Appendix K - Data sources used in the SFRA

1 Historical Flooding

Section 4.1 of the Main Report documents historic flooding records obtained. A GIS layer of records was not available. The Environment Agency's Historic Flood Map is also presented in Appendix A: Mapping.

2 Fluvial flooding

2.1 Flood Zones 2 and 3a

The Environment Agency's Flood Map for Planning Flood Zones 2 and 3a shown in the Appendix A mapping.

Flood Zone 1: Comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1% AEP).

Flood Zone 2: This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (0.1% - 1% AEP) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.1% – 0.5% AEP) in any year.

Flood Zone 3a: This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding (>1.0% AEP) or a greater than 1 in 200 annual probability of flooding from the sea (>0.5% AEP) in any year.

Over time, the online mapping is likely to be updated more often than the SFRA, so SFRA users should check there are no major changes in their area.

The Environment Agency regularly reviews its hydrology, hydraulic modelling and flood risk mapping , and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA.

2.2 Flood Zone 3b (the Functional Floodplain)

Flood Zone 3b: This zone comprises land where water has to flow or be stored in times of flood (the functional flood plain). The SFRA identified this Flood Zone as land which would flood with an annual probability of 1 in 30 years, where detailed modelling exists.

The Environment Agency provided the Upper Ouse and Mid Ouse models (2011) for use in the SFRA and these have been used to identify Flood Zone 3b.

As the 1 in 30-year outputs are not available for these existing models, a precautionary approach has been taken, and surrogate return periods have been used. Where detailed modelling is available, the 1 in 50-year (2% AEP) defended extents have been used to define Flood Zone 3b, using the flood extents provided by the Environment Agency. The 1 in 50-year (2% AEP) and 1 in 25-year (4% AEP) extents were compared, and as there were not significant differences in the flood extents, the 2% AEP was used to define Flood Zone 3b as this adopts a conservative approach.

Please note the Environment Agency are currently updating the modelling of the River Great Ouse but this data was not available for use in the SFRA.

The following layers from provided model outputs were used to define Flood Zone 3b:

- MFO_EA052335_0050_WD
- MFO_EA052340_50yr_region

The 2 layers were merged together and dry islands <250m removed.

Where detailed modelling was not available, then Flood Zone 3a has been used to define Flood Zone 3b. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b.

Flood Zone 3b is the defended scenario, whereas Flood Zone 3a and 2 are undefended. Please note, in some areas, there are some areas where the 2% AEP detailed modelling flood extent is larger than Flood Zone 3. This is because the undefended scenario in the hydraulic model makes some significant changes to the embankments and the crest for Caldecott lake. The undefended is then storing less water in the lake and passing it downstream, producing a smaller outline around the lake and upstream area. If a proposed development is shown to be in Flood Zone 3, further investigation should be undertaken as part of a detailed site-specific FRA to define and confirm the extent of Flood Zone 3b.

The Environment Agency regularly reviews its hydrology, hydraulic modelling and flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA.

3 Surface water flooding

Mapping of surface water flood risk in the study area has been taken primarily from the Risk of Flooding from Surface Water (RoFfSW) maps published online by the Environment Agency. These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the Environment Agency and any potential developers to focus their management of surface water flood risk.

The RoFfSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water (Table K-1).

Table K-1: RoFfSW risk categories

Category	Definition
High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%).
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year.
Low	Flooding occurring as a result of rainfall of between 1 in 1,000 (0.1%) and 1 in 100 (1%) chance in any given year.

Although the RoFfSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to illustrate the flood risk more accurately at a site-specific scale.

4 Climate change

4.1 Fluvial models

The existing models of the Upper Ouse and Mid Ouse were re-run using the latest climate change allowances, for the 2% AEP defended and 1% AEP and 0.1% AEP undefended extents. The models were run for the 19% and 30% climate change allowances for the three AEP events. Where the 20% climate change allowance flood extent already existed, then the model runs have not been re-run, in agreement with the Environment Agency. In some locations there are some small differences in how the existing outlines have been processed.

The Environment Agency regularly reviews its hydrology, hydraulic modelling and flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA.

4.2 Surface water

The RoFSW dataset was run with the latest climate change allowances to understand the effect of climate change on surface water flooding, and risk to smaller watercourses, which are too small to be covered by the EA's Flood Zones. This was run for the 35% allowance for the 3.3% AEP event, and the 40% allowance for the 1% AEP and 0.1% AEP events, using the latest climate change allowances, in agreement with the Environment Agency.

Please refer to Chapter 5 for information on the approach to climate change in this SFRA.

5 Groundwater

Mapping of groundwater flood risk has been based on the JBA Groundwater Flood Risk map.

The JBA Groundwater Flood Risk map shows groundwater flood risk on a 5m square grid. For each grid cell, a depth range is given for modelled groundwater levels in the 100-year return period flood event. It takes into account factors including topography, groundwater recharge volumes and spatial variations in aquifer storage and transmission properties.

Section 4.7 of the Main Report explains groundwater flooding.

6 Sewers

Anglian Water provided a list of recorded internal and external sewer flooding incidents from their Hydraulic Sewer Flooding Risk Register, last updated on the 5 September 2022. The Anglian Water DWMP has also been considered.

This information is included in Section 4.6 of the Main Report.

7 Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within Milton Keynes has been mapped using the outlines produced as part of the National Reservoir Flood Mapping (RFM) study, and are shown online on the **Long-Term Risk of Flooding website** at the time of publication.

The Environment Agency provide two flooding scenarios for the reservoir flood maps: a 'dry-day' and a 'wet-day'. The 'dry-day' scenario shows the predicted flooding which would occur if the dam or reservoir fails when rivers are at normal levels. The 'wet-day' scenario shows the predicted worsening of the flooding which would be expected if a river is already experiencing an extreme natural flood.

Section 4.9 of the Main Report presents the reservoirs affecting Milton Keynes.

8 Flood Defences

The Environment Agency supplied the location of all flood defences within the district in their AIMS database, including information relating to the type of flood defence and their standard of protection. The Reduction in Risk of Flooding from Rivers and Sea due to Defences shapefile was also considered. Chapter 6 of the Main Report provides information on flood defences and schemes.

9 Overview of supplied data

Overview of supplied data for the Milton Keynes SFRA from stakeholders is as follows:

Source of flood risk	Data used to inform the assessment	Data supplied by
Historic (all sources)	Historic Flood Map Recorded Flood Outlines	Environment Agency
	Hydraulic Sewer Flooding Risk Register	Anglian Water
Fluvial (including climate change)	Flood Map for Planning Flood Zones Upper Ouse Model Mid Ouse Model	Environment Agency
Surface Water	Risk of Flooding from Surface Water dataset	Environment Agency
Sewers	Hydraulic Sewer Flooding Risk Register DWMP	Anglian Water
Groundwater	Bedrock geology/superficial deposits datasets (online dataset)	Environment Agency
	Groundwater Flood Risk Map	JBA
Reservoir	National Inundation Reservoir Mapping (Long term flood risk map)	Environment Agency
Flood Defences	Location and description of flood defences (AIMS dataset) Reduction in Risk of Flooding from Rivers and Sea due to Defences	Environment Agency
Cross-boundary impacts	Neighbouring authority sites and Local Plan information, to help assess cross-boundary impacts and the cumulative impact assessment	Bedford Council, Buckinghamshire Council, Central Bedfordshire Council, North Northamptonshire Council, West Northamptonshire Council

Source of flood risk	Data used to inform the assessment	Data supplied by
Other datasets	Partner Data Catalogue: - Source Protection Zones - Aquifer Designation Maps - Areas Susceptible to Groundwater Flooding - Detailed River Network - Flood Alert Areas - Flood Warning Areas - Flood Maps for Planning - Groundwater Vulnerability - Historic Flood Map - Risk of Flooding from Rivers and Sea	Environment Agency (via Milton Keynes City Council)