Level 2 Strategic Flood Risk Assessment - Site BW1

A1-C01

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Prepared for:

Newcastle-under-Lyme Borough Council

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Contents

1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for BW1. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'Newcastle-under-Lyme Level 1 SFRA' and read the 'Newcastle-under-Lyme Level 2 SFRA Main Report' and is therefore familiar with the terminology used in this report.

1.1 Site details

- **Location:** Chatterley Valley, Lowlands Road. The site is located to the west of Tunstall, one of the six towns which amalgamated to form the City of Stoke-on-Trent.
- **Site area:** 6.50ha.
- **Existing site use:** Predominantly greenfield, with a brownfield area in the east.
- **Proposed site use:** Employment.

1.2 Topography

The Environment Agency (EA) 1m resolution LiDAR shows that the ground level slopes upwards over 10m towards the north-west site extent, where the maximum site elevation is 145.69mAOD. The ground level then slopes back down towards the north-west site boundary. The minimum site elevation is 129.99mAOD. The ground level along the north-eastern site boundary is also slightly raised. The land to the north-east and south-west of the site is situated at a higher elevation to the site, with a raised railway embankment running along the south-west site boundary.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock:
  - Pennine Upper Coal Measures Formation consisting of mudstone, siltstone and sandstone in the centre and north-western site extents.
  - Eturia Formation consisting of mudstone, sandstone and conglomerate then consisting of sandstone in the south-eastern site extent.
- Superficial:
  - Alluvial consisting of clay, silt, sand and gravel across the majority of the site.
  - Glaciofluvial deposits consisting of sand and gravel in the far north-western-site extent.

Soils at the site consist of:

- Restored soils mostly from quarry and opencast spoil.

2 Sources of flood risk

2.1 Location of site within the catchment

The site is situated within the upstream end of the 'Fowlea Brook from Source to River Trent' catchment which drains an area of approximately 27.49km². The catchment is predominantly urban downstream of the site with Fowlea Brook running south-eastwards to where it joins the River Trent approximately 5km south-east of the site.

The site is located approximately 375m west of the Trent and Mersey Canal which flows through Derbyshire, Staffordshire and Cheshire before joining the Bridgewater Canal.

2.2 Existing drainage features

Online imagery shows a small pond situated along the southwest border of the site, in the northern end of the site.

An unnamed drain originates at this pond flowing in a south-easterly direction along the south-western boundary of the site. There is also a second drain which flows in a north-easterly direction to the eastern side of the site and then along the north-eastern side of the site in an easterly direction. The drain is then culverted underneath the unnamed road adjacent to the south-east site boundary. Online imagery suggests this drain is also originates at the pond.

There is also a culverted watercourse which flows through the site, between the south-east and north-west site extents. The culverted watercourse runs to Goldendales Pools reservoir approximately 550m south-east of the site and to Bath Pool reservoir approximately 950m north-west of the site.

2.3 Fluvial

2.3.1 Available data

The EA’s Flood Map for Planning (FMfP) has been used within this assessment.

2.3.2 Description of risk to the site

The EA FMfP shows no fluvial flood risk to the site as it is located entirely within Flood Zone 1. The existing drainage channels within the site are not represented by the FMfP, due to their size. Instead, the flood risk from these watercourses is assessed using the EA RoFSW map (Section2.4).

2.4 Surface water

2.4.1 Available data

The EA's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment.

2.4.2 Description of risk to the site

In the 3.3% AEP event, most of the site is shown to not be at surface water risk. However, small areas of surface water are shown to pond along the site boundary. The largest of these is shown to be located in the topographic low point along the north-west site boundary which has predicted depths of over 1.20m. The depths of the other small areas of ponding along the south-west and south-east site boundaries along parts of the drainage channels are predicted not to exceed 0.60m. Velocities are largely shown to be less than 0.25m/s with minimal areas shown to be up to 1.00m/s and, in the area of ponding at the north-west site boundary, between 1.00m/s and 2.00m/s. The highest hazard classification for the area of ponding at the north-west site is shown to be 'Danger for All'. The hazard classification for the other areas of ponding is mainly 'Very Low Hazard' with minimal areas classed as 'Danger for Some' and one small area of 'Danger for Most' along the south-east boundary.

In the 1% AEP event, most of the site is still shown to not be at surface water risk. The areas of ponding from the 3.3% AEP event are shown to have grown slightly along the north-west, south-west and south-east site boundaries. A flow path develops further along the drainage channel along the south-western side of the site and there is further ponding in the northeast corner of the site, upstream of the culvert. The only area of ponding predicted to reach depths of over 1.20m is still the ponding at the north-west border and the other areas are shown to still not exceed 0.60m in depth. Velocities are still largely shown to not exceed 0.25m/s. However, the areas with velocities between 0.25 m/s and 0.50m/s as well as 0.50m/s and 1.00m/s are shown to have grown slightly. There is also still a minimal amount shown to have a velocity of between 1.00m/s and 2.00m/s at the north-west site boundary. The highest hazard classification at the north-west site boundary remains 'Danger for All'. The hazard classification for the other areas of ponding is still mainly 'Very Low Hazard' with minimal areas classed as 'Danger for Some' and one small area of 'Danger for Most' along the south-east boundary.

In the 0.1% AEP event, most of the site is still shown to not be at surface water risk. However, the areas of ponding are shown to grow further in size, encompassing the entire south-east site boundary and most of the south-west and north-west boundaries. There are also new, small flows paths that are shown to develop in the site and flow towards the south-east boundary. Depths at the north-west boundary are still shown to exceed 1.20m, but now for a larger area. Depths for the other areas of ponding are shown to largely not exceed 0.60m but there are now shown to be minimal areas where the ponding is between 0.60m and 0.90m deep. Velocities at the north-west and south-east site boundaries are shown to be largely less than 0.25m/s. Velocities along the south-west border are mainly

between 0.50m/s and 1.00m/s. There is also shown to be a minimal amount of area with a predicted velocity of over 2.00m/s along the south-west border, in the north-western extent of the area of ponding. The highest classification remains 'Danger for All' at the north-west site boundary. The majority of the other areas of ponding are shown to be classified as 'Very Low Hazard' with some areas classed as 'Danger for Some' and minimal areas classed as 'Danger for Most'.

The ponding along the south-east site boundary is shown to build up in the 1% and 0.1% AEP events upstream of the culvert where the drainage channel runs under the road along the south-eastern boundary. The topography of the site means the area of risk largely remains in the eastern side of the site, although there are flow paths which develop further into the site in the 0.1% AEP event. The RoFSW mapping may not fully represent the capacity of this culverts, so it could be that this areas of risk on the site in this area is overestimated if the culvert capacity is larger than what is represented within the mapping. However, if the capacity of the culvert is reduced or blocked for any reason then this could increase the risk to the site in this area. The residual risk is discussed further in Section4.2.

Table 2-1: Existing surface water flood risk based on the RoFSW map.

Event	3.3% AEP	1% AEP	0.1% AEP
Percentage of site at risk* (%)	4	7	17
Maximum depth (m)	Greater than 1.20	Greater than 1.20	Greater than 1.20
Maximum velocity (m/s)	1.00 to 2.00	1.00 to 2.00	Greater than 2.00
Maximum hazard classification	Danger for All	Danger for All	Danger for All

** The percentage surface water extents quoted show the percentage of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 1% AEP includes the 3.3% AEP percentage).*

2.5 Reservoir

The site is not shown to be at risk of reservoir flooding during the 'dry day' or 'wet day' scenario from the EA reservoir flood maps.

2.6 Groundwater

The EA Areas Susceptible to Groundwater Flooding (AStGWF) dataset (1km resolution) suggests that the entire site has between a 25% and 50% susceptibility to groundwater flooding.

In contrast, the JBA Groundwater Emergence Map (5m resolution) shows that large parts of the site have a negligible risk from groundwater as a result of the underlying geological deposits. The north-western site extent has predicted groundwater levels that are between 0.025m and 0.5m below the ground surface. The remainder of the ground along the south-

western site border has predicted groundwater levels groundwater levels that are either at or very near (within 0.025m) of the ground surface.

Based on the RoFSW and topography of the site it is likely that any groundwater that emerges will flow in a south-easterly direction along the south-western extent of the site, following the path of the drainage channel.

This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific Flood Risk Assessment (FRA) stage.

2.7 Sewers

The site is located in a postcode area (ST6 4), where there were no recorded historic sewer flooding incidents within the Newcastle-under-Lyme borough, according to information provided by Severn Trent Water. Severn Trent Water provided historical flooding data for reports of external and internal sewer flooding between 1 January 2004 and 19 March 2024, including locations with repeat incidents.

Severn Trent Water provided a review of the sites in relation to their impact to the existing public sewerage system ranking the sites as high, medium, or low risk. This site was ranked as medium risk due to the size of the development.

2.8 Flood history

The EA's historic flooding and recorded flood outline datasets do not have a record of any flooding on or surrounding the site.

3 Climate change

Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. Please see Section 3.5 of the main Level 2 SFRA report for information on fluvial models and climate change allowances.

Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and escape routes must also address the potential increase in severity and frequency of flooding.

3.1 Fluvial

3.1.1 Available data

In the absence of detailed hydraulic modelling with climate change uplifts, the EA FMfP Flood Zone 2 extent (0.1% AEP) has been used as an indicative 1% AEP event plus climate change flood extent. This can be compared within Flood Zone 3a (1% AEP) to give an indication of areas most sensitive to the impacts of climate change.

3.1.2 Description of risk to the site

The site is not shown to be sensitive to climate change for fluvial risk as the site is located entirely within Flood Zone 1.

3.2 Surface water

3.2.1 Available data

The latest climate change allowances have been applied to the RoFSW map to indicate the impact on pluvial flood risk.

The design event for rainfall intensities is the 1% AEP event with the upper end climate allowance for the 2070s epoch, which is the 1% AEP plus 40% climate change for the Staffordshire Trent Valley Management Catchment which this site falls within.

3.2.2 Description of risk to the site

The extent of surface water risk to the site is shown to increase between the 1% AEP and 1% AEP plus 40% climate change events, particularly in the southeast of the site. Whilst there is less increase in the extents in the northwest of the site and along the south-western boundary, the depths and velocities of the surface water risk are shown to increase.

The 1% AEP plus 40% climate change event largely reflects the extent of the 0.1% AEP event (Section 3.2.2), with some slightly extended areas of ponding, mostly in the south-east of the site. The largest depth is shown to be 3.39m in the north-west of the site. The

majority of the rest of the predicted areas of pooling are shown to not exceed 0.50m with minimal areas shown to be between 0.50m and 1.00m deep. Velocities in the majority of the areas of pooling at the north-west and south-east extents are shown to be less than 0.25m/s. The pooling along the south-west boundary is shown to be mostly between 0.50m/s and 1.00m/s. However, there are small areas with velocities between 1.00m/s and 2.00m/s. There is also shown to be a small area with a predicted velocity of over 2.00m/s along the south-west border, in the north-western extent of the area of ponding. The highest hazard classification is shown to be 'Danger for All' at the north-west site boundary. Most of the other areas of ponding are predicted to be classified as 'Very Low Hazard' with some areas of 'Danger for Some' and 'Danger for Most'.

Table 3-1: Comparison of surface water flood risk to the site between the 1% AEP and 1% AEP 2070s Upper End climate change extents.

Event	1% AEP	1% AEP plus 40% climate change
Percentage of site at risk (%)	7	19
Maximum depth (m)	Greater than 1.20	3.39
Maximum velocity (m/s)	1.00 to 2.00	2.09
Maximum hazard classification	Danger for All	Danger for All

4 Flood risk management infrastructure

4.1 Defences

The site is not protected by any formal flood defences.

4.2 Residual risk

The drain that runs through the site is culverted underneath the unnamed road immediately adjacent to the south-east site boundary. This could pose a residual risk to the site in the event of a blockage, which could cause water to back up and encroach on the site.

There is also a culverted watercourse which flows through the site, leading to reservoirs at either end of the culvert. This could pose a residual risk to the site in the event of a blockage, which could cause water to back up and encroach on the site. However, this is unlikely to occur due to the location of the reservoirs in relation to the site.

5 Emergency planning

5.1 Flood warnings and alerts

The site is not located in an EA Flood Warning or Flood Alert Area.

5.2 Access and escape routes

Safe access and escape routes will need to be demonstrated in the 1% AEP plus climate change fluvial and surface water events. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk elsewhere on the site and in the wider catchment.

5.2.1 Existing access

Existing access onto the site is via Lowlands Road which runs adjacent to the north-east and north-west site boundaries as well as the unnamed road adjacent to the south-east site boundary. Access is not possible via the south-west boundary due to the railway which runs adjacent.

5.2.2 Fluvial

The EA FMfP shows safe access and escape routes within the site and to the surrounding area is maintained with no fluvial flood risk shown. However, the risk from the drainage channels within the site is discussed in Section 5.2.3.

5.2.3 Surface water

Depths are shown to exceed 1.20m along Lowlands Road to the west of the site from the 1% AEP event, with depths of up to 1.20m in the 3.3% AEP event, so access and escape routes should be directed to the east.

Access and escape routes may be achievable from the northeast of the site via Lowlands Road during all modelled events.

In the 3.3% AEP event, there is a small area of ponding along Lowlands Road to the east of the site however maximum depths are between 0.15 and 0.30m with velocities mainly remaining below 0.25m/s and a hazard classification of 'Very low hazard'. The flow path increases in extent during the 1% AEP event and the velocities increase up to between 0.50 and 1.00m/s, however depths remain below 0.30m with a hazard classification of mainly 'Very low hazard' so access should remain unimpeded.

During the 1% AEP plus 40% climate change event, the flow path increases further in extent. Depths along the road mainly remain below 0.25m, but reach a maximum of 0.36m, with velocities of up to 1.55m/s and a maximum hazard classification of 'Danger for most'. Therefore, access for emergency vehicles may be impeded and would need to be assessed in detail through a site-specific FRA.

5.2.4 Dry islands

The site is not located on a dry island.

6 Requirements for drainage control and impact mitigation

6.1 Broadscale assessment of possible SuDS

- Most of the site is considered to have a low susceptibility to groundwater. However, along the western side of the site groundwater levels are indicated to be less than 0.5m below ground level during a 1% AEP event. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate in these areas of the site.
- BGS data indicates that the underlying geology is Pennine Upper Coal Measures Formation and Eturia Formation which is likely to have highly variable permeability. This should be confirmed through infiltration testing. The local soils are identified to be restored soils mostly from quarry and opencast spoil, which may suffer from compaction and, as a consequence, run off and erosion. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
- The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
- The site is located within a Nitrate Vulnerable Zone. Therefore, early engagement with the LLFA and the EA is recommended to determine requirements for the site to manage the impact to surrounding watercourses. Consideration of water quality is likely to be of high importance and demonstrated through the use of the Simple Index Approach.
- The site is not located within a historic landfill site.
- The site appears to predominantly be greenfield, with a small area of brownfield in the east of the site, and soils are identified to be restored soils mostly from quarry and opencast spoil. Soil contamination testing may therefore need to be undertaken to determine whether infiltration is appropriate at the site.
- Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
- The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during all modelled surface water events.

Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.

6.2 Opportunities for wider sustainability benefits and integrated flood risk management

- Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity, helping meet requirements for the Nitrate Vulnerable Zone. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Local Planning Authority, Lead Local Flood Authority, and the EA) at an early stage to understand possible constraints.
- The existing drainage channels running through the site should be integrated into the site drainage strategy as blue-green infrastructure.
- Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development, particularly the lower-lying areas identified to be most sensitive to climate change in the east of the site.
- Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered.
- Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
- The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.

7 NPPF and planning implications

7.1 Exception test requirements

The Local Planning Authority will need to confirm that the sequential test has been carried out in line with national guidelines. The sequential test will need to be passed before the exception test is applied.

The NPPF classifies employment development as 'Less vulnerable'.

The exception test is not required for this site because the site is wholly located in Flood Zone 1.

7.2 Requirements and guidance for site-specific Flood Risk Assessment

At the planning application stage, a site-specific FRA will be required as the proposed development site:

- Is one hectare or greater in Flood Zone 1.
- Is at risk of groundwater emergence.
- At risk of surface water flooding both now and in the future.

All sources of flooding should be considered as part of a site-specific FRA.

A detailed hydraulic model of the drainage channels within the site boundary may be required at FRA stage to accurately represent the risk from these watercourses and set the height of any mitigation measures. The culvert underneath the unnamed road to the south-east of the site should be modelled to accurately determine the risk to the eastern side of the site, including any residual risk as a result of blockages.

Guidance on the requirements for site-specific FRAs can be found in the accompanying Level 2 SFRA report.

7.3 Guidance for site design and making development safe

Development should be steered outside of the topographic low point along the north-west extent of the site. Developers should consider utilising this area as a location for SuDS. Development should also be steered away from the existing drainage channels along the north-eastern and south-western site boundaries which should be retained as blue-green infrastructure.

The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to pre-development greenfield rates, with areas of surface water ponding used as open space and SuDS or water compatible/essential infrastructure uses only.

Given the high likelihood of groundwater emergence in parts of the the site, additional site investigation work may be required to support the detailed design of the drainage system.

Infiltration may not be appropriate at the site but should be confirmed through site-specific assessment. Below ground development such as basements are not appropriate in these areas of the site.

The culvert shown to run beneath the site should be considered within the site design and consultation undertaken with relevant stakeholders. Consideration should be given to opening up the culvert and integrating it into SUDS as part of any development proposal.

Arrangements for safe access and escape routes will need to be provided for the 1% AEP surface event with an appropriate allowance for climate change, considering depth, velocity, and hazard. Design and access arrangements will need to incorporate measures, so development and occupants are safe.

Provisions for safe access and escape routes should not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

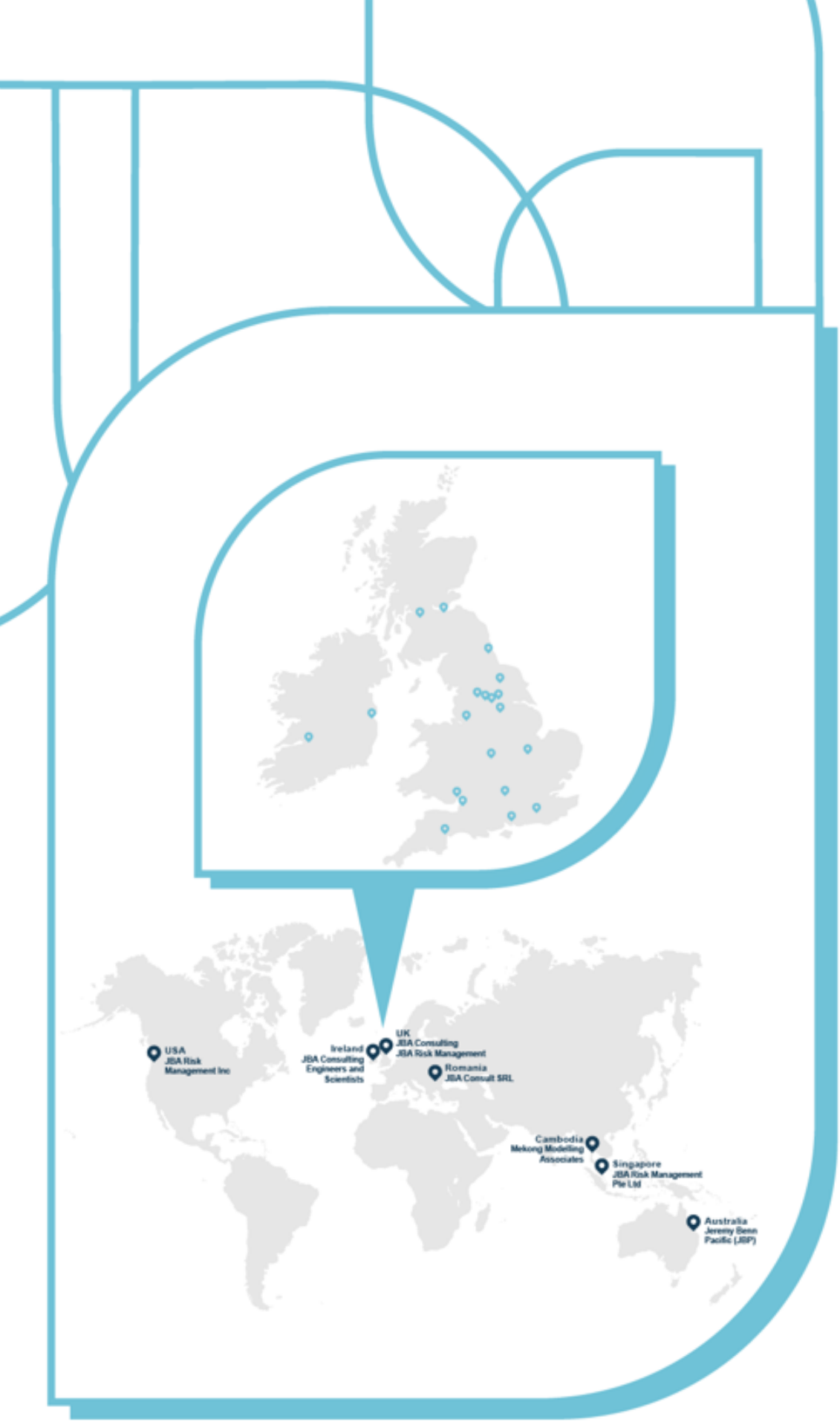
8 Conclusions

There is a pond with two existing drainage channels located within the site boundary. The site is affected by surface water flooding in all modelled surface water events, although the majority of the site is generally at low risk. Although the areas at risk are confined to the north-west, south-west and south-east site boundaries, the risk at the north-west of the site is classed as a 'Danger for All' in all events. There may also be a residual risk of surface water flooding in the southeast of the site as a result of blockages or obstruction in the culvert located to the south-east of the site. Areas of the site may also be at risk of flooding from groundwater.

As the site is located in Flood Zone 1, and the use is 'Less Vulnerable', the exception test is not required. A site-specific FRA will be required, because the proposed development site is one hectare or greater in Flood Zone 1, at risk of groundwater emergence, and identified as being at increased flood risk in the future.

The following points should be considered in development of this site:

- Development should be steered outside of the topographic low point along the north-west extent of the site. Developers should consider utilising this area as a location for SuDS. Development should also be steered away from the existing drainage channels along the north-eastern and south-western site boundaries which should be retained as blue-green infrastructure.
- A detailed hydraulic model of the drainage channels within the site boundary may be required at FRA stage to accurately represent the risk from these watercourses and set the height of any mitigation measures. The culvert underneath the unnamed road to the south-east of the site should be modelled to accurately determine the risk to the eastern side of the site, including any residual risk as a result of blockages.
- The risk to the site from groundwater should be confirmed as part of site-specific flood risk assessment, and any FRA should demonstrate users of the site can be kept safe in the event of groundwater emergence/flooding.
- Safe access and escape routes should be demonstrated in the 1% AEP plus central climate change surface water event.
- A carefully considered and integrated flood resilient and sustainable drainage design should be put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed modelling, with development to be steered away from the areas identified to be at highest risk of surface water flooding within the site.
- Severn Trent Water should be consulted at an early stage regarding the proposed site drainage due to the potential implications on the public sewerage as a result of the historic hydraulic incidents recorded within the vicinity of the site.



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