Level 2 Strategic Flood Risk Assessment – Site LPR16A

Final Report

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Prepared for:
Hinckley and Bosworth Borough Council

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Hinckley & Bosworth Borough Council

Contents

1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for LPR16A. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the Hinckley and Bosworth Level 1 SFRA and read the Hinckley and Bosworth Level 2 SFRA Main Report and is therefore familiar with the terminology used in this report.

1.1 Site details

- Location: Land South of Soar Brook and north of Watling Street (A5), situated in Burbage in the south of Hinckley.
- Site area: 117.38ha
- Existing site use: Predominantly greenfield, with a number of existing buildings in the centre of the site
- Proposed site use: Employment

1.2 Topography

Figure 1-1 shows the topography of the site represented by the Environment Agency (EA) 1m resolution LiDAR. Higher ground in the site is concentrated towards the southwest of the site, with a maximum elevation of 116.0mAOD. The site slopes downhill towards the northeast where Soar Brook bisects the site, as well as sloping down towards the northern and eastern boundaries where there are unnamed tributaries of Soar Brook. The minimum elevation is 87.6mAOD in the northeast of the site.

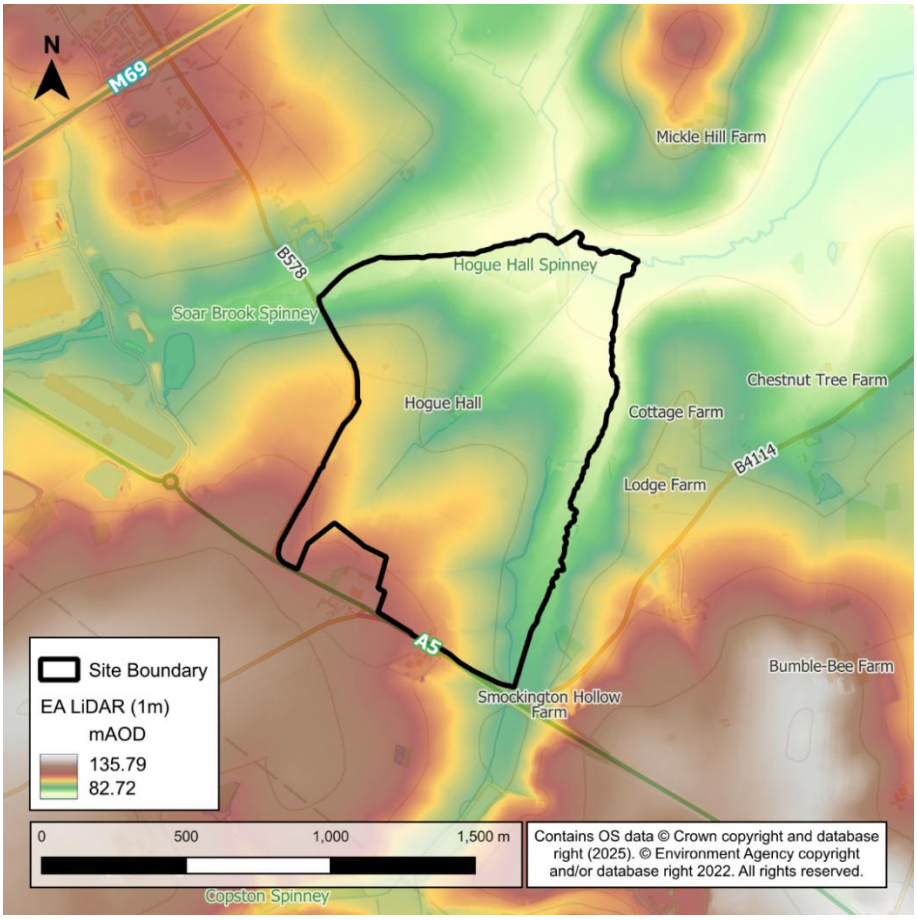


Figure 1-1: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock - Mercia Mudstone Group comprising of mudstone.
- Superficial:
  - Oadby Till Member comprising diamicton underlays most of the central-western and northwest of the site.
  - Dunsmore Gravel Member comprising sand and gravel underlays most of the central-eastern and southeast of the site.
  - Alluvium, comprising clay, silt, sand and gravel, follows the path of the watercourses in the northeast and along the northern and eastern boundaries.
  - Two areas, one in the northwest and one parallel to the eastern boundary are underlain by Wolston sand gravel.

Soils at the site consist of:

- Slightly acid loamy and clayey soils with impeded drainage in the northwest.
- Freely draining slightly acid loamy soils in the south.
- Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils in the east.

2 Sources of flood risk

2.1 Location of site within the catchment

The site is located in the downstream end of the 'Soar Brook from Source to Soar Water Body' with Soar Brook running through the northeast corner of the site. The catchment upstream of the site is approximately 19km^2 and encompasses the southeast side of Hinckley but is otherwise rural in nature.

2.2 Existing drainage features

Soar Brook flows in an easterly direction along the northern site boundary and then across the northeast corner of the site.

There are two unnamed tributaries of Soar Brook within the site. One flows through the centre of the site, and one flows through the eastern side of the site and then along the eastern boundary. They both join Soar Brook in the northern end of the site.

Soar Brook is designated as an EA Main River from where it leaves the site along the northeastern boundary.

Online mapping also shows some small ponds to the west of the site and on the northern and eastern site boundaries. There is also a further unnamed tributary which approaches the site from the north and joins Soar Brook along the northern site boundary.

2.3 Fluvial

2.3.1 Available data

The EA's Flood Map for Planning (FMfP) has been used within this assessment to inform Flood Zones 2 and 3a. Flood Zone 3b has been defined using the EA's Rivers and Sea 3.3% AEP defended flood risk extent.

There is currently no available depth, hazard, or velocity information available within the EA FMfP, therefore, detailed hydraulic modelling is likely to be required during a site-specific Flood Risk Assessment.

2.3.2 Description of risk to the site

The EA FMfP shows the fluvial risk is confined to the northern and eastern site boundaries. Flood Zones 3b, 3a, and 2 all show similar extents along the path of the River Soar along the northern boundary and through the northeast of the site. There is a greater increase in risk between Flood Zones 3b and 3a along the eastern boundary but the Flood Zone 3a and 2 extents remain similar.

The unnamed watercourses within the centre and east of the site are not represented within the EA's FMfP. The risk from these watercourses has been assessed using the EA's Risk of Flooding from Surface Water Map (see Section 2.4).

Table 2-1: Existing fluvial flood risk based on EA FMfP *.

Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
89.2	0.8	2.2	7.8

**The percentage flood zones quoted show the percentage of the site at flood risk from that particular flood zone or event, excluding the percentage of the site at flood risk at a higher risk zone, e.g. Flood Zone 2 does not include the Flood Zone 3 percentage.*

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

The main areas of risk shown in the RoFSW map are associated with the watercourses in the centre and east of the site. The risk along the watercourse in the east of the site is shown to be concentrated along the channel with some areas of ponding surrounding the channel. The risk along the central watercourse follows the path of the watercourse through the centre of the site and then flows out of the watercourse channel in a north-easterly direction towards the site boundary. There are areas of ponding which develop particularly in the north of the site in all modelled AEP events.

The maximum depths, velocities, and hazards shown in Table 2-2 are found along the areas of lower topography where the ordinary watercourse are represented within the topography. The areas of surface water ponding across the site are shown to be relatively shallow, not exceeding 0.6m but mostly remaining below 0.2m, and hazard classification predominantly 'Very Low Hazard'.

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

Event	3.3% AEP	1% AEP	0.1% AEP
Percentage of site at risk* (%)	<1	<1	1.7
Maximum depth (m)	Exceeds 0.6m but does not exceed 0.9m	Exceeds 0.6m but does not exceed 0.9m	Exceeds 0.9 but does not exceed 1.2m
Maximum velocity (m/s)	Exceeds 0.5m/s but does not exceed 1.0m/s	Exceeds 0.5m/s but does not exceed 1.0m/s	Exceeds 1.0m/s but does not exceed 2.0m/s
Maximum hazard classification	Danger for Most	Danger for Most	Danger for Most

** The percentage surface water extents quoted show the percentage of the site at surface water risk from that particular event, excluding the percentage of the site at flood risk at a higher risk zone (e.g. the 1% AEP does not include 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 JBA Groundwater Emergence Map shows that higher risk of groundwater emergence is generally across the southern part of the site, although there are smaller areas of higher risk of groundwater emergence to the north and northeast of the site where groundwater levels within 0.5m of the ground surface. In these smaller areas, there is a risk of groundwater emergence as well as to subsurface assets. Based on the EA RoFSW mapping and topography of the site it is likely that any groundwater that emerges will flow towards the eastern and northern site boundaries following the paths of the associated watercourses.

Elsewhere, the northern and central areas of the site are predominantly deemed to be at negligible risk of groundwater emergence due to the nature of the underlying geology. The southern and eastern areas of the site have groundwater levels between 0.5 and 5m below the ground surface meaning there is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.

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

Severn Trent Water were consulted as part of the Regulation 18 process and each of the Strategic Housing and Employment Land Availability Assessment reports to provide comments on known issues of sewer flooding within or surrounding the site. For this site, Severn Trent Water state that the drainage could connect into two or three different catchments depending on the type of industry and extent of the flows derived from the site. Therefore, a networks constraints assessment cannot currently be made. However, due to the size of the site ongoing consultation with Severn Trent Water should be undertaken throughout the development process.

This assessment does not negate the requirement that drainage at the site should be in line with the drainage hierarchy (see Section 6.1).

2.8 Flood history

The EA's Historic Flood Map shows no records of flooding at the site.

Information provided by Leicestershire County Council shows no recorded flood incidents 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 4.6 of the Hinckley and Bosworth Level 2 SFRA report for information on 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 must also address the potential increase in severity and frequency of flooding.

3.1 Fluvial

3.1.1 Available data

The EA's FMfP Flood Zones plus Climate Change layer has been used to indicate areas of the site likely to be at increased flood risk in future.

There is currently no available depth, hazard, or velocity information available within the EA FMfP, therefore, detailed hydraulic modelling is likely to be required during a site-specific Flood Risk Assessment including modelling of the latest climate change uplifts.

3.1.2 Description of risk to the site

The EA's FMfP Flood Zones plus Climate Change layer shows a very similar extent to Flood Zone 2 with only a few small areas of increased risk along the northern and eastern site boundaries. This data suggests that fluvial flood risk at the site is not particularly sensitive to climate change.

The unnamed watercourses within the centre and east of the site are not represented within the EA's FMfP. The future risk from these watercourses has been assessed using the EA's Risk of Flooding from Surface Water Map (see Section 3.2).

3.2 Surface water

3.2.1 Available data

In the absence of suitable climate change data, the 0.1% AEP extent from the EA's RoFSW mapping has been used as a proxy to indicate areas likely to be at risk during the 1% AEP plus climate change event.

3.2.2 Description of risk to the site

The main increase in risk between the 1% AEP and 0.1% AEP events is along the flow path which forms in the centre of the site, associated with the unnamed watercourse. Velocities along this flow path increase to exceed 0.5m/s in the 0.1% AEP event, from mostly below 0.25m/s in the 1% AEP event. However, surface water depths and hazards across the site

show relatively little change, mostly remaining below 0.2m with hazard classification of ‘Very Low Hazard’.

4 Flood risk management infrastructure

4.1 Defences

The EA AIMS dataset shows that the site is not protected by any formal flood defences.

4.2 Residual risk

There are two culverts upstream of the site. Soar Brook is culverted beneath the B578 before it runs along the site boundary whilst the unnamed watercourse which flows along the eastern boundary is culverted beneath the A5 before it enters the site. The flood extents within the EA FMfP show that both culverts constrict the flow of the watercourses resulting in increased upstream flood risk until it overtops the roads and enters the site. The B578 is first shown to overtop in the 0.1% AEP event (Flood Zone 2), whilst the A5 culvert does not overtop within the present day Flood Zones but is shown to overtop within the Flood Zones plus Climate Change scenario. Should either culvert become blocked, this is likely to increase the likelihood and magnitude of any overtopping into the site or cause issues with access.

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

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 Potential access

The site is likely to be accessed either via the A5 from the south or via the B578 from the west.

5.2.2 Fluvial

As discussed in Section 4.2, both the A5 and B578 are affected by residual flood risk in the Flood Zones plus Climate Change scenario. This is likely to impede access along the B578 from the north and the A5 from the east. Soar Brook is also culverted under the A5 further upstream, where it comes out of bank impeding access to the A5 from the M69 to the west. However, the A5 and B578 can be accessed from the south via the B4114 so access and escape is likely to be possible.

5.2.3 Surface water

Surface water risk at the site is limited and the surface water mapping mostly shows flow paths associated with the ordinary watercourses within the site. The watercourse within the centre of the site extends most of the way through the site, so access and escape may need to be considered to both sides of the watercourse. However, there is very little surface water risk surrounding the site and the access route identified in Section 5.2.2 utilising the B4114 to join the A5 and B578 is unlikely to be impacted in any of the surface water flood events.

5.3 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

Surface water at the site should be discharged in accordance with the drainage hierarchy as set out in the National standards for SuDS (gov.uk). SuDS that provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity, should be prioritised. SuDS proposals should be discussed with relevant stakeholders (Local Planning Authority, Lead Local Flood Authority, and the EA) at an early stage to understand possible constraints.

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.

The following factors should be considered when assessing whether infiltration is suitable at the site:

- Groundwater levels are indicated to be between 0.5 and 5m below ground level across the southern and eastern parts of the site and there is a risk of flooding to subsurface assets and below ground development such as basements. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Where groundwater levels are indicated to be less than 0.5m below ground level during a 1% AEP event in the northwest and east of the site, 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 will not be appropriate in these areas of the site.
- BGS data indicates that the underlying geology is mudstone and is likely to be poorly draining. Any proposed use of infiltration should be supported by infiltration testing.
- 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 not located within a historic landfill site.

If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner (see Section 2.7).

Where possible, proposed attenuation features such as basins, ponds and tanks should be located outside of the areas of considerable fluvial risk along the northern and eastern site boundaries to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into the unnamed watercourse may be susceptible to surcharging due to water levels in the River Soar. The impacts of flood flows will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls.

The watercourses within the centre and east of the site should be integrated into the site drainage strategy as blue-green infrastructure. The areas of risk associated with the watercourse along the northern and eastern boundaries should be used as public open space or to provide wider amenity benefits.

6.2 Wider sustainability benefits

The following are opportunities for wider sustainability benefits and integrated flood risk management 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.
- Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas should be considered.
- Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The Soar Brook currently has a ‘poor’ ecological classification. The use of multistage SuDS treatment will improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.
- Given the large size of the site, bordered by two watercourses which lead to the River Soar (a Main River) opportunities to integrate flood risk management opportunities along these watercourses into the site design to reduce downstream flood risk in the wider catchment should be considered.

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 'Less Vulnerable' development however 'Less Vulnerable' development will not be permitted in Flood Zone 3b.

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:

- Greater than one hectare
- In Flood Zones 3b, 3a, and 2
- Within the Flood Zones plus Climate Change extent
- At risk of ordinary watercourse and surface water flooding

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

Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the EA should be undertaken at an early stage.

Any FRA should be carried out in line with latest guidance including the National Planning Policy Framework (NPPF), Flood Risk and Coastal Change Planning Practice Guidance (PPG), and Hinckley and Bosworth Local Plan Policies.

The development should be designed with mitigation measures in place where required.

7.3 Guidance for site design and making development safe

The site layout must adopt a sequential approach by steering more vulnerable aspects of the development away from the areas of greatest fluvial risk associated with the watercourses along the northern and eastern site boundaries. 'Less Vulnerable' development will not be permitted in the areas of Flood Zone 3b. Developers should consider utilising the watercourses within the centre and east of the site as a green corridor or as a location for SuDS.

If proposed works affect a Main River or ordinary watercourse, the Environment Agency or Leicestershire County Council as the Lead Local Flood Authority should be contacted respectively to obtain prior written consent. Any watercourses should be accommodated within the site layout and should not be culverted except for where access is required. The site layout should allow for access to any watercourse for maintenance and they should

generally be located within publicly accessible areas. A buffer of at least 8 metres should be maintained between the watercourses and any built development.

A detailed hydraulic model of all the watercourses within the site may be required at FRA stage to accurately represent the risk from these watercourses. This will require topographic and channel surveys to properly represent the channels. This should also include modelling of the culverts on these watercourses to understand the potential implications of any blockages for flood risk on the site.

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.

Severn Trent Water should be consulted on the drainage strategy at an early stage to determine which catchment the site will drain into and any potential implications or constraints.

Arrangements for safe access and escape will need to be provided for the 1% AEP fluvial and surface events 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 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.

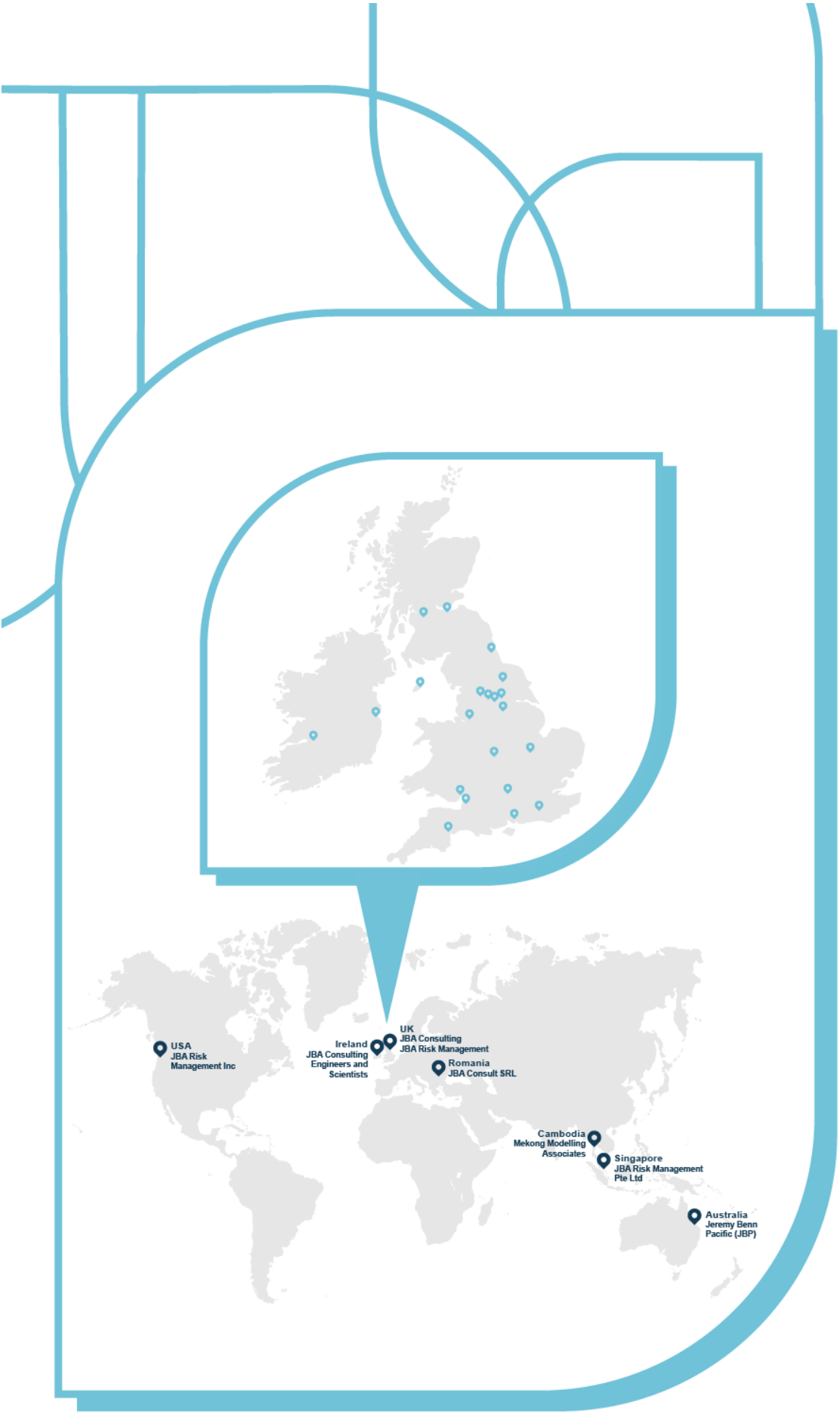
8 Conclusions

The River Soar runs through the north of the site, with tributaries of the River Soar along the northern and eastern site boundaries where there is the greatest fluvial risk. There is also fluvial risk from two smaller watercourses within the centre and east of the site, represented within the surface water mapping. There are two culverts upstream of the site which are shown to present a risk of overtopping to the site, and there is a residual risk of blockages to these culverts increasing the risk on site. There are areas of potential groundwater emergence risk in the northwest and east of the site.

The Exception Test is not required for 'Less Vulnerable' development however 'Less Vulnerable' development will not be permitted in Flood Zone 3b. A site-specific FRA will be required for this site because the proposed development site is greater than 1 hectare, in Flood Zones 2, 3a and 3b, subject to ordinary watercourse and surface water flooding, and identified as being at increased flood risk in the future.

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

- The site layout must adopt a sequential approach by steering more vulnerable aspects of the development away from the areas of greatest fluvial risk along the northern and eastern site boundaries. Developers should consider utilising these areas as green corridors and public open space.
- Given the large size of the site, bordered by two watercourses which lead to the River Soar (a Main River) opportunities to integrate flood risk management opportunities along these watercourses into the site design to reduce downstream flood risk in the wider catchment should be considered.
- A detailed hydraulic model of all the watercourses within the site may be required at FRA stage to accurately represent the risk from these watercourses. This may require topographic and channel surveys to properly represent the channels. This should also include modelling of the upstream culverts to understand the potential implications of any blockages for flood risk on the site.
- Safe access and escape routes should be demonstrated in the 1% AEP plus climate change fluvial and surface water events. This initial assessment has shown that access and escape via the B4114 to join the A5 and B578 is likely to be possible (using the 0.1% AEP surface water extent as a proxy for climate change).
- 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. The watercourses within the centre and east of the site should be integrated into the site drainage strategy as blue-green infrastructure.
- Flood mitigation measures should be implemented then tested to check that they will not displace water elsewhere (for example, if land is raised to permit development in one area, compensatory flood storage will be required in another).



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