Water map)

3.3 Risk of runoff from site post development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on the estimated impermeable area (assumed 85% of site area where this information was not available) and limiting greenfield runoff rate of Qbar (l/s).

Table 3-3: Surface water flood risk from proposed development

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (Ha) and % of site area
30yr Rainfall+25%	12	17765	4681	13804	33.4	0.87 Ha 2.4%
30yr Rainfall+35%	12	19186	4681	14505	37.1	0.97 Ha 2.7%
100yr Rainfall+25%	12*	26974	7801	19173 (6088 exceedance storage)	49.0	1.28 Ha 3.6%
100yr Rainfall+40%	12*	31038	8582	22456 (7951 exceedance storage)	57.4	1.50 Ha 4.2%
Surface water flood risk impacts from development site, mitigation & SuDS options	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					
*critical storm duration limited to 12 hours						

Note: Proposed development limiting runoff rate: (l/sec). Qbar (FEH Statistical) – 154.79, Q30 – 270.89, Q100 – 321.97.

3.4 Observations, mitigation options and site suitability - surface water

- Current and future risk is predominantly very low, being scattered ponding and shallow flow paths within topographic low spots across the site. Safe access and escape routes would likely be achievable via Loicher Lane in all events.
- The topographic flow path within the west of the site 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.
- For the 1% AEP event plus 40% climate change, approximately 4% of the total area of the site would be required for flood storage based on a 1.5m deep pond to ensure runoff volumes do not exceed existing rates.
- The site is currently greenfield, therefore a detailed drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a

result of new development. This may require surface water modelling based on layout plans and detailed design and consultation with the LLFA.

- The NaFRA2 release of the RoFSW should be considered at the FRA stage.
- 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 Guide[2]. Figure 4-1 shows the map covering this site and the surrounding areas and Table 4-1 explains the risk classifications.

The risk of groundwater emergence varies across the site. Within the majority of the site, there is no risk of groundwater emergence. Groundwater conditions may therefore be suited to infiltration SuDS in these areas. There are some scattered areas across the site where there is a risk of groundwater flooding to surface and subsurface assets. Ground survey, including percolation testing may be required to fully ascertain groundwater conditions in these locations at the FRA stage.

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 Loicher Lane culvert blockage

Figure 5-1 shows the modelled flood depths in the event of a blockage of the culvert beneath Loicher Lane at NGR 436422, 394393. There is no modelled risk to the site in this event.

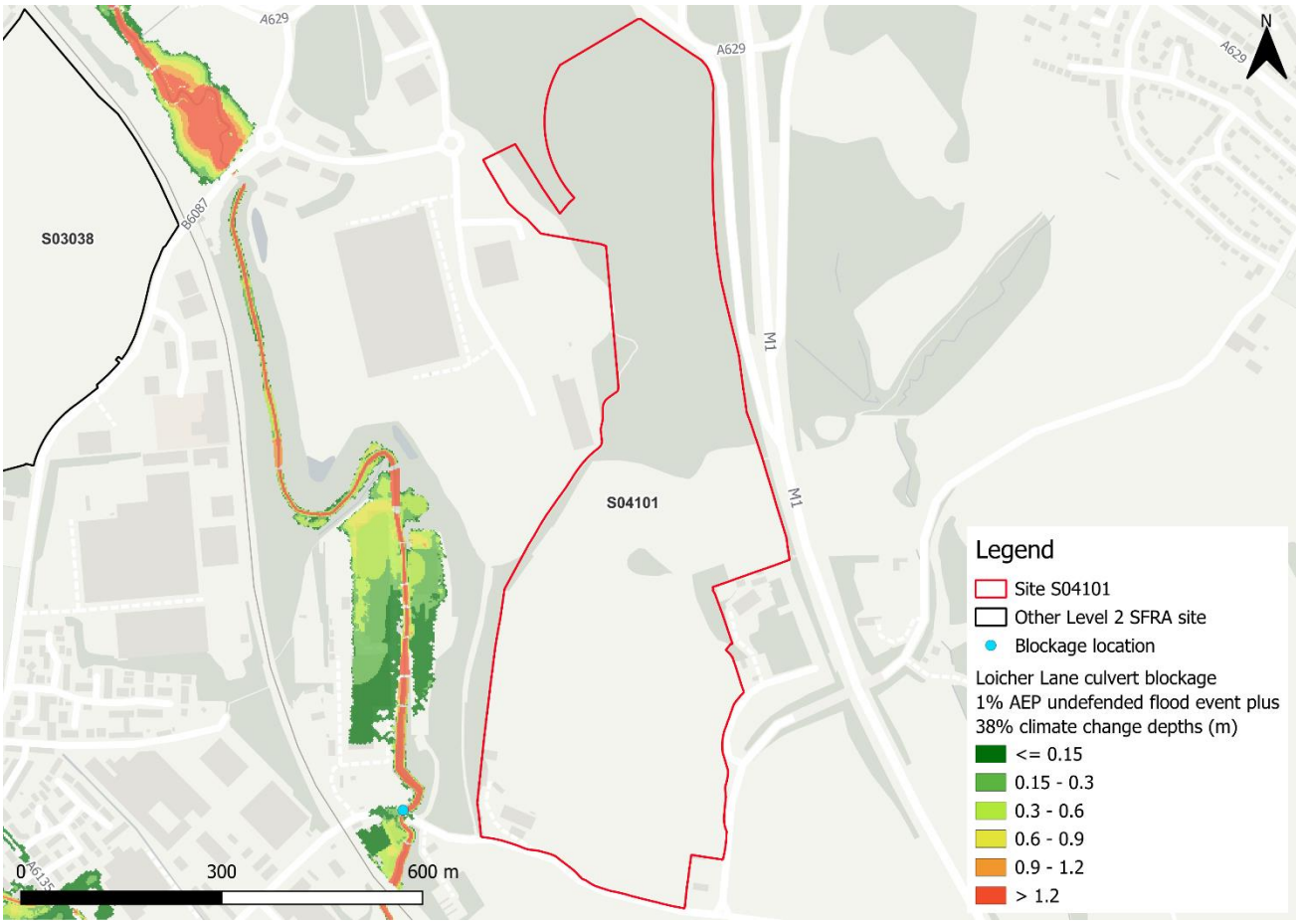

Figure 5-1: Loicher Lane culvert blockage depths (based on a 1% AEP plus higher central climate change event)

5.2 Flood risk from reservoirs

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

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

5.3 Observations, mitigation options and site suitability - residual risk

- The site is not likely to be at residual flood risk based on current information.

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 test[3] as it is proposed for less vulnerable uses, however it must still be proven that the development can be safe for its lifetime, which is 75 years for non-residential development.

6.2 Recommendations, FRA requirements, and further work

Based on the evidence presented in the Level 1 SFRA (2022) and this Level 2 SFRA:

- It should be appropriate to develop this site for less vulnerable purposes given its location largely within Flood Zone 1 and nominal risk from surface water.
- Ideally, development would avoid the area of the site located within Flood Zone 2, however this is based on the HFM and not modelled outputs.
- A detailed drainage strategy will be required given the conversion from open greenspace to built development.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA online guidance; the SCC 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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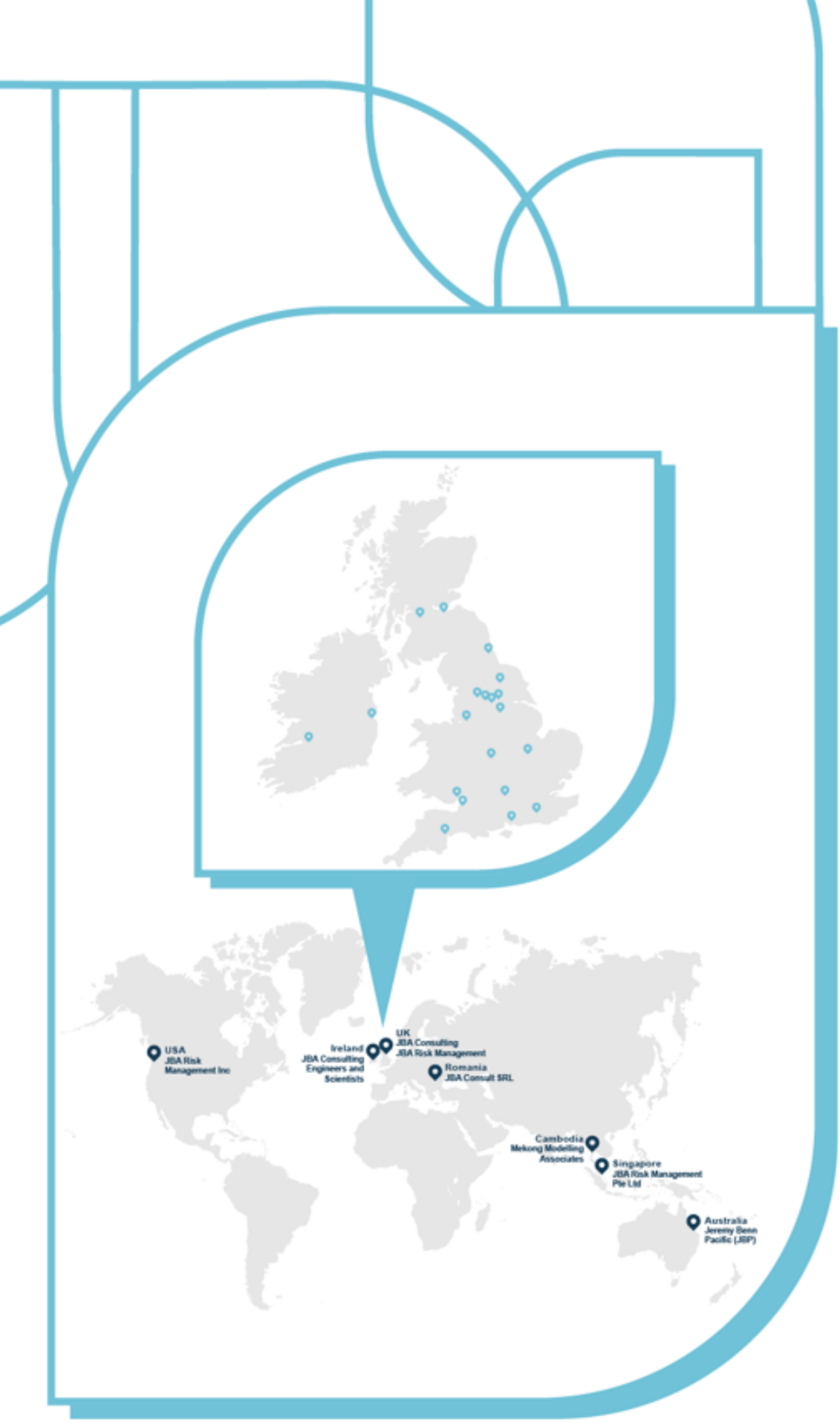

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