

Appendix B - Data sources used in the SFRA

1 Historical Flooding

North Yorkshire County Council provided Section 19 reports in the area and information of historical flooding events across the area of Scarborough Borough. The Environment Agency's Historic Flood Map is also presented in Appendix A: GeoPDF Mapping. Section 5.1 documents historic flooding records obtained.

2 Fluvial flooding

2.1 Flood Zones 2 and 3a

Flood Zones 2 and 3a, as shown in the Appendix A mapping, show the same extent as the online Environment Agency's Flood Map for Planning (which incorporates latest modelled data), where available, except for the following areas where the modelled data was not fully incorporated into the EA Flood Zones:

- River Esk at Whitby
- Vale of Pickering
- River Derwent from Old Malton to Buttercrambe
- Sea-Cut (Scalby Beck) south of West Ayton

Figure B-1 shows the coverage of these models. The extents for these areas have been replaced with the modelled outputs.

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.

2.2 Flood Zone 3b (the Functional Floodplain)

Flood Zone 3b, as shown in Appendix A mapping, has been compiled for the study area as part of this SFRA and is based on the 5% AEP (1 in 20-year chance of flooding in any given year) or 4% AEP (1 in 25-year chance of flooding in any given year) extents produced from Environment Agency detailed hydraulic models where outputs were available (see Figure B-1 for model coverage).

For areas not covered by detailed EA models, a precautionary approach should be adopted for Flood Zone 3b with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a (or Flood Zone 3b derived from 2D generalised modelling), further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b.

If the area of interest is in an area that has seen some major changes to the extent of the Flood Zones, having checked the online mapping, developers will also need to remap Flood Zone 3b as part of a detailed site-specific Flood Risk Assessment.

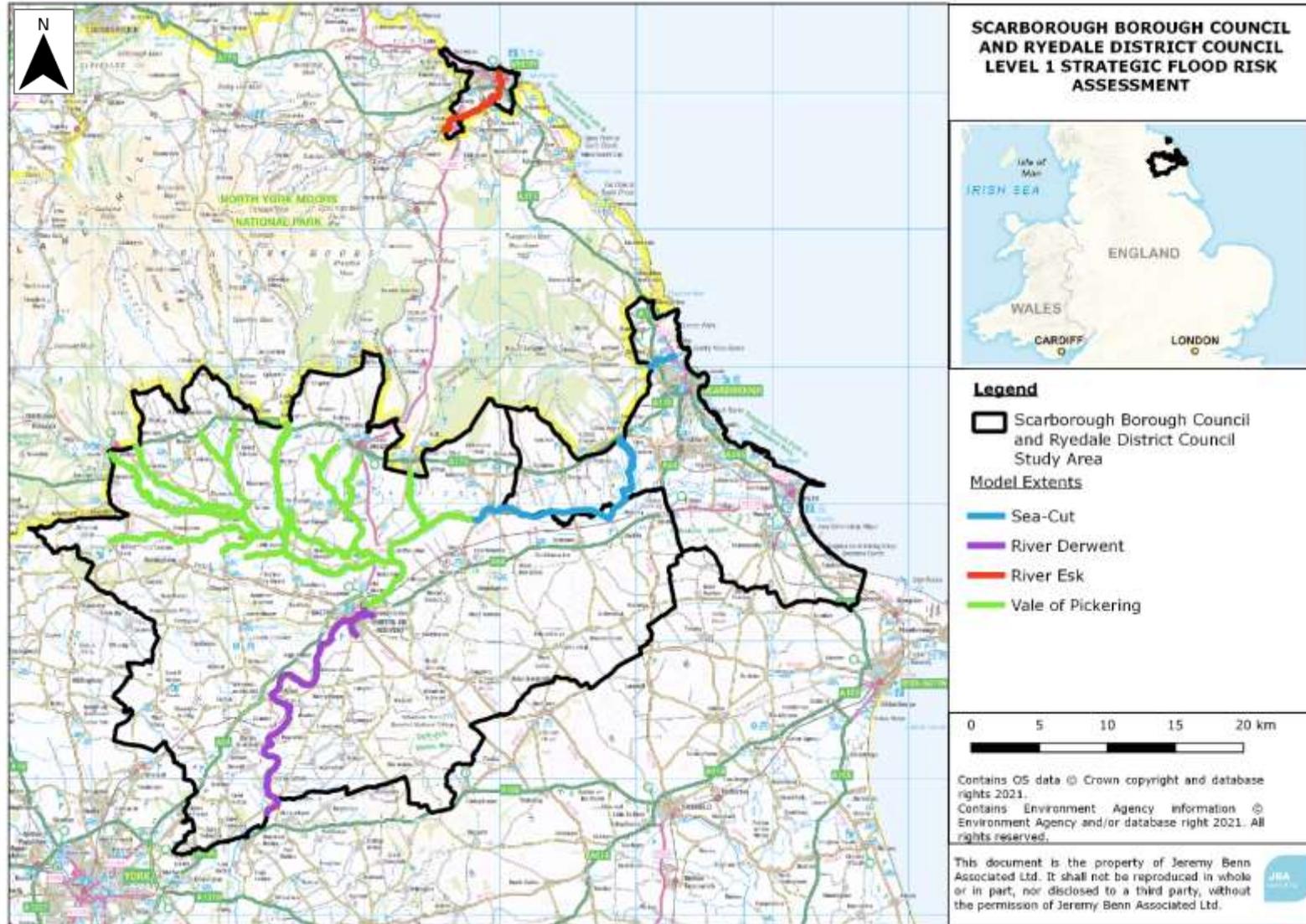


Figure B-1: Existing hydraulic modelling coverage

3 Climate change

Detailed Environment Agency hydraulic models were obtained. For the Sea Cut model the 100-year flows were upscaled by the Derwent Humber Management Catchment 2080's scenarios (+22% and +33%) under the new Environment Agency guidance released in 2021. For most of the other models, 100-year flows upscaled by the previous guidance for the Humber basin's 2080s scenarios (+20% and +30%) were available which were deemed suitable to use following discussion with the EA. For the River Derwent model just the 20% climate change allowance was available, however, this model was not re-run for the Level 1 SFRA as this model is due to be updated for the Level 2 SFRA. Where there were no detailed models available, Flood Zone 2 has been used as an indication of climate change. Figure B-1 shows the existing EA model coverage, where climate change outputs were either already available or were run as part of this SFRA (Sea-Cut – see section 3.1).

Please refer to Chapter 4 for information on the approach to climate change in this SFRA.

3.1 Sea-Cut (Scalby Beck) model

The Sea-Cut (Scalby Beck) through Scarborough Borough and Ryedale is represented by the Environment Agency's Sea-Cut 1D-2D HEC-RAS hydraulic model (2018). This model was re-run with updated climate change guidance released by the Environment Agency in July 2021 (+22% and +33% for the Derwent Humber Management Catchment). The baseline scenario has been used to inform FZ3b and climate change extents.

4 Coastal flooding

Coastal projection modelling was run for the present day (2021) along the east coast of Scarborough Borough. The present-day water levels were uplifted using the UKCP18 climate projections for 2121 for both the higher central and upper end allowances for extreme still water levels.

The tidal section of the River Esk is also represented by the Environment Agency's Tidal Esk 1D-2D ESTRY-TUFLOW hydraulic model (2020).

Coastal flood risk was also assessed using the Tyne to Flamborough Head Shoreline Management Plan and the national coastal erosion risk mapping (2018-2021) which is published online by the Environment Agency. These datasets provide information regarding the short, medium and long-term coastal management strategies to understand potential areas of coastal erosion.

Section 5.5 of the Main Report explains coastal flooding.

5 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 B-1).

Table B-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.

A detailed surface water model for Scarborough was provided by North Yorkshire County Council. Here the RoFfSW mapping was replaced with the model outputs. Figure B-2 shows the extent of the Scarborough surface water model.

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 SFRA 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 more accurately illustrate the flood risk at a site-specific scale.

6 Groundwater

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater Flooding 2010 (AStGWF) dataset and the JBA Groundwater Flood Risk map.

The AStGWF dataset is a strategic-scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and does not take account of the chance of flooding from groundwater rebound (e.g. following cessation of mining or industrial activity). This dataset covers a large area of land, and only isolated locations within the overall susceptible area are likely to suffer the consequences of groundwater flooding.

The AStGWF data should be used only in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale.

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 5.8 of the Main Report explains groundwater flooding.

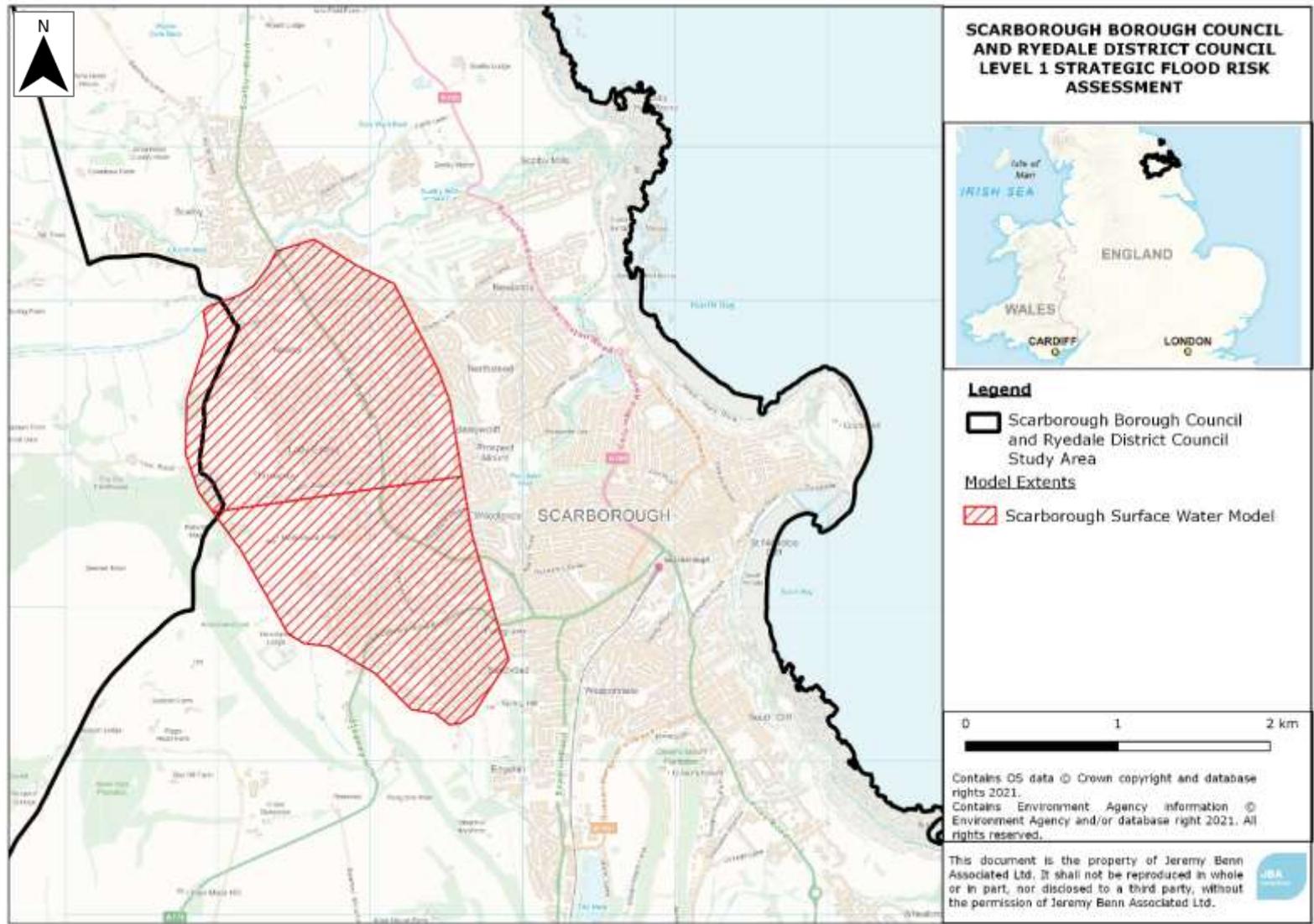


Figure B-2: Scarborough surface water model extent



7 Sewers

Historical incidents of flooding are detailed by Yorkshire Water through their Hydraulic Flood Risk Register (HFRR). The HFRR database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding.

Section 5.7 of the Main Report presents this data.

8 Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within the area has been mapped using the outlines produced as part of the National Inundation Reservoir Mapping (NIRIM) study, and are shown online on the Long-Term Risk of Flooding website at the time of publication. Section 5.9 of the Main Report presents the reservoirs affecting Scarborough Borough and Ryedale.

9 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 Areas Benefitting from Defences shapefile was also considered. Chapter 6 of the Main Report provides information on flood defences and schemes.

10 Overview of supplied data

Overview of supplied data for the Scarborough Borough and Ryedale 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 Hydraulic Modelling Reports	Environment Agency
	Section 19 Reports	North Yorkshire County Council
	Historic Flooding Incidents for Scarborough Borough	North Yorkshire County Council
Fluvial (including climate change)	Sea-Cut (Scalby Beck) (2018) 1D-2D HEC-RAS Hydraulic Model River Derwent (2009) 1D-2D ISIS-TUFLOW Hydraulic Model Vale of Pickering (2019) Hydraulic Model River Esk (2020) (1D-2D) ESTRY-TUFLOW Hydraulic Model	Environment Agency
	Flood Map for Planning Flood Zones	Environment Agency
	Coastal	Projection modelling
Coastal Strategy Reports		Scarborough Borough Council
Shoreline Management Plan		Environment Agency
National coastal erosion risk mapping (2018-2021)		Environment Agency



Surface Water	Risk of Flooding from Surface Water dataset	Environment Agency
	Scarborough Local Model	North Yorkshire County Council
Sewers	Hydraulic Flooding Risk Register (HFRR)	Yorkshire Water
Groundwater	Areas Susceptible to Groundwater Flooding dataset 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	Environment Agency
Cross-boundary impacts	Neighbouring authority sites and Local Plan information, to help assess cross-boundary impacts and the cumulative impact assessment	City of York Council East Riding of Yorkshire Council Hambleton District Council North Yorkshire Moors National Park Authority Redcar and Cleveland Borough Council
Other datasets	Partner Data Catalogue: <ul style="list-style-type: none"> - 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 SBC and RDC)