Sheffield Level 2 Strategic Flood Risk Assessment Main Report

Final

May 2025

Prepared for:

Sheffield City Council

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Document Status

Issue date	23 May 2025
Issued to	Chris Hanson
BIM reference	OZZ-JBA-XX-XX-RP-Z-0002
Revision	P04
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Contract

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This report describes work commissioned by Sheffield City Council by an instruction dated 23 January 2025. The Client's representative for the contract was Chris Hanson of Sheffield City Council. Mike Williamson, Laura Thompson, Freya Nation and Georgina Williams of JBA Consulting carried out this work.

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Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Acknowledgements

We would like to thank the Environment Agency for their assistance with this work.

Contents

1 Introduction

Sheffield City Council (SCC) finalised its Level 2 Strategic Flood Risk Assessment (SFRA) in April 2024 for inclusion in the evidence base on flood risk and spatial planning in the Sheffield Local Plan. Following an 8-month pause to the Sheffield Plan, an extension to the Level 2 SFRA is required to assess an additional 24 sites against all sources of flood risk to help determine whether these sites could be allocated in the Sheffield Plan. These additional 24 sites are Green Belt sites.

Ministerial guidance now indicates that pauses to Local Plan examinations should now not take longer than six months. The methodology used in this Level 2 SFRA is therefore sympathetic to these time pressures and do not include for any additional updates to existing flood models, nor consideration of the Environment Agency's (EA) National Flood Risk Review 2 (NaFRA2) outputs. Any future update to this SFRA should account for the outputs from NaFRA2, including for the revised Flood Map for Planning, published 25 March 2025.

This Level 2 SFRA has been prepared with full consideration of the latest government and Environment Agency (EA) guidance on flood risk and planning policy, namely:

- National Planning Policy Framework[1] (NPPF) 2025,
- Flood Risk and Coastal Change Planning Practice Guidance[2] (FRCC-PPG) 2022,
- How to Prepare a Strategic Flood Risk Assessment[3] guidance 2025,
- Strategic Flood Risk Assessment Good Practice Guide[4] 2021,
- Flood Risk Assessments: Climate Change Allowances[5] 2022.

Close consultation with the EA has been carried out throughout the Level 2 SFRA process with full transparency provided between all parties. At the time of writing, this Level 2 SFRA has assessed and considered risk in the Sheffield Local Planning Authority area at a specific point in time. It would be prudent to update the SFRA with the revised Flood Map for Planning and associated latest guidance during any future update to the Sheffield Plan.

1 National Planning Policy Framework | UK Government | 2025
2 Flood Risk and Coastal Change Planning Practice Guidance | UK Government | 2022
3 How to Prepare a Strategic Flood Risk Assessment | Environment Agency | 2025
4 Strategic Flood Risk Assessment Good Practice Guide | Association of Directors of Environment, Economy, Planning & Transport | 2021
5 Flood Risk Assessments: Climate Change Allowances | Environment Agency | 2022

2 Limitations

This Level 2 SFRA has been prepared under several limitations associated with the availability and quality of data. These limitations have been subject to detailed consultation with the EA whereby alternative approaches have been agreed to enable the Level 2 SFRA to be prepared using available existing information. The timescales of the Local Plan programme meant it was not possible, in many cases, to update EA flood models with the latest information. The limitations include the following:

- The EA Sheffield Comprehensive Flood Review (SCFR) model (2012) is considered by the EA to potentially not be representative of current conditions, namely hydrology, channel survey, and terrain data. However, this model is the best available information to inform flood risk in the locations outside of the Lower Don Valley and Blackburn Brook model domain areas, covering one of the 24 Green Belt sites.
- The functional floodplain is based on the 2% AEP (Annual Exceedance Probability) flood event within the SCFR model domain area and therefore is conservative in these locations and risk may therefore be overestimated. The 3.3% AEP flood event would normally be used to help define the functional floodplain extent; however, this event could not be modelled due to inherent instability issues with both models.
- Climate change modelling of the most up to date EA allowances for peak river flows could not be fully performed due to model stability issues. The 0.1% AEP flood event could not be modelled for climate change within any EA flood model. The 0.1% AEP flood event plus climate change should be considered as the extreme event by which flood warnings, provisions of safe access and escape routes from sites, and emergency plans are measured against.
- Several Green Belt sites are located in the vicinity of unmodelled watercourses. The 0.1% AEP event of the third generation Risk of Flooding from Surface Water map has been used as a proxy for potential fluvial risk in such cases.
- OS Open Data watercourse information is high level and indicative in terms of culvert locations and routes. A number of culverted sections of watercourses included within the functional floodplain extent are likely to be erroneous in terms of the route on which they have been digitised or are not accounted for in the dataset.

Any future SFRA update should look to include updating the EA models with the latest information that is available at the time, including up to date hydrology inputs, channel and bank survey, LIDAR terrain data, and using the latest modelling software to update and run the models. The latest climate change allowances should be modelled and used to update the SFRA. Any SFRA update should also use any additional culvert information available from the LLFA to more robustly define the functional floodplain and residual risk modelling of culvert blockage scenarios.

In the absence of an update to the SFRA ahead of any planning application for allocated sites, the site-specific FRA should address all these limitations to the satisfaction of the LPA, the EA, and the LLFA.

3 Level 2 SFRA requirements

The aim of a Level 2 assessment is to build on the findings of the Level 1 SFRA, focussing on identified sites or communities at high and medium flood risk that are considered important to Local Plan development. This allows the SFRA process to be time efficient using detailed modelling techniques only where they are required in the Level 2 assessment. These locations usually include significant development and / or regeneration areas that are at medium or high risk of flooding from main rivers, ordinary watercourses, or surface water whilst also accounting for the impacts of climate change. Flood risk data such as modelled flood extents, depths, velocities, and hazards are used to assess the sustainability of these areas. Appropriate mitigation techniques and achievable site layouts can then be informed.

This detailed information should support further application of the Sequential Test, the sequential approach to development management, inform on whether sites can pass the Exception Test, where applicable, and allow for flood risk indicators to be produced for use in the Sustainability Appraisal of the Local Plan.

EA guidance[3] for LPAs states a Level 2 SFRA should:

- *Be detailed enough for you to identify which development allocation sites have the least risk of flooding,*
- *Contain the information needed to apply the exception test, if relevant,*
- *Enable you to decide if development can be made safe without increasing flood risk elsewhere.*

It should allow you to:

- *Apply the sequential approach by identifying the severity and variation in risk within medium and high flood risk areas,*
- *Establish whether proposed allocations or windfall sites, on which your local plan will rely, are capable of being made safe throughout their lifetime without increasing flood risk elsewhere,*
- *Apply the exception test, where relevant*.

A site-specific FRA will be required at the development planning stage which will assess risk to each site in greater detail than this Level 2 SFRA. The Level 2 SFRA is a strategic assessment that is not intended to replace the requirement of a site-specific FRA.

3.1 Objectives

In accordance with the latest national policy and guidance, and the individual requirements of SCC, the key objectives of this Level 2 SFRA extension are to:

- Assess present day flood risk from all sources (fluvial, surface water, groundwater, sewers, canals, and reservoirs),
- Document residual risk, including modelling of potential defence breaches and culvert blockages,

- Assess detailed modelled outputs including flood depths, velocities, and hazards, where information is available,
- Assess existing flood warnings and advise on required emergency planning procedures and safety of site access and escape routes in times of flood,
- Account for the potential cumulative impacts of development,
- Provide site-specific surface water flood risk screening and runoff calculations including recommendations on the requirements for drainage control; surface water runoff rates and impact mitigation, including Sustainable Drainage Systems (SuDS); and design solutions that could reduce flood risk,
- Provide site-specific advice on mitigation options i.e. developable / nondevelopable areas; blue / green infrastructure and open spaces; maintenance of fluvial and / or surface water flow routes; land raising and compensatory storage; and advice on minimum finished floor levels,
- Assess any catchment-wide or strategic solutions, e.g. upstream opportunity areas for flood management (storage solutions) to mitigate against the risk of flooding downstream and elsewhere,
- Assess the potential effects from Natural Flood Management (NFM) and Working with Natural Processes (WwNP) schemes on mitigating flood risk,
- Demonstrate whether the second part of the exception test (part b) can be passed for the potential allocations, where applicable,
- Provide recommendations for additional and future works required following on from or to supplement the Level 2 SFRA i.e. further fluvial or surface water modelling, modelling of site layout / design options including provisions for safe access and escape routes, development optioneering (land raising, compensatory storage, flow routes / rates), drainage strategies, site-specific Flood Risk Assessment requirements.

4 Available data and information

The data and information described in this chapter has been used in the Level 2 SFRA to assess the risk to each Green Belt site as required, as described in Chapter 5.

4.1 EA models

The following EA hydraulic river models have been used in the assessment:

- Middle Lower Don model (2015)
- Blackburn Brook model (2018)
- Sheffield Comprehensive Flood Review (SCFR) model (2012)

4.2 EA Open Data

Additional to the EA modelling information, the following datasets, available from the EA's Open Data online portal, have been reviewed and considered:

- Flood Map for Planning (Rivers and Sea) Flood Zones 2 and 3 (2024),
- Flood Storage Areas,
- Third generation Risk of Flooding from Surface Water extents, depths, and hazards for 3.3%, 1% and 0.1% AEP events,
- Spatial Flood Defences,
- Historic Flood Map,
- Recorded Flood Outlines,
- Flood Warning Areas,
- Flood Alert Areas,
- Reservoir Flood Map,
- Working with Natural Processes.

4.3 Other datasets

Other datasets and information used in the Level 2 SFRA include:

- JBA 5m Groundwater Flood Risk Map,
- Functional floodplain dataset,
- OS Open Data Zoomstack base mapping.

4.4 Flood risk data and application of the sequential test

The NPPF recommends that application of the sequential test applies to any source of flooding. The PPG further states in paragraph 23:

"Other forms of flooding need to be treated consistently with river and tidal flooding in mapping probability and assessing vulnerability, so that the sequential approach can be applied across all areas of flood risk".

The general implications of these are summarised as follows:

- The sequential test must be based on mapping that enables decision making according to a prioritisation based on a risk-based sequence. For river and sea flooding, mapping is available nationally that describes low, medium and high-risk flood zones but comparable mapping of this specific type and quality is not available for other sources.
- The other sources of flood risk that can potentially be included in the sequential test are surface water, groundwater, sewer flooding, and reservoir flooding (or other water impounding features such as canals).
- **A basic requirement for the sequential test to be performed is that appropriate, competent mapping can be prepared to enable logical comparison of the flood risk from different sources at alternative locations, both now and in the future, as this is fundamental to establishing a logical "risk sequence".**

Therefore, the following approach was taken to inform the sequential test for new development in Sheffield:

- For flood risk from rivers, the EA's Flood Map for Planning was used for present day risk. Future risk was assessed using local models, updated with the EA's latest climate change allowances, where possible, or using proxies.
- For surface water flood risk, the EA's third generation Risk of Flooding from Surface Water dataset was used for present day. Future risk was modelled using the third-generation surface water models. It should be noted that the Risk of Flooding from Surface Water includes an allowance for drainage (a flood risk management feature), so this is not strictly the same conceptual risk as defined for river flooding (even though it is associated with the same probability). However, it does create a method that can accommodate sequential testing, as it facilitates strategic decisions that direct development to land in a "low risk surface water flood zone".
- For reservoir flood risk, potential high-risk zones were assessed and identified and where allocated sites were identified to be located in such zones, then the implications are recommended to be addressed in a site-specific Flood Risk Assessment.
- The readily available datasets for groundwater and sewer flood risk do not competently define areas of high or low risk of flooding and so more detailed assessment should be performed in a site-specific Flood Risk Assessment.

In applying the sequential test, the LPA has followed the approach described above and has therefore applied the Test in accordance with the NPPF, in the context of the data available to it[6]. Where additional investigation into potential groundwater flooding and residual risk from reservoir flooding is needed, it is appropriate that these are addressed

6 Further information on how the LPA has applied the sequential test are set out in their "Selection of Sites for Green Belt Release" Topic Paper

through site-specific Flood Risk Assessments at the masterplanning or planning application stage. These requirements are set out as recommendations in individual Level 2 SFRA site assessment reports, so can essentially be conditioned as part of the Site Allocation process. The LPA has engaged with both the LLFA and EA throughout the SFRA process and have confirmed that they have received no objections to the approach outlined in this report.

5 Methodology

The following methodology has been applied in this Level 2 SFRA for Green Belt sites:

5.1 Assessing fluvial flood risk

Flood risk from fluvial sources is assessed using the EA's Flood Map for Planning available at the time of the commission (published 2024). Note that the new Flood Map for Planning published on 25 March 2025 includes for the central climate change allowance on peak river flows and also for surface water flood risk. Due to local plan time pressures, the Council cannot include the new information in this study. This Level 2 SFRA is therefore based on the 2024 version of the Flood Map for Planning.

5.1.1 Climate change

Any existing climate change modelling is accounted for. No new modelling has been carried out for this Level 2 SFRA extension.

5.1.2 Unmodelled watercourses

Several of the Green Belt sites for assessment have smaller watercourses within or close to the site boundaries. Given the local plan time pressures, new modelling of these watercourses will not be feasible. The 0.1% AEP event outline of the third generation Risk of Flooding from Surface Water dataset is therefore used to help define flow routes and potential fluvial risk from such watercourses.

It is acknowledged that the third generation dataset has now been retired with the publication of the new RoFSW through NaFRA2. However, time pressures meant it is not possible to include the new dataset in this study.

5.2 Surface water

The third generation Risk of Flooding from Surface Water dataset is used to assess surface water flood risk to the sites.

5.2.1 Climate change

The impact of climate change on surface water has been modelled as part of the 2024 Level 2 SFRA, however this is based on the previous third generation RoFSW mapping and is therefore inconsistent with the new NaFRA2 mapped outputs. The new RoFSW dataset does not include for the upper end climate change allowance recommended in the guidance and is not considered suitable for planning purposes.

5.3 Residual risk modelling

FRCC-PPG para 004 states the requirement in plan making to account for residual flood risks from flood risk management infrastructure. For the Level 2 SFRA this will involve

modelling of blockage of drainage assets (culverts) using available EA models for several sites with culverts on or near to the site.

5.4 Assessing flood risk from reservoirs

The EA's SFRA guidance[3] requests for the assessment of the risk from reservoir dam failure using the EA's Reservoir Flood Map (RFM) which shows the credible worst-case scenarios from dam failure. If a site is shown to be at risk, the SFRA should assess if the design or maintenance of the reservoir would need improving. This will require contacting the reservoir owner(s) to ascertain the flood risk in more detail and whether the proposed development could affect the reservoir's risk designation, it's design category or how it is operated.

The Council may be required, as category 1 responders, to access more detailed information about reservoir risk and reservoir owners using the online Resilience Direct system.

5.5 Assessing flood risk from groundwater

Susceptibility of areas to groundwater flooding is appraised using JBA's national 5m resolution Groundwater Flood Map which is much more refined than the British Geological Survey (BGS) datasets. In creating this map, our team of hydrogeologists and flood risk specialists modelled how and where groundwater levels would rise following prolonged periods of rainfall, considering factors such as topography, groundwater recharge volumes and spatial variations in aquifer storage and transmission properties. The model outputs were validated against recorded groundwater levels for past flood events and checked against areas historically affected by groundwater flooding. The high resolution maps make it easier for users to pinpoint and report risks from groundwater flooding.

5.6 Assessing flood risk from sewers

No additional data has been supplied by Yorkshire Water.

5.7 Access and escape routes and emergency planning

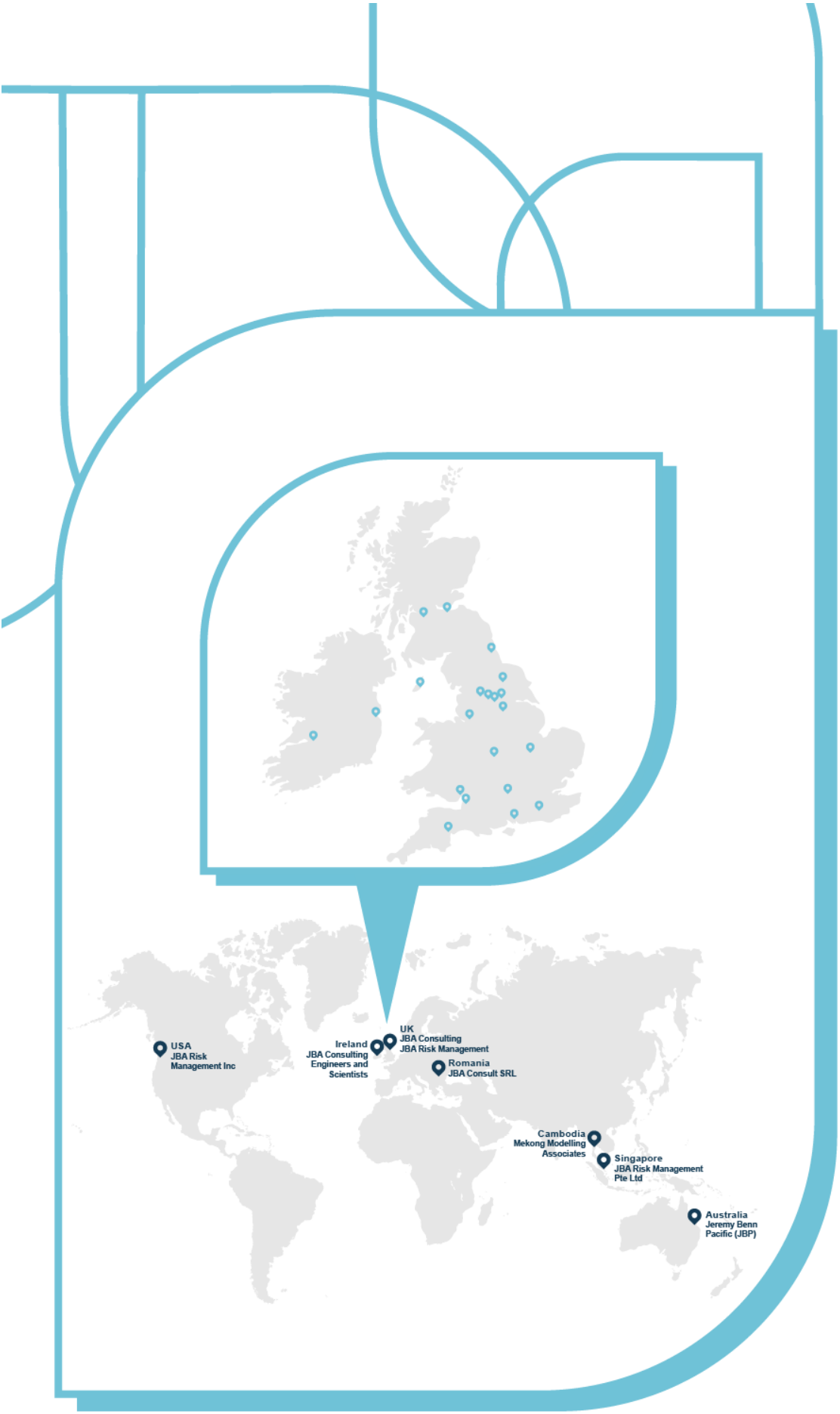
EA Flood Warning Areas and Flood Alert Areas are reviewed against the Green Belt sites. Access and escape routes for each site are also identified. Liaison with Emergency Planners and the local resilience forum may be required at the FRA stage.

5.8 Cumulative impacts

Cumulative impacts of development and land use change were assessed in the Level 1 SFRA and are referred to where appropriate.

6 Level 2 sites screening assessments

23 separate individual detailed Level 2 site screening reports have been produced detailing the site-specific assessments carried out through this Level 2 SFRA. Alongside national planning policy and guidance, all sites have been assessed on the basis of compliance with draft Sheffield Plan policies (with specific regard to Policy GS9: Managing Flood Risk).



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