Oadby and Wigston Level 2 Strategic Flood Risk Assessment

Final

S3 P03

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Prepared for:

Oadby and Wigston Borough Council

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Contract

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This report describes work commissioned by Oadby and Wigston Borough Council by an instruction dated 10 January 2023. The Client's representative for the contract was Ed Morgan of Oadby and Wigston Borough Council. Lucy Briscoe of JBA Consulting carried out this work.

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Acknowledgements

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Contents

List of Figures

List of Tables

Abbreviations

1D	1 Dimensional
2D	2 Dimensional
AEP	Annual Exceedance Probability
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
CIRIA	A company that provides research and training in the construction industry
Defra	Department of the Environment, Food and Rural Affairs
DTM	Digital Terrain Model
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
FRA	Flood Risk Assessment
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
GSPZ	Groundwater Source Protection Zone
IDB	Internal Drainage Boards
LASOO	Local Authority SuDS Officer Organisation
LFRMS	Local Flood Risk Management Strategy
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NaFRA	National Flood Risk Assessment
NPPF	National Planning Policy Framework
NVP	Nitrate Vulnerable Zones
PPG	Planning Policy Guidance
PFRA	Preliminary Flood Risk Assessment
RBMP	River Basin Management Plans
RMA	Risk Management Authority
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

Definitions

1D model: One-dimensional hydraulic model, typically representing a watercourse and structures within the channel (for example bridges and culverts).

2D model: Two-dimensional hydraulic model, typically representing the floodplain flows.

Brownfield: Previously developed parcel of land.

Annual Exceedance Probability (AEP): The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.

Critical Drainage Areas: A discrete geographic area where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting houses, businesses and/or local infrastructure.

Design flood: This is a flood event of a given annual flood probability, which is generally taken as:

- river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or
- tidal flooding with a 0.5% annual probability (1 in 200 chance each year); or
- surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year),

plus, an appropriate allowance for climate change.

Exception Test: Set out in the NPPF, the Exception Test is a method used to demonstrate that flood risk to people and property will be managed appropriately. The Exception Test is applied following the Sequential Test.

Flood defence: Infrastructure used to protect an area against floods such as floodwalls and embankments; they are designed to a specific standard of protection (design standard).

Flood Map for Planning: The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.

Flood Risk Regulations: Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.

Flood and Water Management Act (2010): Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.

Fluvial Flooding: Flooding resulting from water levels exceeding the bank level of a river.

Functional Floodplain: The land where water has to flow or be stored in times of flood.

Greenfield: Undeveloped parcel of land.

Lead Local Flood Authority (LLFA): County councils and unitary authorities which lead in managing local flood risks (risks of flooding from surface water, groundwater and ordinary (smaller) watercourses). The Leicestershire County Council is the lead local flood authority.

Local Planning Authority (LPA): The local government body which is responsible by law to exercise planning functions for a particular area. Oadby and Wigston Borough Councils is the local planning authority.

Main River: A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers.

Natural Flood Management (NFM): A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes to store or slow down flood waters before they can damage flood risk receptors (e.g., people, property, infrastructure, etc.).

Ordinary Watercourse: All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.

Resilience Measures: Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.

Riparian owner: A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.

Risk: In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.

Risk Management Authority (RMA): Operating authorities who's remit and responsibilities concern flood and/or coastal risk management.

Sequential Test: Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.

Sewer flooding: Flooding caused by a blockage or overflowing in a sewer or urban drainage system.

Standard of Protection (SoP): Defences are provided to reduce the risk of flooding (typically from a river, sea or surface water). A Standard of Protection is usually described in terms of an AEP flood event. For example, a flood embankment could be described as providing a 1% AEP Standard of Protection.

Sustainable Drainage Systems (SuDS): Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.

Surface water (pluvial) flooding: Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.

Executive Summary

This Level 2 Strategic Flood Risk Assessment (SFRA) document was created with the purpose of supporting the review and update of the Oadby and Wigston Local Plan to cover the plan period 2020-2041. The Government's Planning Practice Guidance (PPG) on Flood Risk and Coastal Change advocates a tiered approach to risk assessment involving Level 1 and Level 2 assessments.

The aim of the Level 2 assessment is to build on identified risks from Level 1 for proposed development sites, to provide a greater understanding of fluvial, surface water, groundwater, and reservoir related flooding risks to the site. From this, the Local Council and Developers can make more informed decisions and pursue development in an effective and efficient manner. The Level 2 assessment also identifies sites for further risk analysis at the site-specific Flood Risk Assessment (FRA) stage.

In this SFRA, 33 proposed development sites were provided by Oadby & Wigston Borough Council for screening. Of the 33 sites provided, 10 sites were within the boundaries of larger sites. Table 4-1 of the main report lists all sites assessed and identifies sites that lie within larger boundaries. For these sites, screening results for each source of flooding are provided for information, but these sites have not been ranked as they have been considered part of the larger sites. These sites were screened against:

- the latest available Environment Agency fluvial model results
- the Environment Agency's Risk of Flooding from Surface Water dataset, including an allowance for climate change
- risk of groundwater flooding using JBA's 5m resolution groundwater emergence mapping and the Environment Agency's LiDAR dataset
- the Environment Agency's Flooding from Reservoirs dataset

Sites were assigned a category of Red, Amber or Green depending on flood risk:

- **Green**- sites that are at low risk of flooding from all sources. A Flood Risk Assessment will still be required for these sites if they are greater than 1 ha, in line with the National Planning Policy Framework.
- **Amber**- Sites that are generally at low risk of flooding but have specific considerations that will need to be addressed through a site-specific Flood-Risk Assessment at the planning application stage e.g. flood risk to access/egress routes. These specific considerations are noted in the site-specific summary tables, and Table 4-1
- **Red**- Sites with significant flood risk issues that will need to be addressed if the site is to be developed. **Red sites will require the Exception Test to be passed.** A red rating does not mean that a site should not be developed, rather it is a sign that careful consideration should be given to the present issues to ensure users of the site will be safe throughout its lifetime and that there will be no increase to risk off site. It should be noted that in many cases, it is likely that development of these sites will present the opportunity to address existing issues

and help reduce risk off-site. These opportunities are highlighted in the site-specific summary tables (Appendix A).

Following the screening, 12 detailed site summary tables have been produced for the following sites (those identified as Red or Amber through the screening, except Burgess Junction which is only impacted significantly during the 0.1% AEP surface water flood event):

- O&W_002 (including O&W_001/ OAD_008/ WIG_005)
- OAD_001
- OAD_003
- OAD_005
- OAD_006
- OAD_011 (including OAD_009/ 010/002)
- OAD_014
- OAD_015 (cross-boundary site with Harborough District)
- WIG_002
- WIG_009
- WIG_008 (inc. WIG_003/ 004 /006/007)
- WIG_015

The following sites will require the Exception Test to be passed:

- OAD_003
- OAD_005
- OAD_006
- OAD_014
- OAD_015
- WIG_009
- WIG_015

For sites that have not been identified as having significant flooding issues warranting a site summary table, a Flood Risk Assessment will still be required where the site area is equal to or greater than 1 ha.

GEOPDF mapping accompanies each site summary table, showing flood risk datasets available at each site. The site summary tables include:

- The most recent policy and legislation updates in the National Planning Policy Framework (2023).
- An assessment of all sources of flooding including fluvial, surface water, groundwater, and reservoir flooding, the potential increase in risk due to climate change, and how these risks may be mitigated.
- An assessment of existing flood warning and emergency planning procedures, including an assessment of access and egress arrangements during an extreme event.

- Advice and recommendations on the likely applicability of sustainable drainage systems for managing surface water runoff.
- A comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the emerging Local Plan.
- Advice on whether the sites are likely to pass the second part of the Exception Test and the Sequential Test with regards to flood risk and on the requirements for a site-specific FRA, and outline specific measures or objectives that are required to manage flood risk.

The following points summarise the Level 2 assessment:

Sources of Flooding

Note on Site References: Some sites lie entirely within the boundary of a larger site. In these instances, the larger site has been referred to only. Sites OAD_09, OAD_010, and OAD_011 are the same geographical site area with differing development proposals and are referred to as OAD_09/10/11 collectively for the purpose of this report. See Table 4.1 for full details of site references and overlaps.

- Fluvial Flooding - No site is at risk from fluvial flooding from an Environment Agency Main River (i.e. the River Sence). There are several small ordinary watercourses within the Borough that are not currently modelled but have the potential to cause fluvial flood risk, most notably the Wash Brook. For this assessment, the surface water mapping has been used to provide an indication of fluvial risk where there are unmodelled watercourses within the vicinity of some sites, most notably O&W_002,OAD_003, OAD_005, OAD_006, OAD_09/10/11, and WIG_008. However, modelling of these watercourses will be essential in a Flood Risk Assessment to inform the fluvial risk to any development proposals within the vicinity of currently unmodelled watercourses.
- Surface Water Flooding - Surface water risk is widespread across the Borough of Oadby and Wigston, with most sites at risk to some extent. Surface water flows are generally shown to follow the paths of ordinary watercourses in rural areas and is more widespread in urban areas.
- Access and Egress - Most sites have access and egress issues as a result of surface water and potential fluvial flooding from unmodelled ordinary watercourses. Additionally, some sites are bisected by ordinary watercourses. Consideration should be made to these sites as to how safe access and egress can be provided during flood events, both to people and emergency vehicles. Also, consideration should be given to the nature of the risk, for example whether the flooding forms a flow path or bisects the site where access from one side to another may be compromised.
- Effects of Climate Change - Fluvial and surface water risk to sites will increase as a result of climate change. The significance of the increase at a site scale generally depends on the ground elevations at the site and the magnitude of the increase.

- The modelled 1% AEP plus 40% climate change surface water extent is similar to the 0.1% AEP event, showing the Borough of Oadby and Wigston to be sensitive to increases in surface water flooding due to climate change. Sites most sensitive to climate change tend to be those with unmodelled ordinary watercourses that are already at risk in the present day, with OAD_11 being notably sensitive, with a large increase in areas at risk predicted in future.
- The only Main River within the Borough of Oadby and Wigston is the River Sence, whose flood extents do not affect any sites in the 0.1% AEP event.
- Site-specific FRAs should confirm the impact of climate change using latest guidance. It is recommended that Oadby and Wigston Borough Council work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the Borough.

- Historic Flooding - Leicestershire County Council (LLFA) hold a register of recorded flood incidences which document's locations where flooding has been reported. 4 sites (WIG-011, OAD_003, OAD_006, and OAD_09/10/11) are identified as having experienced flooding in the past (recognising that not all flood events are reported to the LLFA, particularly flooding on undeveloped sites where no properties would have been affected in prior events).
- Groundwater Flooding- Groundwater emergence mapping indicates that the majority of the Borough is at negligible risk from groundwater emergence. Parts of sites WIG_008 and WIG_011 are identified as being at higher risk from groundwater emergence, though risk across the majority of the site remains negligible.
- Canal Flooding - The Grand Union Canal flows through the south of Oadby and Wigston Borough and is managed by the Canal and River Trust. The watercourse is controlled by a series of locks. WIG_009 borders the canal and there is the potential for the site to be at risk during a breach or overtopping event.
- Reservoir Flooding - The entirety of the Borough of Oadby and Wigston is outside the 'dry' and 'wet' day flooding from reservoir extents.

Requirements for the Local Authority

- For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test. At planning application stage, the developer must adopt the sequential approach when assessing the feasibility of site allocations. This will ensure that appropriate flood resistance and resilience measures are put in place, which align with the recommendations in National and Local Planning Policy and supporting guidance as well as those set out in this SFRA.
- The Council will need to apply the Exception test to the following sites:
  - OAD_003
  - OAD_005

- OAD_006
- OAD_014
- OAD_015
- WIG_009
- WIG_015

Requirements for Developers

- Any sites located where there is a Main River (including culverted tributaries of a Main River) will require an easement of 8m either side of the watercourse from the top of the bank. This may introduce constraints regarding what development will be possible and consideration will also need to be given for access and maintenance at locations where there are culverts. Developers will be required to apply for appropriate permits so the activity being carried out over easements does not increase flood risk. It is expected that a similar principle is followed for ordinary watercourses. If for any reason development is proposed within 8m of an ordinary watercourse, consultation will need to be undertaken with OWBC and Leicestershire County Council as LLFA to ensure that the development is not at risk of flooding, does not increase the risk of flooding elsewhere and does not impede the ability of the LLFA to undertake any management/maintenance activities as may be necessary.
- A strategic assessment of SuDS options has been undertaken using regional datasets. A detailed site-specific assessment of suitable SuDS techniques should be undertaken at site-specific level to understand which SuDS options are most appropriate.
- At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of unmodelled watercourses so that the potential effects of proposals can be evaluated at site level and ensure there is no increase in risk off-site as a result of development. The modelling should evidence flood extents, depths, velocities, and hazard (including latest climate change allowances).
- For developments that have not been allocated in the Local Plan, developers must undertake the Sequential Test followed by the Exception Test (if required) and present this information to the Local Planning Authority for approval. The Exception Test should be applied where there is development which is classed as;
  - More vulnerable in Flood Zone 3a
  - Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b)
  - Essential infrastructure in Flood Zone 3a or 3b

Whilst the Exception Test is not explicitly required by the NPPF/PPG where a site is at significant risk from other sources of flooding, or where flooding impedes access/egress

regardless of whether the site itself is at risk, the NPPF/PPG do require that all sources of flooding are considered both now and into the future. In these circumstances, the Council should carefully weigh up the benefits of developing such sites against the risk, and developers should demonstrate to the Council's satisfaction that the site can be developed in a way that ensures users of the site are safe in the event of a flood from any source, both now and throughout the lifetime of the development.

The Level 1 SFRA and mapping can be used to scope the flooding issues that a site-specific FRA should investigate in more detail to inform the Sequential and Exception Tests for windfall sites.

It is recommended that as part of the early discussions relating to development proposals, developers discuss requirements relating to site-specific FRA and drainage strategies with both the Local Planning Authority and the Lead Local Flood Authority (LLFA), to identify any potential issues that may arise from the development proposals.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

Paragraph 166 of the National Planning Policy Framework (NPPF) (2023) states that strategic policies should be informed by a Strategic Flood Risk Assessment (SFRA) and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency (EA), and other relevant flood risk management authorities, such as Lead Local Flood Authorities (LLFAs) and Internal Drainage Boards (IDBs).

The Planning Practice Guidance (PPG) (2022) advocates a staged approach to risk assessment and identifies two levels of SFRA:

- Level 1 SFRA (L1): where flooding is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test. Level 1 is completed first to understand whether a Level 2 assessment is required.
- Level 2 SFRA (L2): where land outside the EA's Flood Zones 2 and 3 (and land outside areas affected by other sources of flooding as per the Exception Test requirements) cannot accommodate all the necessary development creating the need to apply the NPPF's Exception Test. In these circumstances, the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This SFRA report fulfils the requirements for a Level 2 assessment of strategic sites identified for potential allocation within the Borough of Oadby and Wigston and has been prepared in accordance with the NPPF (2023) and PPG (2022).

This report should be read alongside Oadby and Wigston Level 1 SFRA (2023) and builds upon the information presented in the Level 1 SFRA.

1.2 SFRA Objectives

The objectives of this Level 2 SFRA are to:

- Provide site-specific strategic flood risk analysis for site options using the latest available flood risk data, thereby assisting the Council in applying the Exception Test to their proposed site options in preparation of the update to Oadby and Wigston Local Plan.
- Using available data to provide information and a comprehensive set of maps presenting flood risk from all sources for each site option.
- Where the Exception Test is required, provide recommendations for making the site safe throughout its lifetime.
- Take into account most recent policy and legislation in the NPPF, PPG and LLFA Sustainable Drainage Systems (SuDS) guidance.

1.3 Consultation

SFRAs should be prepared in consultation with other risk management authorities. The following parties (external to Oadby and Wigston Borough Council as the Local Planning Authority (LPA)) have been consulted during the preparation of this Level 2 SFRA:

- Environment Agency
- Leicestershire County Council (as LLFA)
- Severn Trent Water

1.4 How to Use This Report

Table 1-1 below outlines the contents of this report and how different users can apply this information.

Table 1-1: Outline of the contents of each section of this report and how they should be applied.

Section	Contents	How to use
1. Introduction	Outlines the purpose and objectives of the Level 2 SFRA	For general information and context.
2. The Planning Framework and Flood Risk Policy	Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study. For more detail, please refer to Sections 2 and 3 of the Level 1 SFRA.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Sources of Information Used in Preparing the Level 2 SFRA	Summarises the data used in the Level 2 assessments and GEOPDFs. Outlines the latest climate change guidance published by the Environment Agency and how this was applied to the SFRA. Sets out how developers should apply the guidance to inform site-specific Flood Risk Assessments.	Users should refer to this section in conjunction with the summary tables and GEOPDFs to understand the data presented. This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development. Developers should refer back to this section when understanding requirements for a site-specific Flood Risk Assessment (FRA).

Section	Contents	How to use
4. Level 2 Assessment Methodology	Summarises the sites taken forward to a Level 2 assessment and the outputs produced for each of these sites.	This section should be used in conjunction with the site summary tables and GEOPDFs to understand the data presented.
5. Flood Risk Management Requirements for Developers	Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Refers back to relevant sections in the L1 SFRA for mitigation guidance.	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed. Developers should also refer to the L1 SFRA for further information on flood mitigation options.
6. Surface Water Management and SuDS	Refers back to relevant sections in the L1 SFRA for information on SuDS and surface water management.	Developers should use this section to understand the suitability of SuDS across the study area and refer to the L1 SFRA for further information on types of SuDS, the hierarchy and management trains information.
7. Summary of Level 2 Assessment and Recommendations	Summarises the results and conclusions of the Level 2 assessment, and signposts to the L1 SFRA for planning policy recommendations.	Developers and planners should use this section to see a summary of the Level 2 assessment and understand the key messages from the site summary tables. Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.
Appendix A: GEOPDFs and Site Summary Tables	Provides a detailed summary of flood risk for sites requiring a more detailed assessment. The section considers flood risk, emergency planning, climate change, broadscale assessment of possible SuDS, exception test requirements and requirements for site-specific FRAs. Provides GEOPDFS for each Level 2 assessed site displaying flood risk at and around the site.	Planners should use this section to inform the application of the Sequential and Exception Tests, as relevant. Developers should use these tables to understand flood risk, access and egress requirements, climate change, SuDS, and FRA requirements for site-specific assessments. Planners and developers should use these maps in conjunction with the site summary tables to understand the nature and location of flood risk.

Section	Contents	How to use
Appendix B: Oadby & Wigston Level 2 SFRA Scoping Study	Provides a report which lists all the sites that were screened for the Level 2 assessment, results from the screening and the decisions taken to determine sites taken forward to the Level 2 SFRA.	Developers should use this report to understand flood risk for site-specific assessments.

1.5 SFRA Study Area

The Borough of Oadby and Wigston is relatively small and urbanised and is located south-east of Leicester, sharing its boundaries with Blaby District, Harborough District and City of Leicester (Figure 1-1). The study area covers just under 24km^2 and has a population of approximately 57,700 (Census 2021).

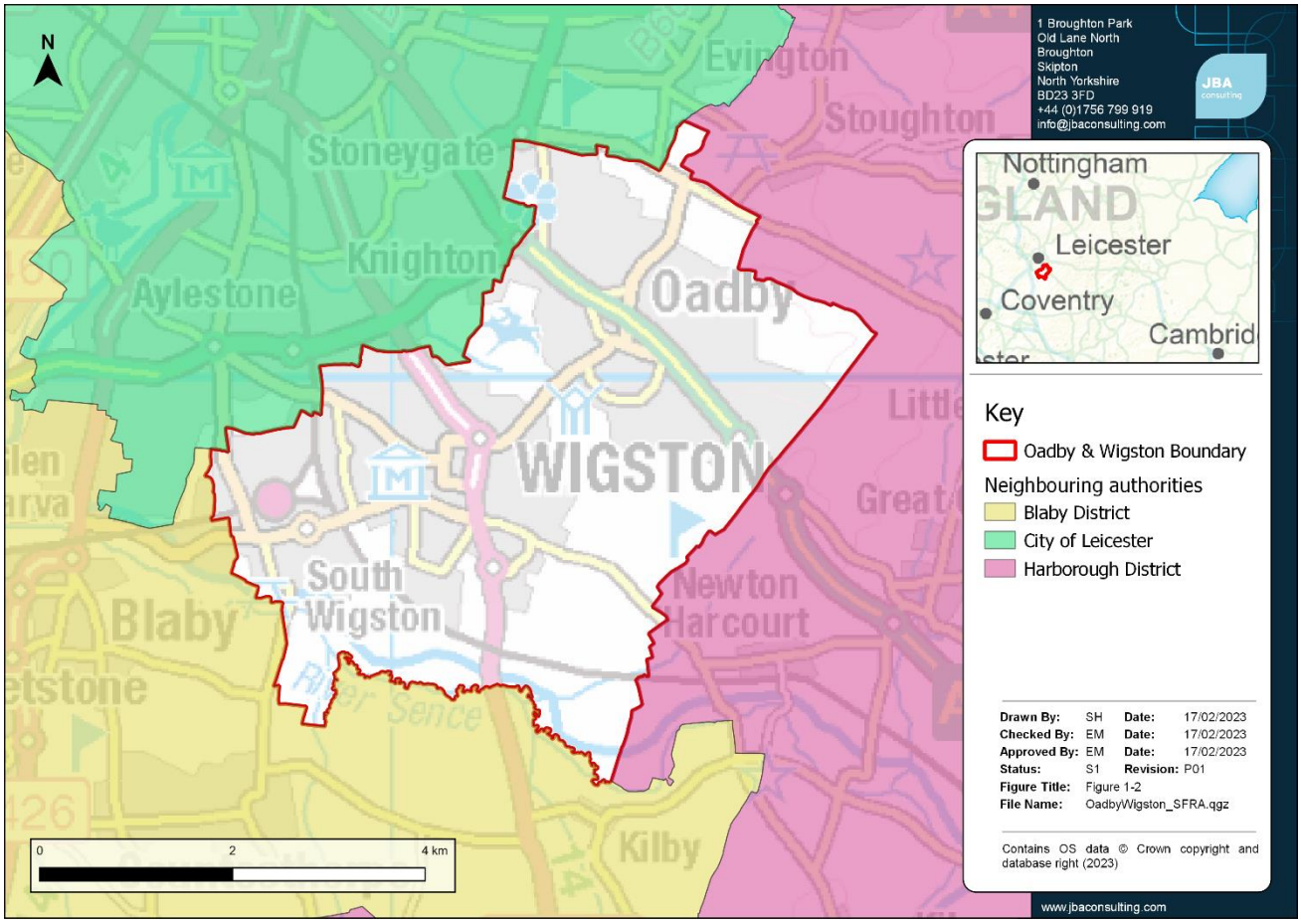

Figure 1-1: Oadby and Wigston Borough boundary and neighbouring authorities

There are 4 named watercourses which are inside Oadby and Wigston Borough boundary (Figure 1-2). The River Sence, Wash Brook, the Evington Brook, and the Grand Union Canal. The Borough of Oadby and Wigston is covered by Severn Trent Water as the water and sewerage provider and Leicestershire County Council is the Lead Local Flood Authority.

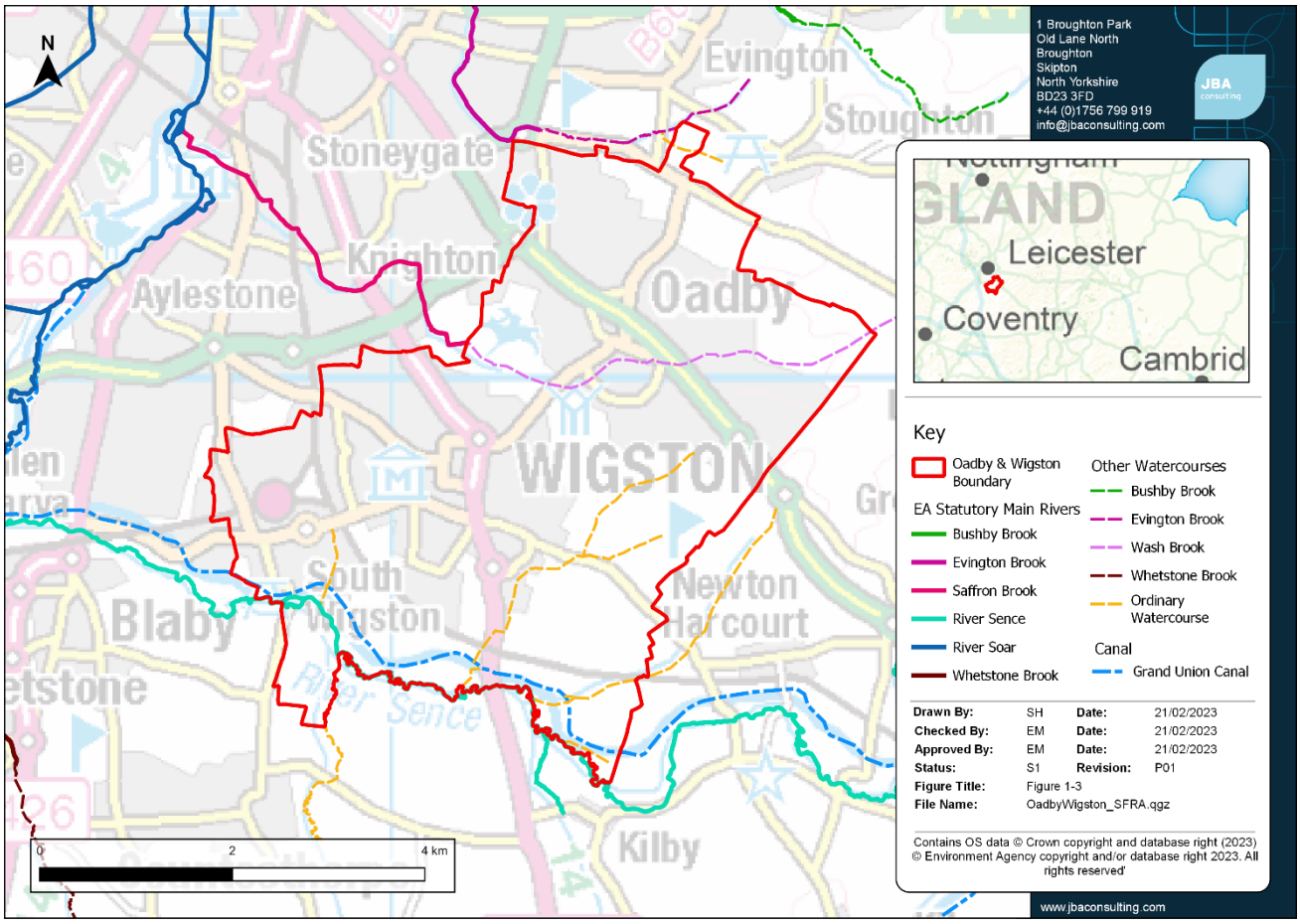

Figure 1-2: Statutory Main Rivers and other Watercourses

2 The Planning Framework and Flood Risk Policy

2.1 National Planning Policy Framework and Guidance

The Revised National Planning Policy Framework (NPPF) was updated in December 2023. The NPPF sets out Government's planning policies for England and how these are expected to be applied. The Framework is based on core principles of sustainability and forms the national policy framework in England, also accompanied by a number of Planning Practice Guidance (PPG) notes. It must be accounted for that in the preparation of local plans and is a material consideration in planning decisions.

2.1.1 Planning Practice and Guidance

An updated version of the PPG was published in August 2022. This advises on 'how to take account of and address the risks associated with flooding and coastal change in the planning process'. The guidance outlines the steps required when preparing strategic policies. Further details regarding the PPG can be found in the Level 1 SFRA.

2.1.2 The Sequential Test

The Sequential Test aims to ensure that areas of little or no flood risk are prioritised for development over areas at a higher risk of flooding. This means areas at a medium or high risk of flooding from any source, now or on the future should be avoided for development where possible in favour of areas at lower risk.

2.1.3 The Exception Test

It may not always be possible for all new development to be allocated on land that is not at risk from flooding. To further inform whether land should be allocated, or Planning Permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required.

The Exception Test should only be applied following the application of the Sequential Test. It applies in the following instances, where it is not possible for development to be located in areas with a lower risk of flooding:

- More vulnerable in Flood Zone 3a
- Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b)
- Essential infrastructure in Flood Zone 3a or 3b
- Any development with significant* risk in the Risk of Flooding from Reservoirs mapping 'Wet Day' flood extent.

Whilst the Exception Test is not explicitly required by the NPPF/PPG where a site is at significant risk from other sources of flooding, or where flooding impedes access/egress regardless of whether the site itself is at risk, the NPPF/PPG do require that all sources of flooding are considered both now and into the future. Therefore, the Council should

carefully weigh up the benefits of developing such sites against the risk, and satisfy themselves that the site can be developed in a way that ensures users of the site are safe in the event of a flood from any source, both now and throughout the lifetime of the development. Flood risk issues are not always black and white - the significance of issues requires professional judgement, based on the location, topography and nature (including depth, velocity and hazard) of flooding, rather than simply whether part of a site is within a given flood extent.

It is noted that the EA's Flood Map for Planning Flood Zones represent undefended fluvial outputs. In this SFRA, the Upper Sence has been modelled with defended fluvial events, developers, where necessary, will need to show that any residual risk to sites can be safely managed and supported by detailed modelling.

Flood Zone 3b, the functional floodplain, is based on the fluvial defended modelled 3.3% AEP event extent for the Upper Sence. Where detailed fluvial modelling is unavailable, Flood Zone 3 should be considered as Flood Zone 3b for planning purposes.

2.2 Use of SFRA Data

This SFRA has been developed using the best available information, supplied at the time of preparation. This relates both to the current risk of flooding from rivers, the sea, surface water and groundwater and, where available, the potential impacts of future climate change.

Datasets used to inform this SFRA may be updated following the publication of this SFRA and new information on flood risk may be produced by Risk Management Authorities. This new information (such as updated mapping and modelling) may supersede the information included in this SFRA. Guidance should be sought from Oadby and Wigston Borough Council, Leicestershire County council as LLFA, and the Environment Agency as appropriate to check the most up to date source of information is used for future flood risk assessment.

2.3 Roles and Responsibilities for Flood Risk Management

Risk Management Authorities (RMAs) are comprised of different organisations that have responsibilities for flood risk management. The RMAs in and around the Borough of Oadby and Wigston are displayed below in Table 2-1, alongside a summary of their responsibilities.

Table 2-1: Roles and responsibilities for flood risk management

Risk Management Authority	Strategic Level	Operational Level	Planning Role
Environment Agency.	Strategic overview for all sources of flooding, national strategy, reporting	Main rivers, reservoirs and tidal flooding.	Statutory consultee for development in Flood Zones 2 and 3 for coastal and fluvial extents.

Risk Management Authority	Strategic Level	Operational Level	Planning Role
	and general supervision.		
Leicestershire County Council as Lead Local Flood Authority (LLFA).	Preliminary Flood Risk Assessment and Local Flood Risk Management Strategy.	Surface water, groundwater and ordinary watercourses (consenting, enforcement and works).	Statutory consultee for surface water for all major developments.
Oadby and Wigston Borough Council as Local Planning Authority (LPA).	Local Plan production.	Determination of Planning Applications and managing open spaces under Council ownership.	Determination of Planning Applications and managing open spaces under Council ownership.
Water Companies: Severn Trent Water	Asset Management Plans supported by Periodic Reviews (business cases) and Develop Drainage and Wastewater Management Plans (DWMPs).	Public sewers.	Non-statutory consultee for all major developments. Also provides comments below this threshold where a specific request is received from Council Adoption of SuDS under Sewerage Sector Guidance.
Highways Authorities: National Highways (for motorways and trunk roads) Leicester City Council Local Highway Authority (for other adopted roads).	Highway drainage policy and planning.	Highway drainage Local Highway Authority can adopt some highway drainage features.	Internal planning consultee regarding highways and design standards and options.

2.4 Relevant Legislation

The following legislation is relevant to development and flood risk in the Borough of Oadby and Wigston:

- The Flood Risk Regulations (2009) have been repealed as of 31 December 2023, as most of the legislation is duplicated by the Flood and Water Management Act 2010, which details flood risk management, strategies and the responsibilities of local, regional, and national authorities.
- Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991), Environment Act (1995), Flood and Water Management Act (2010) – as amended and implemented via secondary legislation. These set out the roles and responsibilities for organisations that have a role in FRM.
- The Land Drainage Act (1991, as amended) and Environmental Permitting Regulations (2018) also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an Ordinary Watercourse or Main River.
- The Water Environment Regulations (2017) – these transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produce River Basin Management Plans (RBMPs). These aim to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reaches 'good' status. Note that this secondary UK legislation, which implements EU Directives, is subject to repeal/ amendment following the UK exit from the EU. At the time of publishing this report the references here were correct.
- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014) and Strategic Environmental Assessment Directive (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

2.5 Relevant Flood Risk Policy and Strategy Documents

This section highlights policies and other relevant documents for the Borough of Oadby and Wigston at the time of writing. Hyperlinks are provided to external documents:

- Leicestershire County Council LFRMS (2015) – sets out how Leicestershire County Council will manage flood risk from surface water runoff, groundwater and ordinary watercourses for which they have a responsibility as LLFA.
- Leicestershire County Council PFRA (2011) - a high level overview of flood risk within the Borough of Oadby and Wigston from all sources within a local area, including consideration of surface water, groundwater, ordinary watercourses and canals.
- River Trent CFMP (2010)– a high-level strategic plan providing an overview of flood risk across the Trent Catchment. The Environment Agency use CFMPs to work with other key decision makers to identify and agree long-term policies for sustainable flood risk management.

- The Humber FRMP (2022) – this plan identifies what flood risk activities are occurring across the river basin district (RBD) as well as those in locally important areas, referred to as 'Strategic Areas'.
- The Humber RBMP (2015) – legally binding locally specific environmental objectives that underpin water regulation (such as permitting) and planning activities.
- Severn Trent Water's DWMP (2023) – long term plan which outlines how Severn Trent Water plans to approach and manage sewerage and wastewater over the next 25 years.

2.6 LLFAs, Surface Water, and SuDS

The NPPF (2023) states that:

- 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (paragraph 169)

When considering planning applications, local planning authorities should consult the LLFA on the management of surface water in order to satisfy that:

- The proposed minimum standards of operation are appropriate.
- Through the use of planning conditions or planning obligations there are clear arrangements for on-going maintenance over the development's lifetime.

For proposed developments within the Borough of Oadby and Wigston, reference should be made to the LLFAs SuDS requirements and guidance for new developers which are set out in Surface Water Drainage for Developments.

The NPPF (2023) paragraph 167 states that:

- 'All plans should apply a sequential, risk-based approach to the location of development' and should achieve this by 'using opportunities provided by new development […] to reduce causes and impacts of flooding.' (paragraph 161)

As such, Oadby and Wigston Borough Council expects Sustainable Drainage Systems (SuDS) to be incorporated on minor development as well as major development and, if possible, development in areas at material risk of flooding should be avoided. Masterplans should be designed to ensure that space is made for above ground SuDS features and that the requirements of existing surface water flow paths and storage volumes are appropriately accommodated. Underground tanks should only be used on sites as a last resort.

2.7 Updated Strategic Flood Risk Assessment Guidance

There have been several updates (the latest being in March 2022) to the 'How to prepare a Strategic Flood Risk Assessment' guidance primarily affecting Level 1 SFRA guidance. The guidance for Level 2 SFRA's remained unchanged for the geographical area covered and topics to be included. Guidance for Level 2 SFRAs is to include the following topics:

- nature of flood risk from all sources
- if flood risk management features and structures were to fail
- the impact on reservoirs
- information for the Sequential Test
- information for the Exception Test
- information for assessing the safety of the development
- access and escape routes.

The guidance also includes links to various nature strategies, management plans and local design guidance. There is also guidance on improving the clarity on the sequential test and use of SuDS. This Level 2 assessment is undertaken in accordance with this guidance, with the Level 1 assessment completed in 2023 in accordance with the Level 1 guidance.

3 Sources of Information Used in Preparing the Level 2 SFRA

3.1 Topography, Geology, Soils and Watercourses

Topography, geology, soils, and watercourses data were obtained from the following sources:

- Topography data was obtained from the Environment Agency's 1m LiDAR Composite Digital Terrain Model (DTM) 2022.
- Bedrock Geology and Superficial Deposits data was procured from the British Geological Society's (BGS) 50K mapping dataset.
- Watercourses data – main rivers were mapped using the Environment Agency's Statutory Main River Map dataset, and ordinary watercourses from the Environment Agency's (Partner Only) Detailed River Network (DRN) dataset. Caution should be taken when using these layers to identify culverted watercourses which may appear as straight lines but are not.

3.2 Historic Flooding

The historic flood risk within Oadby and Wigston Council's administrative area has been assessed using the following:

- The Environment Agency's 'Recorded Flood Outlines' have been used to understand whether historic flooding has been recorded at all sites. The dataset takes into account the presence of defences, structures and other infrastructure, where they existed at the time of flooding.
- Recorded flooding incidents provided by Oadby and Wigston Borough Council, and Leicestershire County Council (flood incidents database and Section 19 investigations).
- Canal and Rivers Trust recorded flooding incidents.
- Severn Trent Water historic sewer flooding incidents.

It is important to note that the absence of historic flood records does not mean than an area has never flooded, only that records are not held. For previously undeveloped sites, it is likely that historic flooding incidents may have gone unreported due to a lack of site use or interest. In addition, it is also possible that flooding mechanisms have changed since the date of a recorded flooding incident, making it more or less likely for flooding to occur on site.

3.3 Flood Defences

For sites where existing flood defences provide a reduction in the flood risk to the site, it is important to understand the standard of protection these structures and measures provide. It is also necessary to understand how this level of protection changes over time, considering the implications of climate change.

If flood defences are required to protect a development site, evidence will be required to show that the new development does not adversely impact and increase flood risk to other areas, for example that there is no net loss in floodplain storage in circumstances where this is a material consideration. It will need to be established that these defences can be appropriately managed and maintained during the lifetime of the development. In some cases, it will be a requirement to demonstrate that there is an appropriate level of commitment to the maintenance of the standard of protection afforded by existing defences, where reliance is placed on the standard they provide.

Current flood defences have been taken from the Environment Agency's Asset Information Management System (AIMS) Spatial Defences dataset. Their current condition and standard of protection are based on those recorded in the tabulated shapefile data. The Council's asset register was also obtained in the Level 1 SFRA.

Flood defences along the Upper Sence have a design standard of protection up to and including the 0.1% AEP flood event (this can be used as a proxy for the 0.5% AEP plus climate change flood event).

3.4 Flood Zones from the EA's Flood Map for Planning

Flood Zones are discrete areas of land identified to be at risk from flooding from rivers and sea. They represent the undefended scenario. Table 3-1 outlines the definition of Flood Zones as per the PPG.

Table 3-1: Definition of the Flood Zones as per the Planning Practice Guidance

Flood Zone	Definition
Zone 1 – Low probability	Land having a less than 0.1% annual probability of river or sea flooding.
Zone 2 – Medium probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding.
Zone 3a – High probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea.

Flood Zones 1, 2 and 3a have been taken from the Environment Agency's 'Flood Map for Planning' and do not take into account flood defences. There is no functional floodplain/Flood Zone 3b across the entirety of the borough of Oadby and Wigston due to it being defended up to and including the 0.1% AEP flood event or no detailed modelling being available on ordinary watercourses. As such, where there is no detailed modelling, Flood Zone 3 should be considered as Flood Zone 3b for planning purposes. This is important for planning long term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

The Flood Map for Planning is based on generalised modelling to provide an indication of flood risk. Planning is based on generalised modelling to provide an indication of flood risk.

Whilst the generalised modelling is typically suitable for use on a large scale, they are not provided for specific sites or for land where the catchment of the watercourse is less than 3km^2.

For watercourses with smaller catchments, the Risk of Flooding from Surface Water (RoFSW) map provides an indication of the floodplain of small watercourses and ditches. It is more accurate in upper to mid river valley locations than lower valley locations near the coast. This is because it does not represent the floodplain for small watercourses as well in topographically flat areas where the flow routes are not as well defined.

Even where more detailed models of Main Rivers have been used by the Environment Agency to inform the Flood Map for Planning, they will be largely based on remotely detected ground model data and not topographic survey.

Also, the Flood Map for Planning does not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure or climate change. Hence there could still be a risk of flooding from other sources and the level of flood risk will change over time during the lifetime of a development.

For these reasons, the Flood Map for Planning is not of a resolution to be used as application evidence to provide the details of possible flooding for individual properties or sites and for any sites with watercourses on, or adjacent to the site. Accordingly, for site-specific flood risk assessments supporting development proposals it will be necessary to perform more detailed studies, including modelling, in circumstances where flood risk is an issue.

3.5 Climate Change

The Environment Agency published updated climate change guidance in 2019 on how allowances for climate change should be included in both strategic and site-specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development.

In 2018 the government published new UK Climate Projections (UKCP18). The Environment Agency have used these to further update their climate change guidance for new developments with regards to updated fluvial, rainfall, and tidal allowances. The new climate change allowances were released in July 2021 for peak river flows, May 2022 for peak rainfall allowances, and December 2019 for sea level allowances. These should be used when undertaking a detailed Flood Risk Assessment.

To apply the climate change guidance, the following information needs to be known:

- The vulnerability of the development.
- The likely lifetime of the development – in general at least 75 years is used for commercial development (depending on the development's characteristics) and 100 years for residential, but this needs to be confirmed in an FRA.
- The River Basin in which the site is located.

The Climate Change Act 2008 creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050.

The NPPF sets out that flood risk should be managed over the lifetime of a development, taking climate change into account.

3.6 Flooding from Rivers

3.6.1 Fluvial Modelling

The fluvial model for the Upper Sence were obtained from the Environment Agency. This provides a more accurate representation of actual flood risk of the Sence than the Environment Agency's Flood Map for Planning. The following Annual Exceedance Probability events for the defended fluvial scenarios have been assessed:

- 3.3% AEP (1 in 30-yr) defended fluvial
- 1% AEP (1 in 100-yr) defended fluvial
- 0.5% AEP (1 in 200-yr) defended fluvial
- 0.1% AEP (1 in 1000-yr) defended fluvial

There are no other hydraulic models available within the Borough of Oadby and Wigston.

3.6.2 Impacts of Climate Change on Fluvial Flood Risk

Climate change is expected to increase the peak flows of rivers, meaning that flows which were previously thought to be extreme will now be considered far more possible. Areas benefiting from flood defences will find the standard of protection changes over time with overtopping of defences more likely unless they are upgraded.

Peak river flow climate change allowances developed by the Environment Agency are divided into a series of Management Catchments, where the Borough of Oadby and Wigston falls under the Soar Management Catchment (Table 3-2). This information provides a strategic assessment of climate change risk; developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA, following the Climate Change Guidance set out by the Environment Agency.

Table 3-2 Climate change allowances for fluvial flood risk

Allowance Category	Total potential chance anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Upper end	28%	35%	60%
Higher central	18%	21%	37%
Central	14%	16%	28%

3.6.3 Climate Change Uplifts for Fluvial Hydraulic Modelling

Climate uplifts of 20%, 30% and 50% were used for the Upper Sence model. No sites within Oadby & Wigston are shown to be at risk in any modelled event.

3.7 Flooding from the Sea

The Borough of Oadby and Wigston is a landlocked area in Central England and has no risk of flooding from tidal or coastal flooding.

3.8 Surface Water Flooding

3.8.1 Present Day risk of Flooding from Surface Water

Mapping of surface water flood risk in the Borough of Oadby and Wigston has been taken from the Environment Agency's Risk of Flooding from Surface Water (RoFSW) mapping. Surface water flood risk is subdivided into the following four categories:

- **High**: An area has a chance of flooding greater than 3.3% AEP (1 in 30-yr) each year.
- **Medium**: An area has a chance of flooding between 1% AEP (1 in 100-yr) and 3.3% AEP (1 in 30-yr) each year.
- **Low**: An area has a chance of flooding between 0.1% AEP (1 in 1,000-yr) and 1% AEP (1 in 100-yr) each year.
- **Very Low**: An area has a chance of flooding of less than 0.1% AEP (1 in 1,000-yr) each year.

The results should be used for high-level assessments. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be required to illustrate the flood risk more accurately at a site-specific scale. Such an assessment should use the RoFSW in partnership with other sources of local flooding information to confirm the presence of a surface water risk at that particular location.

Detailed modelling based on site survey will be necessary where there is a significant risk of surface water flooding. It is the intention that the Environment Agency will prepare updated

and improved surface water mapping while updating the National Flood Risk Assessment (NaFRA). At the time of writing, it is anticipated that this data will be available in 2024 and at that time it is recommended that the surface water risk assessment is reviewed. It is not anticipated that the updated mapping will fundamentally change the locations identified to be at risk from surface water flooding, but the improved analysis techniques will reduce some of the uncertainties associated with the assessment.

3.8.2 Impacts of Climate Change on Surface Water Flood Risk

Climate change is predicted to result in wetter winters and increased summer storm intensity in the future. This increased rainfall intensity will affect land and urban drainage systems, resulting in surface water flooding, due to the increased volume of water entering the systems.

The potential impacts of surface water plus climate change will likely need to be considered at site-specific assessment stage. In May 2022, the Environment Agency updated the surface water climate change projections, which are now based on management catchments – the Soar Management Catchment. Table 3-3 shows the peak rainfall intensity allowances that apply in the Borough of Oadby and Wigston when considering surface water flood risk. Both the central and upper end allowances should be considered to understand the range of impact.

Table 3-3: Climate change allowances for peak rainfall intensity

Allowance Category	Total Potential change anticipated for '2050s' (2040 to 69)	Total potential change anticipated for '2070s' (2061 to 2125)
3.3% AEP Central	20%	25%
3.3% AEP Upper end	35%	35%
1% AEP Central	20%	40%
1% AEP Upper end	25%	40%

3.8.3 Climate Change Uplifts for Surface Water Hydraulic Modelling

As part of this SFRA, the surface water models were run for the 3.3% and 1% AEP events for the 2050s and 2070's period.

3.8.4 Critical Drainage Areas

A critical drainage area (CDA) is defined as “a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer and/or river) often cause flooding in a Flood Risk Area during severe weather thereby affecting people, property or local infrastructure.” These can cover wide areas within both rural and urban environments and are typically where manmade drainage

infrastructure has been identified as at critical risk of failure, resulting in flooding. An absence of CDAs does not mean there are no areas with potential drainage problems.

There are no CDAs identified within the Borough of Oadby and Wigston at time of writing.

3.9 Sewer Flooding

3.9.1 Impact of Climate Change on Sewers

Surface water and fluvial flooding with climate change have the potential to impact the sewerage system, so careful management of these is needed for development. Due to differing ages of settlements, there will be drainage systems consisting of different types of sewers. Increasing pressures from climate change, urban creep and infill development could impact the performance of the sewerage system. Severn Trent Water's DWMP is aligned to the 2°C climate pathway, in line with the Climate Change Committees recommendation to 'plan for 2°C, prepare for 4°C'. The Borough of Oadby and Wigston lies within Severn Trent's Soar Management catchment, and it is estimated that in the 2% AEP storm, an additional 1800 homes will be at risk in the 2°C and 2500 additional homes will be at risk in the 4°C climate scenarios in 2050 compared to the present day. It is estimated that maintaining current risk levels across the catchment would require investment of £127m in the 2°C and £151m in the 4°C scenario. Developers for all sites within the Borough of Oadby and Wigston should work collaboratively with Severn Trent Water to ensure that development proposals do not increase the risk of sewer flooding and take advantage of opportunities for development to help further Severn Trent's strategic objectives with regard to managing flood risk form sewers.

3.10 Groundwater

In comparison to fluvial flooding, current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. Groundwater level monitoring records are available for areas on Major Aquifers; however, for lower lying valley areas, which can be susceptible to groundwater flooding caused by a high-water table in mudstones, clays, and superficial alluvial deposits, very few records are available. Additionally, there is an increased risk of groundwater flooding where long reaches of watercourse are culverted as a result of elevated groundwater levels not being able to naturally pass into watercourses and be conveyed to less susceptible areas.

To assess groundwater flooding emergence within the Borough of Oadby and Wigston, the Groundwater Flood Data 5m Resolution (JBA licensed product) has been provided by JBA. The Groundwater Flood Data shows areas of potential groundwater emergence during a 1% AEP flood event, and highlights areas where there is sufficient evidence to suggest that flooding may occur. This data cannot form part of the Sequential Test as it is not directly comparable to other datasets (e.g. Flood Zones), and therefore cannot categorise an area as high, medium or low risk on its own. The map should be interpreted as an initial indicative tool to assess groundwater flood risk at preliminary stages of planning/site allocation. Where mapping indicates a risk of groundwater flooding a detailed assessment

should be undertaken to confirm the risk to the site as part of any planning application, which may require ground investigations.

The Groundwater Flood data categorises into 5 different classes, with a detailed description of the classes in Table 3-4 below.

Table 3-4: JBA Groundwater Flood data classifications

Risk Class	Depth range	Description
0 - No risk	>5m	The zone is deemed as a having negligible risk from groundwater flooding due to the nature or local geological deposits
1	At least 5m	Flooding from groundwater is unlikely
2	Between 5m and 0.5m	Risk of flooding to subsurface assets but surface manifestation is unlikely
3	Between 0.5m and 0.0025m	Risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge locally<0.0
4	<0.025m	Risk of groundwater flooding to surface and subsurface assets. Groundwater may emerge at significant rates and gas the capacity to flow overland and/or pond within any topographic low spots.

3.10.1 Impact of Climate Change on Groundwater Flooding

The impact of climate change is uncertain for groundwater flooding associated with rivers and land catchments and those watercourses where groundwater has a large influence on winter flood flows. There is no technical modelling data available to assess climate change impacts on groundwater. It would depend on the flooding mechanism, historic evidence of known flooding and geological characteristics, for example prolonged rainfall in a chalk catchment. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding.

Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months.

3.11 Reservoirs

The risk of inundation due to reservoir breach or failure of reservoirs within the area has been assessed using the Environment Agency's Risk of Flooding from Reservoirs dataset.

This dataset displays a prediction of the credible worst-case scenario. The dataset gives no indication of the likelihood or probability of reservoir flooding. The Reservoir Flood Maps do not describe the risk of flooding (simply a credible worst case) and data includes layers for:

- 'Dry days' – Individual flood extents for all large, raised reservoirs in the event that they were to fail and release the water held on a "dry day" when local rivers are at normal levels.
- 'Wet days' – Individual flood extents for all large, raised reservoirs in the event that they were to fail and release the water held on a "wet day". A wet day is assumed to be a failure at the same time as experiencing a river flood with a 1 in 1000 chance of occurring in any year.
- 'Fluvial contribution' – The extent of river flooding added to the reservoir model to determine the impacts of failure on a wet-day.

3.12 Residual Risk

The residual flood risk to sites is identified as the risk of blockages of bridges/culverts or overtopping/ breach of defences could result in the inundation of a site, with the sudden release of water with little warning. There are several culverted sections of watercourse within the Borough, particularly through Wigston, and there is the potential for over topping of the Grand Union Canal to pose a risk to areas in the south of the Borough.

No register of culverts within the Borough of Oadby and Wigston was available for the assessment, however OS Mapping and the Environment Agency's Detailed River Network Layer were used to identify determine where watercourses flow into culverts or through structures (i.e. bridges) in the vicinity of the sites. Any potential locations at risk from blockage are flagged in the site summary tables (WIG_008, WIG_009, WIG_011, OAD_003, OAD_005, OAD_006, & OAD-011). These will need to be considered by the developer as part of a site-specific Flood Risk Assessment.

3.12.1 Breach Modelling

No breach modelling for the Grand union Canal was available for use in this assessment, however flooding would be limited to the south of the Borough, and only WIG_009 has the potential to be affected. There are no formal defences along the River Sence which could breach, and undefended modelling suggests that there is very little flood risk to the Borough of Oadby and Wigston from the River Sence with flood extents limited to the very south of the Borough even in the most extreme undefended scenarios.

3.13 Adapting to Climate Change

The PPG Climate Change guidance contains information and guidance for how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime.

- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development.
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses; and
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity, and amenity, for example by leaving areas shown to be at risk of flooding as public open space.
- Considering the standard of protection of defences and sites for future development, in relation to sensitivity to climate change. The Council and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option.

It is recommended that the differences in flood extents from climate change are compared by the Council when allocating sites, to understand how much additional risk there could be, where this risk is in the site, whether the increase is marginal or activates new flow paths, whether it affects access/ egress and how much land could still be developable overall.

3.14 Depth, Velocity, and Hazard to People

The Level 2 assessment seeks to map the probable depth and velocity of flooding as well as the hazard to people during the defended fluvial 1% AEP event plus an allowance for climate change. The 1% AEP plus climate change flood event has been investigated in further detail because the Level 2 assessment helps inform the Exception Test and usually flood mitigation measures and access/ egress requirements focus on flood events lower than the 0.1% AEP event (e.g. the 1% AEP plus climate change event).

Where detailed model outputs were available, the 1% AEP plus climate change depth, velocity and hazard data has been used. This data is only present where models have a 2D element, representing the floodplain in detail. In the absence of detailed hydraulic models (or models with detailed 1D-2D outputs), the Flood Map for Planning dataset has been used, as well as the Risk of Flooding from Surface Water dataset. The depth, hazard, and velocity of the 1% AEP plus climate change surface water flood event has also been mapped and considered in this assessment. Hazard to people has been calculated using the below formula as suggested in Defra's FD2321/TR1 "Flood Risk to People." The different hazard categories are shown in Table 3-5. Developers should also test the impact of climate change depths, velocities, and hazard on the site, at Flood Risk Assessment stage.

Table 3-5: Defra's FD2321/TR1 "Flood Risks to People" classifications

Degree of Flood Hazard	Flood Hazard Rating	Description
Very Low Hazard	< 0.75	Caution “Flood zone with shallow flowing water or deep standing water”
Moderate	0.75 – 1.25	Dangerous for some (i.e. children) “Danger: flood zone with deep or fast flowing water”
Significant	1.25 – 2.00	Danger for most people “Danger: flood zone with deep fast flowing water”
Extreme	>2.00	Danger for all “Extreme danger: flood zone with deep fast flowing water"

Please note these hazard ratings are due to be updated soon. These classifications are based on the guidance of FD2321/TR1.

As part of a site-specific FRA, developers will need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood depth, velocity and hazard based on the relevant 1% AEP plus climate change event, using the relevant climate change allowance based on the type of development and its associated vulnerability classification. Not all this information is known at the strategic scale and the level of resolution may not be appropriate to enable site scale assessment of proposed development schemes.

3.15 Note on SuDS Sustainability

The hydraulic and geological characteristics of each site were assessed to determine the factors that potentially constrain schemes for surface water management. This assessment is designed to inform the early-stage site planning process and is not intended to replace site-specific detailed drainage assessments.

The assessment is based on catchment characteristics and additional datasets such as the JBA Groundwater emergence risk map and British Geological Survey (BGS) Soil maps of England and Wales which allow for a basic assessment of the soil characteristics on a site-by-site basis. LIDAR data was used as a basis for determining the topography and average slope across each development site. Other datasets were used to determine other factors. These datasets include:

- Historic landfill sites
- Groundwater Source Protection Zones
- Detailed River Network
- The Flood Map for Planning

This data was then collated to provide an indication of particular groups of SuDS systems which might be suitable at a site. SuDS techniques were categorised into five main groups, as shown in Table 3-6. This assessment should not be used as a definitive guide as to which SuDS would be suitable but used as an indicative guide of general suitability. Further site-specific investigation should be conducted to determine what SuDS techniques could be used on a particular development, informed by detailed ground investigations.

Table 3-6: Summary of SuDS categories

SuDS Type	Technique
Source Controls	Green Roof, Rainwater Harvesting, Pervious Pavements, Rain Gardens
Infiltration	Infiltration Trench, Infiltration Basin, Soakaway
Detention	Pond, Wetland, Subsurface Storage, Shallow Wetland, Extended Detention Wetland, Pocket Wetland, Submerged Gravel Wetland, Wetland Channel, Detention Basin
Filtration	Surface Sand filter, Sub-Surface Sand Filter, Perimeter Sand Filter, Bioretention, Filter Strip, Filter Trench
Conveyance	Dry Swale, Under-drained Swale, Wet Swale

The suitability of each SuDS type for the site options has been described in the summary tables, where applicable. The assessment of suitability is broadscale and indicative only; more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS.

Further SuDS guidance and design requirements for the Borough of Oadby and Wigston are available in Section 6.

4 Level 2 Assessment Methodology

4.1 Site Screening

Oadby and Wigston Borough Council provided 33 sites for assessment, 10 of which were fully within the boundaries of a larger site. These sites were screened against available flood risk information and spatial data to provide a summary risk to each site including:

- The proportion of the site in each Flood Zone derived from the Level 1 SFRA, which includes modelling data for the River Sence.
- Whether the site is shown to be at risk from surface water flooding from the RoFSW data set.
- If the site is at risk from groundwater emergence using the JBA groundwater emergence risk map.
- Proportion of the site in the reservoir 'wet' and 'dry' extents (there are no areas of risk identified within the Borough of Oadby and Wigston)
- Other considerations such as safe access and egress to or from a site that affect the viability of development.

The screening provides an opportunity to identify sites that may show to be 100% in Flood Zone 1, but upon inspection using GIS software, have an ordinary watercourse flowing through or adjacent to the site. While Flood Zone maps may not be available for these water courses, it does not mean the watercourse doesn't pose a risk, only that no modelling of the watercourse has been conducted to identify the risk.

The Flood Zones are not provided for specific sites or land where the catchment of the watercourse falls below 3km^2. For this reason, the Flood zones are not of a resolution to be used as application evidence to provide the details of possible flooding for individual properties or sites, and any sites with a watercourse in or adjacent to the site. The RoFSW has been used in these cases as it provides a reasonable representation of the floodplain of such watercourses to use for strategic assessment. Detailed modelling of such watercourses will be needed as part of a detailed FRA to support any planning application for such sites.

4.2 Sites Taken Forward to a Level 2 Assessment

In this SFRA, 33 proposed development sites were provided by Oadby & Wigston Borough Council for screening. Of the 33 sites provided, 10 sites were within the boundaries of larger sites. Table 4-1 list all sites assessed and identifies sites that lie within larger boundaries.

A Red-Amber-Green system was applied to the sites on the basis that:

- **Green**- sites that are at low risk of flooding from all sources. A Flood Risk Assessment will still be required for these sites if they are greater than 1 ha, in line with the National Planning Policy Framework.
- **Amber**- Sites that are generally at low risk of flooding but have specific considerations that will need to be addressed through a site-specific Flood-Risk

Assessment at the planning application stage e.g. flood risk to access/egress routes. These specific considerations are noted in the site-specific summary tables.

- **Red**- Sites with significant flood risk issues that need to be addressed if the site is to be developed**. Red sites will require the Exception Test to be passed**.
  A red rating does not mean that a site should not be developed, rather it is a sign that careful consideration should be given to the present issues to ensure users of the site will be safe throughout its lifetime and that there will be no increase to risk off site. It should be noted that in many cases, it is likely that development of these sites will present the opportunity to address existing issues and help reduce risk off-site. These opportunities are highlighted in the site-specific summary tables (Appendix A).

Table 4-1 details the sites taken forward to Level 2, and full details of the screening process are contained in Appendix B.

Following the first screening undertaken at the start of Level 2 SFRA, an additional 9 sites were provided for screening, alongside a small update to the boundary of WIG_008. Outcomes of this screening are also included in Table 4-1, and full details of the screening are in Appendix B.

Table 4-1 Sites screened as part of the Level 2 SFRA

Site Code	Area (ha)	Comments	RAG
O&W_002 (inc.O&W_001/ OAD_008/ WIG_005)	66.5	Ordinary watercourse runs through site	A
O&W_001	45.3	-	N/A
OAD_008	12.7	-	N/A
WIG_005	21.1	-	N/A
OAD_001	3.6	Site partly within Flood Zone 2 & 3	A
OAD_003	6.1	Significant surface water risk to the site, associated with ordinary watercourse	**R**
OAD_004	0.6	No significant risks to site identified	G
OAD_005	3.1	Significant surface water risk to the site, associated with ordinary watercourse	**R**
OAD_006	22.9	Significant surface water risk to the site, associated with ordinary watercourses feeding Wash Brook	**R**
OAD_007	9	Ordinary watercourse runs adjacent to the site, surface water flow path shown through the site.	A
OAD_011 (inc.OAD_009/ 010/002)	33.7	Significant surface water flow paths through the site, associated with ordinary watercourses.	A

Site Code	Area (ha)	Comments	RAG
OAD_002	22.8	-	N/A
OAD_009	33.7	-	N/A
OAD_010	33.7	-	N/A
WIG_001	3.3	No significant risks to site identified	G
WIG_002	26.0*	Significant surface water risk to the site.	A
WIG_008 (updated boundary, inc. WIG_003/ 004 /006/007)	71.1	Ordinary watercourse runs through the site, significant surface water risk associated.	A
WIG_003	3.3	-	N/A
WIG_004	40.6	-	N/A
WIG_006	8.3	-	N/A
WIG_007	29.0	-	N/A
WIG_009	3.6*	Significant surface water risk to the site.	**R**
WIG_010	12.8	Within 50m of an ordinary watercourse, flood extents unlikely to encroach on site.	G
WIG_011	7.87	Some surface water risk	A
Additional Sites			
Baxters Place	1.1	No significant risks to site identified	G
Brooksby Square Development	1.3	No significant risks to site identified	G
Burgess Junction Development	1.2	Significant surface water risk to the site in the 0.1% AEP event- this should be considered as part of a site-specific FRA, low risk from other sources.	A
Chapel Mill Development	0.97	No significant risks to site identified	G
Long Lanes Development	0.90	No significant risks to site identified	G
OAD_014	2.7	Partly within Flood Zones 2 and 3, significant surface water risk to site although majority of site is low risk.	**R**
OAD_015	64.3	Partly within Flood Zones 2 and 3, significant surface water risk to site although majority of site is low risk.	**R**
SWIG_001	0.58	No significant risks to site identified	G
WIG_015	37.03	Partly within Flood Zones 2 and 3, significant areas of surface water risk on site.	**R**

4.2.1 Cross Boundary site with Harborough District

OAD_15 is a large (377ha) site which straddles the border between Oadby and Wigston and its neighbour to the west, Harborough District is proposed on land between Oadby and Stretton Road. This site is referred to as OAD015 in the Borough of Oadby and Wigston's emerging Plan, and SHELAA Ref ID: 24/8631 by Harborough District Council in their emerging Plan documents. The site lies on the banks of the River Sence, and is at risk from other sources of flooding, therefore would need to be considered as part of a Level 2 SFRA prior to allocation.

To avoid delays to finalising the Oadby and Wigston Level 2 SFRA and to ensure that the site is developed with a consistent vision across both parts of the site, OWBC and HDC have agreed to commission a single Level 2 Site Assessment that covers the entire site. This assessment forms part of both the Oadby and Wigston Level 2 SFRA, and the future Harborough Level 2 SFRA. Whilst the site is included in both SFRAs, the assessment of risk and advice given is consistent between them.

Recommendations made in the assessment apply to the entire site, and any future work (e.g. Flood Risk Assessments, Drainage Strategies, Site Master-Planning) should consider the site as a single entity, regardless of the Local Authority boundaries.

For details of risk to the site, including requirements for the Exception Test and guidance for developing the site safely, please refer to the site assessment (OWB-JBAU-XX-XX-RP-HM-0035-S3-P02-OAD015_Site_Summary_Table) and associated mapping (OWB-JBAU-XX-XX-MP-HM-0002-Site_Summary_GeoPDF_OAD015).

4.3 Site Summary Tables

As part of the Level 2 SFRA, 12 detailed site summary tables have been produced for the following sites (those identified as Red or Amber through the screening, except Burgess Junction):

- O&W_002 (including O&W_001/ OAD_008/ WIG_005)
- OAD_001
- OAD_003
- OAD_005
- OAD_006
- OAD_011 (including OAD_009/ 010/002)
- OAD_014
- OAD_015 (cross-boundary site with Harborough District)
- WIG_002
- WIG_009
- WIG_008 (inc. WIG_003/ 004 /006/007)
- WIG_015

The following sites will require the Exception Test to be passed:

- OAD_003
- OAD_005
- OAD_006
- OAD_014
- OAD_015
- WIG_009
- WIG_015

For WIG_009 results from the existing Environment Agency hydraulic model for the River Sence was used in the assessment to provide depth, velocity, and hazard information. For more information, please refer to sections 3.6 and 3.12 of this report.

The Environment Agency's Risk of Flooding from Surface Water (RoFSW)mapping has also had Central and Upper End climate change uplifts applied to it in order to indicate the future risk of surface water flooding during the 3.3% and 1% AEP events.

Using the model information combined with the Flood Zones, climate change, RoFSW extents and reservoir mapping, detailed site summary tables have been produced for the site options (Appendix A). Each table sets out the following information:

- Basic site information
- Location of site in the catchment
- Area, site type, current land use (greenfield/brownfield), proposed site use
- Sources of flood risk
- Existing drainage features

- Fluvial flooding - proportion of site at risk including descriptions of FMfP mapping and modelling (extent, depth, velocity, and hazard rating).
- Reservoir mapping
- Historic flooding
- Flood risk management infrastructure
- Description of residual risk including breach of defences if applicable
- Emergency planning for access and egress, Flood Warning Areas, and Flood Alert Areas.
- Climate change
- Summary of climate change allowances and increase of flood extent compared to Flood Zones, fluvial modelling and surface water modelling.
- Requirements for drainage control and impact mitigation
- Broadscale assessment of possible SuDS to provide indicative surface water drainage advice for each site assessed accounting for the presence of Groundwater Source Protection Zones and Historic Landfill Sites.
- NPPF Planning implications - Exception Test requirements.
- Requirements and guidance for site specific FRA (including consideration of opportunities for strategic flood risk solutions to reduce the flood risk)
- Key messages summaries the considerations for the site
- The mapping information and description of the data sources for the following mapped outputs:
    - Flood Zones
    - Climate change
    - Fluvial depth, velocity, and hazard mapping
    - Surface water
    - Surface water depth, velocity, and hazard mapping.

5 Flood Risk Management Requirement for Developers

5.1 Introduction

The report provides a strategic assessment of flood risk in the Borough of Oadby and Wigston. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk and any defences at a site are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the Exception Test can be satisfied.

5.2 Principles for new Developments

Apply the Sequential and Exception Tests

Developers should refer to the Level 1 SFRA for more information on how to consider the Sequential and Exception Tests. For allocated sites, Oadby and Wigston Borough Council will need to carry out the Sequential and Exception Tests. For windfall sites, a developer must undertake the Sequential Test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the Sequential Test should the Exception Test then be applied if required. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not be seen as an alternative to proving these tests have been met.

Developers should also apply the sequential approach to locating development within the site. The following questions should be considered:

- Can risk be avoided through substituting less vulnerable uses or by amending the site layout?
- Can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
- Can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?

Consult with the statutory consultees at an early stage to understand their requirements.

Developers should consult with the Environment Agency, Leicestershire County Council as LLFA and Severn Trent Water as the water and sewerage company, at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design.

Consider the risk from all sources of flooding and that they are using the most up to date flood risk data and guidance.

The SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific Flood Risk Assessment. At a site level, Developers will need to check before commencing on a more detailed Flood Risk Assessment that they are using the latest available datasets. Developers should apply the latest Environment Agency climate change guidance (2022 at time of writing) and ensure the development has accounted for climate change adaptation measures.

Ensure that development does not increase flood risk elsewhere and in line with the NPPF, seeks to reduce the causes and impacts of flooding.

Section 9 of the Level 1 SFRA report sets out the requirements for taking a sustainable approach to surface water management, particularly regarding the NPPF. As part of these requirements developers should ensure mitigation measures do not increase flood risk elsewhere and that floodplain compensation is provided where necessary.

Ensure the development is safe for future users.

Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered. Developers should consider both the **actual and residual risk of flooding to** the site.

Further flood mitigation measures may be needed for any developments in an area protected by flood defences, where the condition of those defences is 'fair' or 'poor', and where the standard of protection is not of the required standard.

Enhance the natural river corridor and floodplain environment through new development.

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted. Where possible, developers should identify and work with partners to explore all avenues for improving the wider river corridor environment. Developers should open existing culverts and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings.

Consider and contribute to wider flood mitigation strategy and measures in the Borough of Oadby and Wigston and apply the relevant local planning policy.

Wherever possible, developments should seek to help reduce flood risk in the wider area e.g., by contributing to a wider community scheme or strategy for strategic measures, such as defences or natural flood management or by contributing in-kind by mitigating wider flood risk on a development site. Developers must demonstrate in an FRA how this has been considered at a site level.

5.3 Requirements for Site Specific Flood Risk Assessments

5.3.1 When is an SFRA Required

Site-specific FRAs are required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1.
- Proposals for new development (including minor development such as non-residential extensions, alterations which do not increase the size of the building or householder developments and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency).
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

An FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is in Flood Zone 1); the Environment Agency should be contacted to agree the breach assessment approach.
- Where evidence of historical or recent flood events have been passed to the LPA.
- In an area where surface water flood risk is a material consideration.
- If a basement property falls within a Critical Drainage Area, an FRA is required for surface water and sewer flooding.
- Land identified in an SFRA as being at increased risk in the future.

5.3.2 Objectives of Site Specific FRAs

Site-specific FRAs should be proportionate to the degree of flood risk, as well as appropriate to the scale, nature, and location of the development. Site-specific FRAs should establish:

- whether a proposed development will be at risk of flooding, from all sources, both now and in the future, accounting for climate change
- whether a proposed development will increase flood risk elsewhere
- whether the measures proposed to deal with the effects and risks are appropriate
- the evidence, if necessary, for the local planning authority to apply the Sequential Test; and
- whether, if applicable, the development will be safe and pass the Exception Test.

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the Environment Agency and Oadby and Wigston Borough Council. Further advice can be found in Section 2 of the Level 1 SFRA report. Guidance and advice for developers on the preparation of site-specific FRAs include:

- Standing Advice on Flood Risk (Environment Agency);
- Flood Risk Assessment for Planning Applications (Environment Agency);

- Site-specific Flood Risk Assessment: CHECKLIST (NPPF PPG, Defra).
- Surface Water Drainage for Developments (Leicestershire County Council)

Guidance for local planning authorities for reviewing Flood Risk Assessments submitted as part of planning applications has been published by Defra in 2015 – Flood Risk Assessment: Local Planning Authorities.

5.4 Local Requirements for Site Specific Flood Risk Assessments

The Level 1 SFRA provides details on the following mitigation measures in Section 8.3 and should be referred to alongside this report:

- Site layout and design (8.3.1)
- Modification of ground levels (8.3.2)
- Raised floor levels (8.3.3)
- Safe access and egress (8.3.1)
- Development and raised defences (8.3.4)
- Developer contributions (8.3.5)
- Buffer strips (8.3.6)
- Making space for water (8.3.7)

5.5 Flood Warning and Emergency Planning

Section 8.6 of the Level 1 SFRA discusses NPPF requirements and what a Flood Response Plan (also known as an Emergency Plan) will need to consider and other relevant information on emergency planning. Further information is provided by the Leicestershire Local Resilience Forum in reducing flood risk from other sources.

Section 6 of the Level 1 SFRA discusses how to reduce flood risk from other sources, such as groundwater, surface water and sewer flooding.

5.6 Reservoirs

The risk of reservoir flooding is extremely low to all sites in the Borough of Oadby and Wigston as there are no reservoirs which could pose a risk within or outside the Borough in the event of a breach or uncontrolled release. Should reservoirs be constructed in future which could pose a risk within the Borough, care should be taken when allocating development downstream of a reservoir so that the implications with respect to risk designation and any necessary investment to improve the safety of the asset are appropriately addressed. In addition, developers should consider the following during the planning stage:

- Developers should contact the reservoir owner for information on:
  - the Reservoir Risk Designation
  - reservoir characteristics: type, dam height at outlet, area/volume, overflow location
  - operation: discharge rates/maximum discharge

- discharge during emergency drawdown; and
- inspection/maintenance regime.

- The EA and Natural Resources Wales online Reservoir Flood Maps contain information on the extents, depths and velocities following a reservoir breach (note: only for those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975). Consideration should be given to the extent, depths and velocities shown in these online maps.
- The GOV.UK website on Reservoirs: owner and operator requirements provides information on how to register reservoirs, appoint a panel engineer, produce a flood plan and report an incident.

Developers should use the above information to:

- Apply the sequential approach to locating development within the site.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond, and whether in fact it is appropriate to place development immediately on the downstream side of a reservoir.
- Assess the potential hydraulic forces imposed by a sudden reservoir failure event and check that the proposed infrastructure fabric could withstand the structural loads.
- Develop site-specific Emergency Plans and/ or Off-site Plans if necessary and ensure that future users of the development are aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand.

5.7 Duration and Onset of Flooding

The duration and onset of flooding affecting a site depends on a number of factors:

- The position of the site within a river catchment, with those at the top of a catchment likely to flood sooner than those lower down. The duration of flooding tends to be longer for areas in lower catchments.
- Upstream reservoirs in these catchments will provide some online flood storage that reduce the flood risk downstream and delays the onset of flooding. At the confluence of the larger watercourses and smaller tributaries, there may be different timings of peak flows, for example smaller tributaries would peak much earlier than the larger catchments.
- The principal source of flooding: where this is surface water, depending on the intensity and location of the rainfall, flooding could be experienced within 30 minutes of the heavy rainfall event e.g., a thunderstorm. Typically, the duration of flooding for areas at risk of surface water flooding or from flash flooding from small watercourses is short (hours rather than days).
- The preceding weather conditions prior to the flooding: wet weather lasting several weeks will lead to saturated ground. Rivers respond much quicker to rainfall in these conditions.

- Whether a site is defended, noting that if the defences were to fail, a site could be affected by very fast flowing and hazardous water within 15 minutes of a breach developing (depending on the size of the breach and the location of the site in relation to the breach), causing danger to life.
- Catchment geology, for example chalk catchments take longer to respond than typical clay catchments.

It is recommended that a site-specific Flood Risk Assessment refines this information, based on more detailed modelling work where necessary.

6 Surface Water Management and SuDS

The Level 1 SFRA summarises guidance and advice on managing surface water runoff and flooding in Section 9. Below is a guide to what is included in sections not expanded on here, for reference alongside this Level 2 SFRA:

- Section 9.1 – Role of the LLFA and LPA in surface water management
- Section 9.2 – Sustainable Drainage Systems (SuDS)

6.1 Sources of SuDS Guidance

6.1.1 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) provides guidance on planning, design, construction and maintenance of SuDS. The manual is divided into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document.

6.1.2 Non-statutory Technical Guidance, Defra (March 2015)

Non-Statutory Technical guidance provides non-statutory standards on the design and performance of SuDS. It outlines peak flow control, volume control, structural integrity, flood risk management and maintenance and construction considerations.

6.1.3 Non-statutory Technical Guidance for Sustainable Drainage Practice Guidance, LASOO (2016)

The Local Authority SuDS Officer Organisation (LASOO) produced their Practice guidance in 2016 to give further detail to the Non-statutory technical guidance.

6.2 Groundwater Vulnerability Zones

The Environment Agency have published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise of the underlying bedrock. The map shows the vulnerability of groundwater at a location based on the hydrological, hydro-ecological and soil propertied within a one-kilometre grid square.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas. Groundwater vulnerability maps can be found on Defra's Interactive MagicMap website.

6.3 Groundwater Source Protection Zones (GSPZ)

The Environment Agency also defines Groundwater Source Protection Zones (SPZs) near groundwater abstraction points. These protect areas of groundwater used for drinking water. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. Groundwater Source Protection Zones can be viewed on the Defra Interactive MagicMap website. The Borough of Oadby and Wigston is not located within any GSPZs.

6.4 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process. The NVZ coverage can be viewed on Defra's Interactive MagicMap website. The Borough of Oadby and Wigston falls under the Soar NVZ for surface water (ID S309).

6.5 SuDS Suitability Across the Area

The suitability of SuDS techniques is dependent upon many variables, including the hydraulic and geological characteristics of the catchment.

The permeability of the underlying soils can determine the infiltration capacity and percolation capacities. As such, a high-level review of the soil characteristics has been undertaken using British Geological Survey (BGS) soil maps of England and Wales which allow for a basic assessment of the soil characteristics and infiltration capacity. A high-level assessment of the suitability of SuDS is included in the site tables in Appendix A. This is based on national datasets, and it should be assessed in more detail when designing SuDS.

This strategic assessment should not be used as a definitive site guide as to which SuDS would be suitable but rather as an indicative guide of general suitability based solely on soil type. Several other factors can determine the suitability of SuDS techniques including land contamination, the depth and fluctuation of the water table, the gradient of local topography and primary source of runoff etc. When considering NVZs and if areas have pollutants, infiltration may only be suitable where treatment measures are provided, prior to any discharge to surface or groundwaters.

Further site-specific investigation should be conducted to determine what SuDS techniques could be utilised at a particular development. The result of this assessment does not remove the requirements for geotechnical investigation or detailed infiltration testing and does not substitute the results of site-specific assessments and investigations. The LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

7 Summary of Level 2 Assessment and Recommendations

7.1 Assessment Methods

As part of the Level 2 SFRA,14 detailed site summary tables have been produced for the 33 Level 2 sites assessed.

The summary tables set out the flood risk to each site, including Flood Zone coverage, maps of extent, depth, and velocity of flooding as well as hazard mapping for the 1% AEP plus an allowance for climate change. Climate change mapping has also been produced to indicate the impact which different climate change allowances may have on the sites (where models are available), the 1% plus 40% climate change surface water events. Each table also sets out the NPPF requirements for the site as well as guidance for site-specific FRAs.

A broadscale assessment of suitable SuDS options has been provided giving an indication where there may be constraints to certain sets of SuDS techniques. This assessment is indicative and more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. It may be possible that those SuDS techniques highlighted as possibly not being suitable can be designed to overcome identified constraints.

Consideration has also been given to the safety implications for development with respect to surface water flood risk. This reflects the requirement to consider the application of the Exception Test in circumstances where flood risk cannot be avoided.

7.2 Summary of Key Site Issues

Oadby and Wigston Borough Council Provided 33 sites for assessment, 10 of which were entirely within larger sites- where this was the case, sites were considered as part of the larger site rather than individually. As part of the Level 2 SFRA, 12 detailed site summary tables have been produced for the following sites (those identified as Red or Amber through the screening, except Burgess Junction):

- O&W_002 (including O&W_001/ OAD_008/ WIG_005)
- OAD_001
- OAD_003
- OAD_005
- OAD_006
- OAD_011 (including OAD_009/ 010/002)
- OAD_014
- OAD_015 (cross-boundary site with Harborough District)
- WIG_002
- WIG_009
- WIG_008 (inc. WIG_003/ 004 /006/007)

- WIG_015

The following sites will require the Exception Test to be passed:

- OAD_003
- OAD_005
- OAD_006
- OAD_014
- OAD_015
- WIG_009
- WIG_015

For these sites, detailed summary tables have been produced that set out the flood risk to each site, NPPF requirements for the site, and guidance for site specific FRAS have been produced. A broadscale assessment of suitable SuDS options has been provided, giving an indication where there may be constraints to certain types of SuDS techniques.

The following points summarise the Level 2 Assessment:

- The majority of sites are shown to be at some risk of surface water flooding where access and egress are affected in some way. The following sites are affected by watercourses and flow paths which affect access to parts of the site: WIG_008, WIG_009, OAD_005, OAD_006, and OAD_09/10/11. The following sites have limited access through roads affected by significant flow paths: WIG_002, WIG_009, OAD_003, OAD_005, OAD_006, OAD_007, and OAD_09/10/11.
- For WIG_008, WIG_009, and WIG_011 the presence of groundwater close to the surface is noted.

- **Fluvial Flooding**
  - No site is at risk from fluvial flooding from the Upper Sence model, including defended and undefended scenarios including climate change allowances.
  - Ordinary watercourses - there are several small ordinary watercourses within the Borough are not currently modelled but have the potential to cause fluvial flood risk. For this assessment, the surface water mapping has been used to provide an indication of risk at a strategic level; however, modelling of these watercourses will be essential in a Flood Risk Assessment to inform the risk to any development proposals within the vicinity of unmodelled watercourses.
- **Surface Water**
  - Surface water risk is widespread across the Borough of Oadby and Wigston, with most sites at risk to some extent. Surface water flows are generally shown to follow the paths of ordinary watercourses in rural areas and is more widespread in the urban areas. Most sites are at some degree of risk from surface water, ranging from marginally affected to significantly affected. The sites at most significant risk are: WIG_008, WIG_009, OAD_005, and OAD_006.
- **Access and egress**
  - The vast majority of sites have potential issues with access and egress in some form, either from surface water flow paths and watercourses isolating parts of the site, or surface water significantly impacting access roads serving the site. The following sites have areas isolated by watercourses and flow paths: WIG_008, WIG_009, OAD_005, OAD_006, and OAD_09/10/11. The following sites have limited access through roads affected by surface water flooding: WIG_002, WIG_009, OAD_003, OAD_005, OAD_006, OAD_007, and OAD_09/10/11.
  - Consideration should be made to these sites as to how safe access and egress can be provided during flood events, both to people and emergency vehicles. Also, consideration should be given to the nature of the risk, for example whether the flooding forms a flow path or bisects the site where access from one side to another may be compromised. This assessment is based on current access arrangements to the site and in many cases, it is likely that improvements can be delivered as part of development.
- **Effects of climate change**
  - Fluvial and surface water climate change mapping indicates that flood extents are predicted to increase. As a result, the depths, velocities, and hazard of flooding may also increase. The significance of the increase tends to depend on the topography of the site and the climate change percentage allowance used.
  - For surface water, the 3.3% AEP +25% and +35% and the 1% AEP +25% and +40% climate change surface water events have been used. The

RoFfSW modelled 1% AEP plus 40% climate change surface water event is similar to the 0.1% AEP event,

- For fluvial flooding, the undefended and defended extents of the River Sence did not reach any site. When the Central, Higher Central and Upper End climate change allowances have been applied, extents still do no reach any site.
- Site-specific FRAs should confirm the impact of climate change using latest guidance. It is recommended that Oadby and Wigston Borough Council work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the Borough.

- **Historic Flooding**
  - Leicestershire County Council (LLFA) hold a register of recorded flood incidences which document's locations where flooding has been reported. 4 sites (WIG-011, OAD_003, OAD_006, and OAD_09/10/11) are identified as having experienced flooding in the past (recognising that not all flood events are reported to the LLFA, particularly flooding on undeveloped sites where no properties would have been affected in prior events).
- **Groundwater**
  - Groundwater emergence mapping indicates that the majority of the Borough is at negligible risk from groundwater emergence due to the nature of the local geological deposits. Parts of site WIG_008 and WIG_011 are identified as being at higher risk from groundwater emergence, though risk across the majority of the site remains negligible.
- **Canals**
  - The Grand Union Canal runs through the south of the Borough of Oadby and Wigston Borough boundary and is managed by the Canal and River Trust. The watercourse is controlled by a series of locks. WIG_009 borders the canal and there is the potential for the site to be at risk during a breach or overtopping event.
- **Reservoirs**
  - The entirety of the Borough of Oadby and Wigston is outside the 'dry' and 'wet' day flooding from reservoirs extent extents.
- **Requirements for the Local Authority**
  - For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test. At planning application stage, the developer must adopt the sequential approach when assessing the feasibility of site allocations. This will ensure that appropriate flood resistance and resilience measures are put in place, which align with the recommendations in National and Local Planning Policy and supporting guidance as well as those set out in this SFRA**.**

- **Requirements for Developers**
  - It is recommended that as part of the early discussions relating to development proposals, developers discuss requirements relating to site-specific FRA and drainage strategies with both the Local Planning Authority and the Lead Local Flood Authority (LLFA), to identify any potential issues that may arise from the development proposals'
  - Any sites located where there is Main River (including culverted reaches of Main River) will require an easement of 8m either side of the watercourse from the top of the bank. This may introduce constraints regarding what development will be possible and consideration will also need to be given for access and maintenance at locations where there are culverts. Developers will be required to apply for appropriate permits so the activity being carried out over easements does not increase flood risk. For ordinary watercourses, if development is proposed within 8m of a watercourse, consultation will need to be undertaken with OWBC and Leicestershire County council as LLFA to ensure that the development is not at risk of flooding, does not increase the risk of flooding elsewhere and does not impede the ability of the LLFA to undertake any management/maintenance activities as may be necessary
  - A strategic assessment of SuDS options has been undertaken using regional datasets. A detailed site-specific assessment of suitable SuDS techniques should be undertaken at site-specific level to understand which SuDS options are most appropriate.
  - At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of unmodelled watercourses so that the potential effects of proposals can be evaluated at site level and ensure there is no increase in risk off-site as result of development. The modelling should evidence flood extents, depths, velocities, and hazard (including latest climate change allowances), inform development zoning within the site and prove, if required, whether the Exception Test can be passed.
  - For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test. At planning application stage, the developer must adopt the sequential approach when assessing the feasibility of site allocations. This will ensure that appropriate flood resistance and resilience measures are put in place, which align with the recommendations in National and Local Planning Policy and supporting guidance as well as those set out in this SFRA.
  - For developments that have not been allocated in the Local Plan, developers must undertake the Sequential Test followed by the Exception Test (if required) and present this information to the Local Planning Authority for approval. Developers will need to apply the Exception Test and use information in a site-specific Flood Risk Assessment to inform this test at

planning application stage. The Exception Test should be applied where there is development which is classed as;

- More vulnerable in Flood Zone 3a
- Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b)
- Essential infrastructure in Flood Zone 3a or 3b

- Whilst the Exception Test is not explicitly required by the NPPF/PPG where a site is at significant risk from other sources of flooding, or where flooding impedes access/egress regardless of whether the site itself is at risk, the NPPF/PPG do require that all sources of flooding are considered both now and into the future. In these circumstances, the Council should carefully weigh up the benefits of developing such sites against the risk, and developers should demonstrate to the Council's satisfaction that the site can be developed in a way that ensures users of the site are safe in the event of a flood from any source, both now and throughout the lifetime of the development. The Level 1 SFRA and mapping can be used to scope the flooding issues that a site-specific FRA should investigate in more detail to inform the Sequential and Exception Tests for windfall sites.
  It is recommended that as part of the early discussions relating to development proposals, developers discuss requirements relating to site-specific FRA and drainage strategies with both the Local Planning Authority and the Lead Local Flood Authority (LLFA), to identify any potential issues that may arise from the development proposals

7.2.1 Considering the Exception Test for the proposed sites in the Borough of Oadby and Wigston

In principle, it is possible for the majority of sites assessed in the Level 2 SFRA to satisfy the flood risk element of the Exception Test, for example by:

- siting development away from the highest areas of risk
- considering safe access/ egress in the event of a flood (from all parts of the site, if say the site is severed by a flood flow path)
- using areas in Flood Zone 2 for the least vulnerable parts of the development in accordance with Table 2 in the NPPF. Residential development should not be permitted in Flood Zone 3 and no development at all should be permitted in Flood Zone 3b (aside from essential infrastructure, such as a bridge crossing the lowest points of a site)
- testing flood mitigation measures if these are to be implemented, to ensure 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)
- considering space for green infrastructure in the areas of highest flood risk where this is appropriate.

Within the Borough of Oadby and Wigston the following sites would be subject to the Exception Test: OAD_005, OAD_006, OAD_09/10/11, OAD_15, WIG_008 and WIG_009.

If these sites are taken forwards, OWBC should satisfy themselves that any proposals safely address the risks to the site, in line with the strategies recommended above.

7.3 Planning Policy Recommendations

The planning policy recommendations in Section 8 of the Level 1 SFRA still stands for the site allocations and any windfall development that comes forward. Recommendation in the L2 SFRA are as follows:

- Developers should consider flood resilience measures for new developments.
- Finished floor levels should be above the 1% AEP plus climate change peak flood level.
- Combine infiltration (e.g. permeable surfaces) and attenuation (e.g. balancing ponds and flood storage reservoirs) SuDS techniques to overcome constraints to the area of a site set aside for infiltration systems caused by development pressures.
- Where appropriate, opportunities for betterment should be sought where surface water flooding issues are present, which could be implemented through Supplementary Planning documents for individual settlements.
- Encourage the use of permeable surfacing in gardens and use measures to optimise drainage and reduce runoff.
- Consider opportunities for water conservation through rainwater harvesting and water butts where appropriate for new and existing development.
- Promote land management practices where appropriate to attenuate runoff and alleviate potential issues downstream.

Further site-specific recommendations have been made in the Level 1 report Appenddix F regarding Cumulative Impact Assessment.

7.4 Guidance for Windfall Sites and Sites Not Assessed in the Level 2 SFRA

- For sites not covered by the Environment Agency's Flood Zones, or where Flood Zones do exist, but no detailed hydraulic modelling is present, it is recommended that developers construct detailed hydraulic models at these sites as part of a site-specific FRA using channel, structure, and topographic survey, to confirm flood risk. Site-specific flood modelling will probably need to be developed in locations where it is necessary to understand the effects of proposed development schemes on the existing flood flow paths and flood volume storage.
- If a site's extents either include or borders with a Main River (including a culverted reach of Main River), an easement of 8m is required from either bank for access and maintenance. Any future development will require a flood risk permit from any activity within 8m of a Main River.
- If an ordinary watercourse is within or immediately adjacent to the site area, consultation with the Lead Local Flood Authority should be undertaken. If alterations or discharges are proposed to the watercourse, a land drainage consent will be required.

- Where necessary, blockages of nearby culverts may need to be simulated in a hydraulic model to confirm residual risk to the site.
- Surface water risk should be considered in terms of the proportion of the site at risk in the 3.3% AEP (30-year), 1% AEP (100-year) or 0.1% AEP (1,000-year) events, whether the risk is due to isolated minor ponding or deeper pooling of water, or whether the risk is due to a wider overland flow route.
- Surface water risk and mitigation should be considered as part of a detailed site-specific Flood Risk Assessment and Surface Water Drainage Strategy.
- Access and egress should be considered at the site, but also in the vicinity of the site, for example, a site may have low surface water risk, but in the immediate locality, access/ egress to and from the site could be restricted for vehicles and/ or people.
- Sites where there is a canal within or immediately adjacent to the site area, developers should consult the Canals and Rivers Trust. Any proposed alterations to the canal or discharges must be agreed with the Canals and Rivers Trust.
- If a site is located within 250m of a landfill site, there could be amenity, dirt, and contamination issues. Sites could be sensitive from the perspective of controlled waters and therefore any redevelopment must ensure there is no pollution risk to the water environment.

7.5 Use of SFRA Data and Future Updates

It is important to recognise that the SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

The SFRA should be a 'living document', and as a result should be updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by Oadby and Wigston Borough Council, Leicestershire County Council, the Highways Authority, Severn Trent Water, and the Environment Agency. Such information may be in the form of:

- New hydraulic modelling results
- Flood event information following a future flood event
- Policy/legislation updates
- Environment Agency flood map updates
- New flood defence or alleviation schemes.

The Environment Agency regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed Flood Risk Assessment. It is recommended that the SFRA is reviewed when there are significant updates to the Environment Agency's Flood Zone mapping. This will ensure the latest data is still represented in the SFRA, allowing a cycle of review and a review of any updated data by checking with the above bodies for any new information.

7.5.1 Neighbourhood Plans

Flood risk should be fully addressed in the plan preparations and in bring forward policies for the allocation of land and therefore the SFRA findings should be used in production of Neighbourhood Plans.

Neighbourhood planners can use the information in the Level 1 and Level 2 SFRAs on the sources of flood risk across the Borough of Oadby and Wigston and the flood risk mapping, to assess the risk of flooding to sites within their community. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas.

The Level 1 Oadby and Wigston SFRA highlights on a broad scale where flood risk from fluvial, surface water, groundwater, and the effects of climate change are most likely. The maps are useful to provide a community level view of flood risk but may not identify if an individual property is at risk of flooding or model small scale changes in flood risk. Local knowledge of flood mechanisms will need to be included to complement the broadscale mapping.

A GEOPDFs and Site Summary Tables

B Level 2 SFRA Scoping study

B.1 Scoping Study Report

B.2 Screening Outputs

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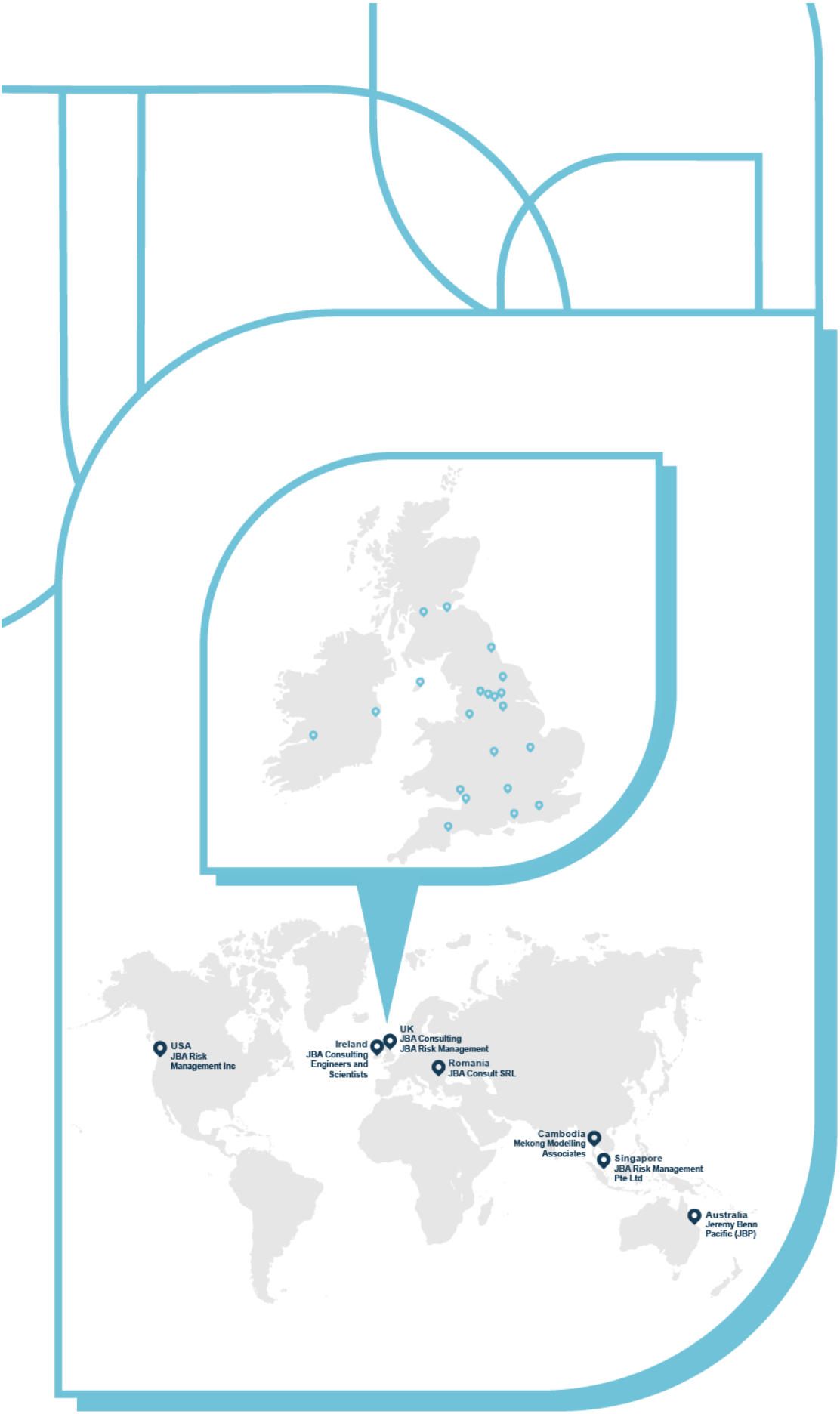

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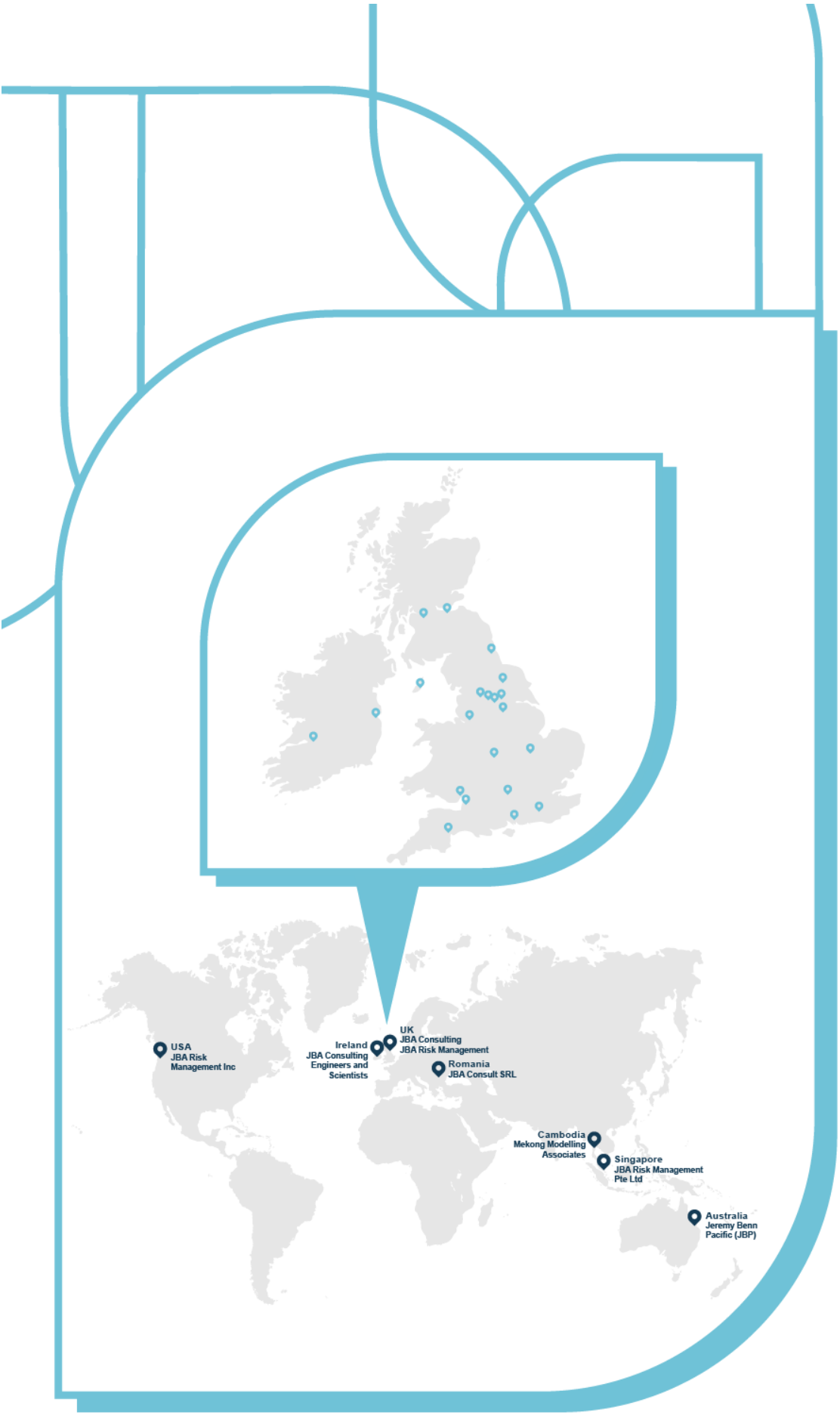

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