AECOM

Selby District Level 1 Strategic Flood Risk Assessment

Selby District Council

August 2022

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Quality information

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Abbreviations of Terms

ACRONYM	DEFINITION
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
AOD	Above Ordnance Datum
AStGWF	Areas Susceptible to Groundwater Flooding
BGS	British Geological Survey
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
CoP	Code of Practice
Defra	Department for Environment, Food and Rural Affairs
DLUHC	Department for Levelling Up, Housing and Communities
FMfSW	Flood Map for Surface Water
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act 2010
GIS	Geographical Information System
IDB	Internal drainage Board
IUD	Integrated Urban Drainage
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RMA	Risk Management Authority
RoFSW	Risk of Flooding from Surface Water
SA	Sustainability Appraisal
SDC	Selby District Council
SFRA	Strategic Flood Risk Assessment
SPD	Supplementary Planning Document
SPZ	Source Protection Zone
SWMP	Surface Water Management Plan
SuDS	Sustainable Drainage Systems
UKCP09	United Kingdom Climate Projections 2009
YWSL	Yorkshire Water Services Limited

Glossary of Terms

GLOSSARY	DEFINITION
1D Hydraulic Model	Hydraulic model which computes flow in a single dimension, suitable for representing systems with a defined flow direction such as river channels, pipes and culverts
2D Hydraulic Model	Hydraulic model which computes flow in two dimensions, suitable for representing systems without a defined flow direction including topographic surfaces such as floodplains
Annual Exceedance Probability (AEP)	Probability of exceeding a specified flow or level in any year. It is the inverse of the return period for an annual maximum series
Asset Information Management System (AIMS)	Environment Agency database of assets associated with Main Rivers including flood defences, structures and channel types. Information regarding location, standard of service, dimensions and condition.
Aquifer	A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water.
Attenuation	In the context of this report - the storing of water to reduce peak discharge of water.
Catchment Flood Management Plan	A high-level plan through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions. In the Humber River Basin District for fluvial events a 20 - 50% increase in river flow is applied (dependent on development vulnerability classification) and for rainfall events, a 40% increase. These climate change values are based upon information within the NPPF and Planning Practice Guidance as at 22nd July 2021.
Culvert	A structure, often a covered channel or pipe that carries water below the level of the ground.
Design flood	This is a flood event of a given annual flood probability, which is generally taken as: fluvial (river) flooding likely to occur with a 1% AEP including an allowance for climate change. The suitability of a proposed development is assessed and mitigation measures, if any, are designed against the design flood. Both should contain a suitable allowance for climate change.https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.
DG5 Register	A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than a 5% AEP
Exception Test	The exception test[1] should be applied following the application of the sequential test. The exception test is a test to ensure that flood risk to people and property can be managed satisfactorily, while allowing appropriate development to go ahead in situations where suitable sites at lower risk of flooding are not available. Conditions need to be met before the exception test can be applied.
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) which is the largest flood that a given project is designed to safely accommodate.
Flood Modeller Pro	A commonly used 1D hydraulic modelling software package.
Flood Resilience	Measures incorporated into a building that minimise water ingress (e.g. to buildings) and/or promote fast drying and easy cleaning, to reduce any permanent damage.
Flood Resistant	Measures to prevent flood water entering a building or damaging its fabric. This has the same meaning as flood proof.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption).
Flood Zone	Flood Zones refer to the probability of river and sea flooding ignoring the presence of existing flood defences (i.e. the natural floodplain). It should be noted that Flood Zones

[1] Environment Agency. 2021. Flood Risk and Coastal change Guidance. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change#Exception-Test-to-Local-Plans

GLOSSARY	DEFINITION
	on the Environment Agency Flood Map for Planning do not take account of the potential impact of climate change.
Fluvial	Relating to the actions, processes and behavior of a watercourse (river or stream).
Freeboard	Freeboard is a safety factor which is applied to account for residual uncertainty within design, often an extra 300mm or 600mm added to finished floor level above the design flood level to account for any uncertainty in flood levels.
Functional Floodplain	Land where water has to flow or be stored in times of flood.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Lead Local Flood Authority (LLFA)	As defined by the Flood and Water Management Act, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area, in this case North Yorkshire County Council.
Light Detection and Ranging (LiDAR)	Airborne ground survey mapping technique, which uses a laser to measure the distance between the aircraft and the ground. Within this report, LiDAR has been used to map topography across the District as illustrated in Appendix A Figure 2.
Local Planning Authority (LPA)	The public authority that is responsible for controlling planning and development through the planning system.
Main River	Watercourse defined on a 'Main River Map' designated by Defra. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities for Main Rivers only.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
New Local Plan	The New Local Plan[2] is the Sites and Policies Local Plan which is being developed to deliver the strategic vision to promote the growth of the Selby District. It will incorporate site specific designations and policies to support targeted of growth of Selby.
Ordnance Datum	In the British Isles, an ordnance datum is a vertical datum used by the Ordnance Survey as the basis for deriving altitudes on maps. A spot height may be expressed as AOD (Above Ordnance Datum), in this instance meaning above mean sea level at Newlyn in Cornwall
Ordinary Watercourse	A watercourse that does not form part of a Main River. This includes "*all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows*" according to the Land Drainage Act 1991.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account. An example of residual flood risk includes the failure of flood management infrastructure, or a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defences, or an intense rainfall event which the drainage system cannot cope with.
Sequential Test[3]	Aims to steer vulnerable development to areas of lowest flood risk.
Sewer Flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Source Protection Zone (SPZ)	Defined areas in which certain types of development are restricted to ensure that groundwater sources remain free from contaminants.
Surface Water Flooding	Flooding caused when intense rainfall exceeds the capacity of the drainage systems or when, during prolonged periods of wet weather, the soil is so saturated such that it cannot accept any more water.
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.
Tide locked	This is when the incoming level of the high tide stops drainage including from rivers and surface water from flowing out to sea.
Topographic survey	A survey of ground levels.
TUFLOW	A modelling package for simulating depth averaged 2D free-surface flows and is in widespread use in the UK and elsewhere for 2D inundation modelling.

[2] Selby District Council. New Local Plan. Available at: https://www.selby.gov.uk/localplan
[3] Environment Agency. 2017. Flood Risk Assessment: the sequential text for applicants, Available at: https://www.gov.uk/guidance/flood-risk-assessment-the-sequential-test-for-applicants#the-exception-test

1. Introduction

In its role as the Local Planning Authority (LPA), Selby District Council (SDC) is currently preparing documents for the New Local Plan (the Sites and Policies Local Plan) that will form part of the Local Plan to guide future development and to set the vision for future development across parts of the District. As part of this process, baseline evidence must be collated to inform key planning issues. Since the previous Selby District Strategic Flood Risk Assessment (SFRA) was published in 2020, a number of changes in planning policy and guidance have occurred. In addition to this, updated flood datasets have been made available which include improvements to river modelling and flood mapping.

The revised National Planning Policy Framework (NPPF)[4] (released on 20 July 2021) and associated Planning Practice Guidance (PPG) for Flood Risk and Coastal Change[5] emphasise the active role Local Planning Authorities (LPAs) should take to ensure that flood risk is understood and managed effectively and sustainably throughout all stages of the planning process.

Some key aspects of the NPPF related to flood risk, climate change and resilience are as follows:

- The requirement to identify policies and physical measures to provide for resilience to climate change effects;
- The consideration of cumulative impacts in, or affecting, local areas susceptible to flooding;
- The need to consider the introduction of Natural Flood Management;
- The specific requirement for sustainable drainage systems and the need to evidence their use in site specific FRAs; and
- The requirement to prepare emergency plans in site specific FRAs.

AECOM has been commissioned by SDC to update their existing Level 1 and Level 2 SFRAs. The methodology followed in this study complies with the revised NPPF and accompanying PPG as well as guidelines from the Environment Agency and forms the Level 1 SFRA for the Selby District. This document supersedes the Level 1 SFRA issued in 2020.

The SFRA has been completed in collaboration with the SDC as LPA, North Yorkshire County Council (NYCC) as the Lead Local Flood Authority (LLFA), the Environment Agency and Yorkshire Water Services Ltd (YWSL). The results of this SFRA are intended to inform strategic land use planning and decision making from a flood risk perspective.

1.1 Approach to Flood Risk Management

The NPPF and associated PPG emphasise the active role LPAs should take to ensure that flood risk is assessed, avoided, and managed effectively and sustainably throughout all stages of the planning process. The overall approach for the consideration of flood risk set out in Section 1 of the PPG can be summarised as follows:

This has implications for LPAs and developers as described below.

[4] Revised National Planning Policy Framework, Published 20th July 2021. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[5] Communities and Local Government. 2021. *Planning Practice Guidance: Flood Risk and Coastal Change.* Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change

1.1.1 Assess Flood Risk

The NPPF outlines that strategic policies should be informed by a SFRA and should manage flood risk from all sources. Figure 2-1, shows the watercourses present in the SDC area.

For sites in areas at risk of flooding, or with an area of 1 hectare or greater, developers must undertake a site-specific Flood Risk Assessment (FRA) to accompany planning applications (not required where prior approval has been sought for certain types of permitted development).

1.1.2 Avoid Flood Risk

SDC should apply the sequential approach to site selection so that development is, as far as reasonably possible, located where the risk of flooding from all sources is lowest, taking account of current and future impacts of climate change and the vulnerability of future users and property to flood risk, where possible.

In plan-making this involves applying the Sequential Test, and where necessary the Exception Test to Local Plans. In decision-making this involves applying the Sequential Test and, if necessary, the Exception Test for specific development proposals.

1.1.3 Manage and Mitigate Flood Risk

Where alternative sites in areas at lower risk of flooding are not available, or where there are overriding reasons for development, it may be necessary to locate development in areas at risk of flooding. In these cases, SDC and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development and will not increase flood risk overall.

SDC and developers should seek flood risk management opportunities (e.g. safeguarding land), and to reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems (SuDS)).

1.2 Levels of SFRA

The Planning Practice Guidance identifies the following two levels of SFRA:

- Level 1: where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient detail to enable application of the Sequential Test.
- Level 2: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all 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 Level 1 SFRA is intended to help SDC in applying the Sequential Test for their site allocations and identify where the application of the Exception Test may be required via a Level 2 SFRA.

1.3 SFRA Aims and Objectives

The purpose of this SFRA update is to collate and present the most up to date flood risk information from all sources for use by SDC to inform the preparation of Local Plans and prudent decision-making by Development Management Officers on a day-to-day basis.

The key objectives of the 2022 SFRA update are:

- To take account of best practice, the latest guidance and the most up to date information;
- To assess the flood risk to and from the District from all sources, now and in the future, as well as outline how cumulative land use changes and development in the area may potentially impact flood risk;
- To be a robust piece of evidence to inform the preparation of the New Local Plan and the associated sustainability appraisal, so that flood risk is fully accounted for when considering allocation options and guides development to the safest areas;
- To inform the preparation of the emerging New Local Plan policies;
- To inform the application of the Sequential Test and, if necessary, the Exception Test;
- To identify requirements for site specific flood risk assessments;

- To assist in the determination of the acceptability of flood risk in relation to Selby's emergency planning capability; and

To consider opportunities to reduce flood risk to existing communities and developments and recommend how the New Local Plan can best influence this issue.

2. The SFRA Study Area

2.1 Selby District

SDC's administrative area covers an area of approximately 600km^2 and had a population of approximately 92,000 at the 2021 census. It is the southernmost district of North Yorkshire and is bordered by the administrative areas of East Riding of Yorkshire Council, Leeds City Council, Wakefield Metropolitan Brough Council, City of York Council, Harrogate Borough Council and Doncaster Metropolitan Borough Council.

Selby District is predominantly rural, with dispersed market towns, villages, and hamlets with more industrial development towards the south of the district. The primary urban centres of Selby, Sherburn-in-Elmet and Tadcaster are located to the east, west and north-west of the District respectively. Of these, Selby is the main service town serving the large rural catchment and has received significant investment in infrastructure, including modern flood defences and improvements to the wastewater treatment works

The A1(M) passes through the district to the west, the M62 passes through the south of the District, and the A19, A63 and A64 all pass through the south. Figure 2-1 shows the watercourses in the SDC study area. Further mapping of the Selby District is presented in **Appendix A Figure 1**.

Appendix A, Figure 1 Main River and Canal Overview

2.2 Topography

Light Detection and Ranging (LiDAR) topographic survey data[6], presented in **Appendix A Figure 2**, indicates that the District is made up of significant areas of flat low lying land. The relief peaks at 65m Above Ordnance Datum (AOD) along the western edge of the District, which steeply drops away and the majority of the area ranges between 0m AOD and 15m AOD.

The flatter areas of topography along the rivers within the study area exacerbate the likely susceptibility of many areas of the District to flood risk, both from river and surface water flooding.

Appendix A, Figure 2 Topography

2.3 Surface Watercourses

2.3.1 Main Rivers

The following watercourses are designated Main Rivers[7], the locations of which are shown in **Appendix A Figure 3,** fall within Selby District Council:

- River Ouse;
- River Wharfe;
- Cock Beck;
- The Fleet;
- Bishop Dike;
- Whin Dike;
- Mill Dike;
- Upper Fox Drain;
- Selby Dam;

[6] Light Detection and Ranging (LiDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground. Up to 100,000 measurements per second are made of the ground, allowing highly detailed terrain models to be generated at spatial resolutions of between 25 cm and 2 m. The Environment Agency's LiDAR data archive contains digital elevation data derived from surveys carried out since 1998.

[7] 'Main Rivers' are watercourses defined by the Environment Agency as larger rivers and streams, designated on the statutory Main River Map maintained by the Environment Agency and the Department for Environment, Food and Rural Affairs (DEFRA).

- Cockret Dike;
- Holme Dike;
- River Derwent;
- River Aire; and
- River Went.

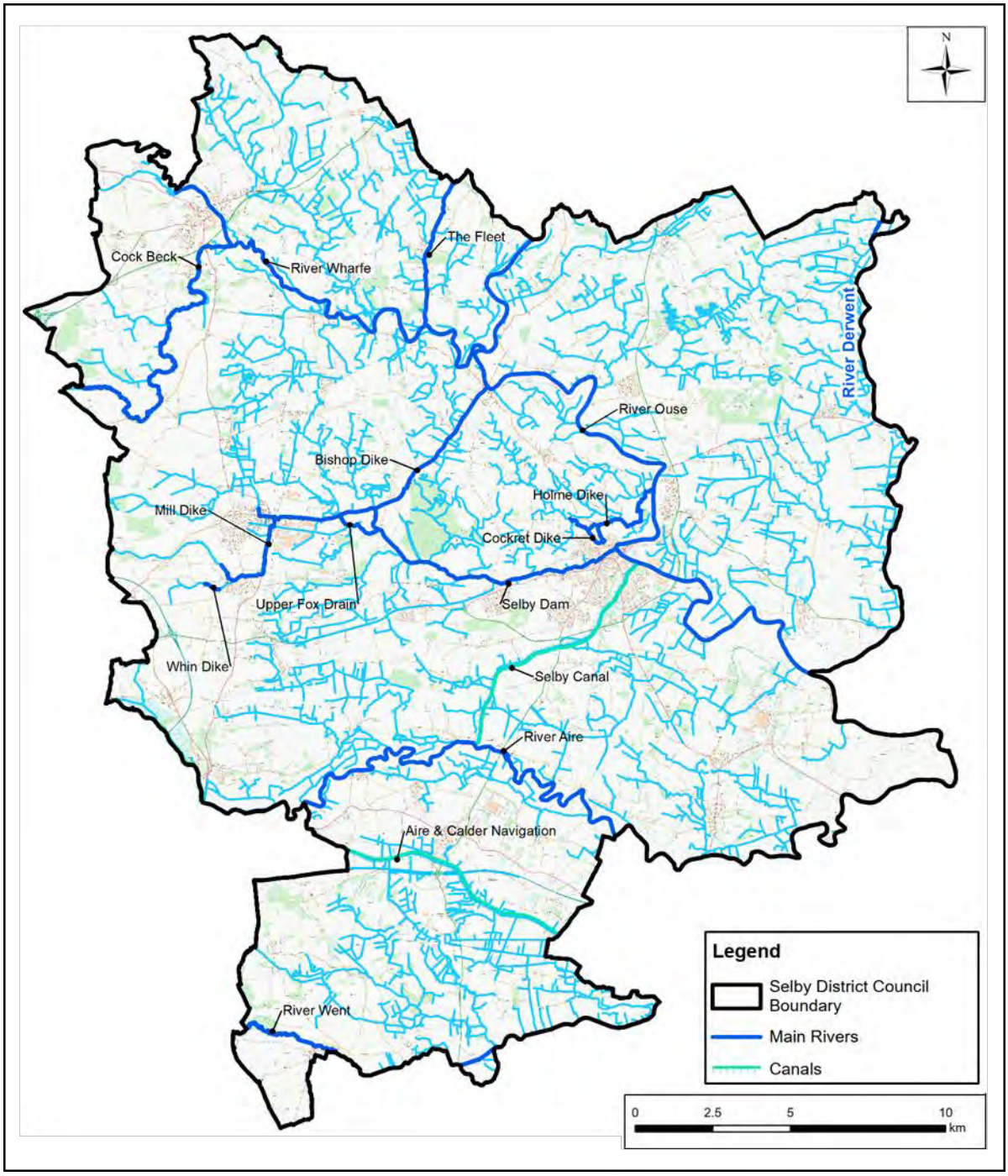


Figure 2-1: Selby District Council Study Area. (Contains OS data © Crown copyright and database right 2022)

The River Ouse enters the district to the north of Stillingfleet. The river flows in a generally south easterly direction through the district before exiting the district to the north of Long Drax where, for a short distance, it forms the boundary between Selby District Council and the East Riding of Yorkshire. The River Wharfe, a tributary of the River Ouse, enters the district from the north west flowing in a south easterly direction through Tadcaster and Ulleskelf, before joining the River Ouse to the north of Cawood. The River Derwent, designated as a Site of Special Scientific Interest and a Special Area of Conservation, forms the boundary between Selby District and the East Riding of Yorkshire. The river, a tributary of the River Ouse, flows in a southerly direction east of South Driffield, joining the River Ouse at Barmby on the Marsh. The River Aire and the River Went are located to the south of the district. Within the Selby District the River Aire flows eastwards and forms parts of the District boundary with Wakefield Metropolitan Borough Council to the south west. The River Went, a tributary of the River Don, forms sections of the southern Selby District boundary with the East Riding of Yorkshire and Doncaster Metropolitan Borough Council. The River Went flows into the tidal Lower Don and is 'tide locked' at its lower reach.

Appendix A, Figure 3 Surface Waterbodies

2.3.2 Tidal Influences

Tidal influences affect both the River Ouse and River Aire within the study area. The River Ouse tidal limit is located at Naburn Weir (NGR SE 592 445). The River Aire is tidally influenced for 26 km downstream of the lock and weir at Chapel Haddlesey, (NGR SE 581 259). Although a high astronomical tide may not be sufficient on its own to cause flooding, when it coincides with a fluvial event or storm surge, river levels could be raised locally resulting in overtopping and subsequent inundation.

2.3.3 Minor Watercourses

The majority of Ordinary Watercourses[8] within the Selby District fall under the jurisdiction of the following four Internal Drainage Boards (IDBs):

- Selby IDB – responsible for ordinary watercourses to the north of the River Aire to the area of Barkston Ash, Church Fenton and Wharfe's Mouth (where the River Wharfe forms a confluence with the River Ouse). The IDB protects people and their property against river and surface water flooding through water level management within the low-lying catchment areas of the River Aire and River Ouse;
- Ainsty IDB - responsible for ordinary watercourses to the north of Barkston Ash, Church Fenton and Wharfe's Mouth to the northern boundary of Selby District;
- Ouse and Derwent IDB – responsible for ordinary watercourses to the east of the River Wharfe; and.
- Danvm Drainage Commissioners - responsible for ordinary watercourses to the south of the River Aire. The IDB is responsible for the water level management of the River Aire, River Went, River Don, Ea Beck, River Dearne, River Dove and Aire & Calder Navigation, which rely upon pumping water from low lying areas.

The IDBs are responsible for managing water levels in the watercourses designated to each IDB and work in partnership with other authorities to actively manage and reduce the risk of flooding within the board's district. They have permissive powers under the Land Drainage Act to undertake maintenance on any watercourse within their district other than "Main River" and to supervise all matters relating to the drainage of land within their districts.

2.3.4 Canals

There are two canal systems in Selby District, the Aire and Calder Navigation and the Selby Canal, the locations of which are shown in **Appendix A Figure 3**. The Aire and Calder Navigation enters the district from the south eastern boundary, to the south of Kellingley, flowing in an easterly direction and passing through Eggborough before leaving the district to the southeast of Great Heck.

The Selby Canal bypasses the lower reaches of the River Aire from the village of West Haddlesey to Selby where it joins the River Ouse.

Appendix A, Figure 3 Surface Waterbodies

[8] An Ordinary Watercourse is every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and feature through which water flows, which does not form part of a Main River

2.3.5 Reservoirs

The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large raised reservoirs (defined in the Reservoir Act 1975 as holding over 25,000 cubic metres (m^3) of water above ground level) must be inspected and supervised by a panel engineer.

Table 2-1 indicates there are 16 reservoirs located within or upstream of Selby District under the ownership of the Environment Agency or Yorkshire Water.

Table 2-1: Reservoirs within and upstream of Selby District

Name	Owner	OS Grid Ref	Within Selby District
Lindley Wood Reservoir	Yorkshire Water Services	421967, 448642	No
Eccup Reservoir	Yorkshire Water Services	430875, 441878	No
Grimwith Reservoir	Yorkshire Water Services	405910, 464004	No
Fewston Reservoir	Yorkshire Water Services	418953, 454052	No
Thruscross Reservoir	Yorkshire Water Services	415549, 457398	No
Swinsty Reservoir	Yorkshire Water Services	419580, 452679	No
Cawood Ings Wistow Lordship	Environment Agency	462374, 433013	Yes
Barmby Raw Water Reservoir	Yorkshire Water Services	470120, 429183	No
Kellington Ings Reservoir	Environment Agency	467280, 422715	Yes
Brotherton Little Marsh to Birkin Holme Washlands	Environment Agency	449469, 424429	Yes
Brayton Barff Reservoir	Yorkshire Water Services	458445, 430444	Yes
Bolton Ings (Dales) Reservoir	Environment Agency	454181, 440303	No
Clifton Ings Washlands Reservoir	Environment Agency	458682, 452857	No
Tadcaster, Hackenby, North Ings and Cock Beck	Environment Agency	450692, 441378	Yes
Angram	Yorkshire Water Services	404381, 476381	No
Kirkby/Great/Little Ings	Environment Agency	452305, 440154	Yes

2.4 Geology

Datasets have been obtained from the British Geological Survey (BGS) website to provide a high-level identification of the superficial deposits and bedrock geology across the Selby District. Mapping of the superficial deposits and bedrock geology is displayed in **Appendix A Figures 4** and **5** respectively.

Bedrock is the consolidated rock underlying the ground surface. Superficial deposits refer to the more geologically recent deposits (typically of Quaternary age) that may be present above the bedrock such as floodplain deposits, beach sands and glacial drift. Underlying geology can influence the presence and nature of groundwater in an area, and therefore potential groundwater flood risk. The geology can also impact on the potential for infiltration-based drainage systems.

The bedrock geology consists of four main formations. The Triassic Sandstone (undifferentiated) Group dominates three- quarters of the District to the east and is comprised of sandstone and conglomerate. The western third of the District is underlain by a succession of formations which run approximately from west to east comprising the Permian Rocks (mudstone, siltstone and sandstone), the Zechstein Group (dolomitised limestone and dolomite) and Pennine Upper Coal Measures (mudstone, siltstone, sandstone, coal, ironstone and ferricre).

Superficial deposits are dispersed throughout the District with the majority of the central, north eastern and southern parts of the District underlain by Clay and Silt Glacial Deposits (Lacustrine Deposits). Alluvium, consisting of clay, silt, sand and gravel follows the Main River valleys. To the north and western parts of the District there are areas of Till (Diamicton) and Glacial Diamicton, as well as sand and gravel from the Glaciofluvial Terrace deposits, River Terrace deposits and Lacustrine deposits. There are small isolated patches of Peat within the central part of the District and areas of Head deposits to the south-west and north-west.

Appendix A, Figure 4 Bedrock Geology and Figure 5 Superficial Geology

2.5 Hydrogeology

Aquifers are defined as layers of permeable rock or unconsolidated material (sand, gravel, silt etc.) capable of storing and transporting large quantities of water. The understanding of the behaviour and location of aquifers is important as they can provide an indication of the potential for groundwater flooding. The use of infiltration techniques will be dependent on the ground and groundwater conditions. However, other SuDS techniques may be suitable even if groundwater conditions preclude infiltration.

The majority of the District is designated as a Principal Aquifer (associated with the bedrock geology) by the Environment Agency[9], with some smaller areas designated as Secondary B Aquifers. The superficial deposits are designated as Secondary A Aquifers or Secondary Undifferentiated Aquifers by the Environment Agency. Environment Agency aquifer definitions are outlined in Table 2-2 below.

Table 2-2: Environment Agency Aquifer Designations

Aquifer	Environment Agency Definition
Principal	*"layer of rock that have high intergranular and/or fracture permeability. They usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale"*
Secondary 'A'	*"permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers"*
Secondary 'B'	*"predominantly lower permeability strata which may in part have the ability to store and yield limited amounts of groundwater by virtue of localised features such as fissures, thin permeable horizons and weathering."*
Secondary Undifferentiated	*"assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type"*

It is important to note that aquifer designation mapping is intended to be used at a strategic scale and further site-level investigation may be necessary.

Appendix A, Figure 6 Bedrock Aquifers and Figure 7 Superficial Aquifers

2.6 Consultation

Following on from the consultation undertaken in 2020, the Environment Agency and North Yorkshire County Council (in addition to Selby District Council) were consulted to inform the SFRA update in April and October 2021 and March 2022. Consultation data obtained in 2018 from the Canal and River Trust, Internal Drainage Boards

[9] DEFRA (2022) *Magic Maps,* Available from: https://magic.defra.gov.uk/MagicMap.aspx?chosenLayers=aqbedrock,aqdrift,backdropDIndex,backdropIndex,europeIndex,vmlBWIndex,25kBWIndex,50kBWIndex,250kBWIndex,miniscaleBWIndex,baseIndex&box=-596566:-83527:1410471:1316473&useDefaultbackgroundMapping=false [Accessed July 2022]

(IDBs) and Yorkshire Water has been used to inform historical flood records and the risk of flooding from their associated assets.

Publically available information from the following neighbouring authorities has been reviewed to inform this assessment:

- Leeds City Council;
- Wakefield Metropolitan Borough Council;
- Doncaster Metropolitan Borough Council;
- City of York Council; and
- East Riding of Yorkshire Council.

2.7 Use of SFRA Data

Level 1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. The primary purpose is to provide an evidence base to inform the Local Plan and any future flood risk policies. Developers will be able to use the information in the SFRA to scope out the sources of flood risk that will need to be explored in more detail at site level.

This SFRA has been developed building upon existing knowledge with respect to flood risk within the Planning Authority Area.

New information may influence future development control decisions within these areas, such as updated hydraulic models (which then update the Flood Map for Planning), flood event information, new defence schemes and updates to policy and legislation. Therefore, it is important that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk within the Planning Authority Area.

Developers should check the online Flood Map for Planning in the first instance to identify any major changes to the Flood Zones.

2.8 SFRA Reporting Structure

This Level 1 SFRA report has been prepared for Selby District Council and is structured as follows:

- Section 1: Introduction
- Section 2: The SFRA Study Area
- Section 3: Legislative and Planning Policy Context
- Section 4: Planning Policy for Flood Risk Management
- Section 5: SRFA Methodology
- Section 6: Climate Change Impacts
- Section 7: Understanding Flood Risk in the Selby District
- Section 8: Guidance for the Application of the Sequential and Exception Tests in Selby District
- Section 9: Site Specific Flood Risk Assessment – Guidance for Developers
- Section 10: Managing and Mitigating Flood Risk
- Section 11: Surface Water Management and SuDS
- Section 12: Summary and Recommendations
- Appendix A: SFRA Mapping
- Appendix B: Data Register
- Appendix C: Hydraulic Modelling for the SDC area

3. Legislative and Planning Policy Context

3.1 Introduction

This section sets out the Flood Risk Management roles and responsibilities for each Risk Management Authority (RMA) and relevant legislation, policy and strategy.

3.2 Flood Risk Management – Roles and Responsibilities in Selby District

A summary of the responsibilities of each RMA is shown in Table 3-1 below.

Land and property owners, often referred to as 'Riparian Owners' are usually responsible for the maintenance of any watercourse(s) located either on or next to their properties. Property owners are also usually responsible for the protection of their properties from flooding as well as other management activities, for example, by maintaining riverbeds/ banks, controlling invasive species and allowing the flow of water to pass without obstruction.

Table 3-1: Responsibilities for Managing Flood Risk in Selby District

Key Responsibilities of Different Authorities	Environment Agency	North Yorkshire County Council	Selby District Council	Yorkshire Water	National Highways	Internal Drainage Boards	Canals and Rivers Trust	Riparian or Land Owners
Fluvial Flooding from Main Rivers	✓							✓
Fluvial Flooding from Ordinary Watercourses		✓	✓[10]			✓		✓
Surface Water flooding		✓						
Groundwater Flooding		✓						
Sewer Flooding				✓				✓
Reservoir Flooding	✓			✓		✓	✓	✓
Canal Flooding							✓	
Highways flooding		✓			✓			✓

Table 3-2 shows the RMAs that are statutory and non-statutory planning consultees for flood risk issues within Selby District

[10] Under the amended Land Drainage Act 1991 section 14A, District councils do have some limited powers. These powers include maintaining, repairing, operating and improving existing works; construct or repair new works; maintain or restore natural processes, monitor, investigate and survey a location or natural process, alter the water level, and alter or remove works as long as this is in line with North Yorkshire County Council's Local Flood Risk Management Strategy.

Table 3-2: Statutory Planning Consultees for Flood Risk in Selby District

Flood Risk	Environment Agency	North Yorkshire County Council (LLFA)	Selby District Council	Yorkshire Water	Internal Drainage Boards	Canals and Rivers Trust
Flood Zone 2 & 3	All development (except minor development and access & egress issues).		Development with access and egress issues & Minor development.			
Surface water drainage from site		All major developments (≥10 dwellings, commercial ≥ 1000m^2).	1-9 dwellings and new commercial buildings ≤1000m^2.	Where development connects to a Yorkshire Water sewer (non-statutory).	Where development discharges to an IDB watercourse/ land drain.	Where development discharges to a canal managed by the Canal & River Trust
Surface Water Indicative Flood Problem Areas			All new buildings/ change of use to dwellings.			
Groundwater Indicative Flood Problem Areas			All new buildings/ change of use to dwellings.			
Reservoirs	Large (those which hold 25,000m^3 of more above ground level) or high risk[11] reservoirs					
Ordinary Watercourses		Works in Ordinary Watercourses (Non-Statutory).			Works in Ordinary Watercourses (IDB maintained (Non-Statutory).	
Canals						Development of new inland marinas
Main Rivers	Works within 20m of a designated Main River.					
Sewerage	Major development not using a main sewer.			Where development connects to a Yorkshire Water sewer (non- statutory).		

[11] High risk reservoirs are deemed by the Environment Agency as those where an uncontrolled release of water could put people's lives at risk.

3.3 Key Legislation for Flood and Water Management

3.3.1 Flood Risk Regulations (2009)

The Flood Risk Regulations 2009 were created to transpose the EU Floods Directive (Directive 2007/60/EC) into law in England and Wales. The Floods Directive provides a framework to assess and manage flood risks in order to reduce adverse consequences for human health, the environment (including cultural heritage) and economic activity.

3.3.2 Flood and Water Management Act 2010

In response to the severe flooding across large parts of England and Wales in summer 2007, the Government commissioned Sir Michael Pitt to undertake a review of current flood risk management practices. The Pitt Review – Learning Lessons from the 2007 Floods[12], and subsequent progress reviews outlined the need for changes in the way the UK is adapting to the increased risk of flooding and the role different organisations have to deliver this function.

The FWMA, enacted by Government in 2010 in response to The Pitt Review, created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for Local Authorities, as Lead Local Flood Authorities, designed to manage local flood risk (from surface water, groundwater and Ordinary Watercourses) and to provide a strategic overview role of all flood risk for the Environment Agency.

The FWMA also formalises the flood risk management roles and responsibilities of other organisations including the Environment Agency, water companies and highways authorities establishing them as Risk Management Authorities (RMAs). The responsibility to lead and co-ordinate the management of tidal and fluvial flood risk remains that of the Environment Agency.

3.4 National, Regional and Local Policy Documents and Strategies

3.4.1 National Strategy for Flood and Coastal Erosion Risk Management for England (2020)

In accordance with the FWMA, the Environment Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England. Whilst this strategy has been developed by the Environment Agency with input from Defra, it provides an overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. The first strategy was published in 2011, the strategy was updated in 2020.

The National FCERM Strategy sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. Building on existing approaches to flood and coastal risk management the FCERM Strategy promotes the use of a wide range of measures to manage risk. It describes how risk should be managed in a co-ordinated way within catchments and along the coast and how to balance the needs of communities, the economy and the environment

It sets the context for, and informs the production of, local flood risk management strategies by LLFAs, which will in turn provide the framework to deliver local improvements needed to help communities manage local flood risk. It also builds on Governments 25 Year Environment Plan by incorporating a stronger approach to making nature part of the solution and to support an integrated approach to land management to better support flood risk management needs. It has 3 long-term ambitions:

- climate resilient places: working with partners to bolster resilience to flooding and coastal change across the nation, both now and in the face of climate change
- today's growth and infrastructure resilient in tomorrow's climate: making the right investment and planning decisions to secure sustainable growth and environmental improvements, as well as infrastructure resilient to flooding and coastal change

[12] The Cabinet Office. 2008. The Pitt Review: Learning Lessons from the 2007 Floods. Available at: http://cip.management.dal.ca/publications/Pitt%20Review.pdf, [Last accessed 29 July 2022]

- a nation ready to respond and adapt to flooding and coastal change: ensuring local people understand their risk to flooding and coastal change, and know their responsibilities and how to take action

The Environment Agency's 'Flood and coastal risk projects, schemes and strategies: climate change allowances' guidance[13] was first published in July 2020. The 2020 version of the guidance reflects an assessment completed by the Environment Agency using the UK Climate Projections (UKCP) data to produce more representative climate change allowances for river flood flows and extreme rainfall for each of the river basin districts in England. In July 2021 climate change allowances for river flow were provided at a management catchment level rather than by river basin district. The new guidance will apply to flood and coastal risk projects, schemes and strategies from 20 July 2021. A later update in May 2022 provided updates to peak rainfall intensity allowances also based at a management catchment level. Different approaches are used based on catchment size and level of urbanization within the catchment. It is essential that land use planning decisions consider the impact of a changing climate where appropriate both now and into the future.

3.4.2 River Basin Management Plans

The Humber River Basin District River Basin Management Plan[14] (RBMP), managed by the EA, has been updated since the first cycle in 2009. The latest version was published in December 2015.

Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques. The Humber RBMP includes such examples whereby land management techniques have been designed to reduce flood risk whilst also reducing sediment loss and improving water quality. The plans include:

- an assessment of river basin characteristics;
- a review of the impact on human activity, the status of water bodies; and
- an economic analysis of water use and progress since the first plan in 2009.

The Plans are currently being reviewed as part of the current planning cycle.

3.4.3 Flood Risk Management Plans

Under the Regulations, the Environment Agency is required to prepare FRMPs for all of England covering flooding from Main Rivers, the sea and reservoirs. As such, the Humber FRMP[15] has been published by the Environment Agency and sets out the proposed measures to manage flood risk in the Humber River Basin District (RBD) from 2015 to 2021 and beyond. The Humber FRMP for 2021 to 2027 is anticipated in Autumn 2022.

FRMPs explain the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs. FRMPs set out how risk management authorities will work with communities to manage flood and coastal risk over the period 2015-2021. Risk management authorities include the Environment Agency, local councils, internal drainage boards, Highways England and LLFAs.

Each river basin district also has a river basin management plan, which looks at how to protect and improve water quality and use water in a sustainable way. FRMPs and river basin management plans work to a 6-year planning cycle. The current cycle is from 2015 to 2021, work is currently underway to revise the plans and all supporting assessments. The Humber FRMP has been developed alongside the Humber River Basin Management Plan (RBMP). Both flood risk management and river basin planning form an important part of a collaborative and integrated approach to catchment planning for water. The Humber RBD FRMP draws on existing policies and actions within reports and plans which have been prepared in the past such as the Ouse, Aire, Don and Derwent Catchment Flood Management Plans (CFMP).

[13] Environment Agency. 2022. Flood and coastal risk projects, schemes and strategies. Available at: https://www.gov.uk/guidance/flood-and-coastal-risk-projects-schemes-and-strategies-climate-change-allowances
[14] Environment Agency. 2015. Humber river basin district River Basin Management plan. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718328/Humber_RBD_Part_1_river_basin_management_plan.pdf
[15] Environment Agency. 2016. Humber River Basin District Flood Risk Management Plan 2015 to 2021. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500465/Humber_RBD_Part_1_river_basin_management_plan.pdf

3.4.4 Catchment Flood Management Plans (CFMP)

A CFMP is a high-level strategic planning document that provides an overview of the main sources of flood risk and how these can be managed in a sustainable framework for the next 50 to 100 years. The Environment Agency engages stakeholders within the catchment to produce policies in terms of sustainable flood management solutions whilst also considering local land use changes and effects of climate change. Whilst not entirely superseded by the FRMP, CFMPs complement the later FRMPs and RBMPs prepared for the District and region respectively. The Selby District sits within the Environment Agency's CFMP area for the River Ouse, River Aire, River Derwent and the River Don, where the visions and preferred policy for these areas are:

- Ouse Catchment Sub Areas 2, Policy Option 6: "Areas of low to moderate flood risk where action will be taken with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits"
- Ouse Catchment Sub Areas 6, Policy Option 4: "Areas of low, moderate or high flood risk where flood risk is already being managed effectively but where further actions may be needed to keep pace with climate change";
- Aire Catchment Sub Areas 8, Policy Option 6: "Areas of low to moderate flood risk where action will be taken with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits";
- Derwent Catchment Sub Areas 6, Policy Option 3: "Areas of low to moderate flood risk where existing flood risk is generally managing effectively"; and
- Don Catchment Sub Areas 7, Policy Option 3: "Areas of low to moderate flood risk where existing flood risk is generally managed effectively"

3.4.5 NYCC Local Flood Risk Management Strategy

The Local Flood Risk Management Strategy is a legal document which provides a framework for addressing flood risk across the North Yorkshire area. The development, maintenance and implementation of the strategy for the management of local flood risk is a statutory duty of NYCC, as a LLFA under the FWMA.

The LFRMS defines how NYCC, in partnership with other organisations who also have statutory roles, will seek to manage flood risk across their area. The FWMA defines 'Local Flood Risk' as flooding from Ordinary Watercourses, surface water and groundwater. The FRMS recognises the importance of dealing with flood risk from all sources in a co-ordinated way, so the strategy has been developed to reflect this.

The strategy aims to understand flood risk from all sources across the area, reduce its likelihood and impact on residents and visitors and take the opportunity to improve the environment. It is a living document which provides an ongoing comprehensive framework for managing North Yorkshires flood risk. The strategy has drawn on existing plans and knowledge to form an understanding of the various flood risks, what management is already in place and where risk remains a concern.

3.4.6 Surface Water Management Plan

A Surface Water Management Plan (SWMP) is a study to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from surface runoff, groundwater, and Ordinary Watercourses. SWMPs are produced by a partnership of flood risk management authorities who have responsibilities for aspects of local flooding, including the County Council, Local Authority, Sewerage Undertaker and other relevant authorities.

The purpose of a SWMP is to identify what the local surface water flood risk issues are, what options there may be to prevent them or the damage they cause and who should take these options forward. This is then presented in an Action Plan that the stakeholders and partners agree.

At the time of publication of this SFRA document, no SWMP has been published that covers the Selby District.

3.4.7 Yorkshire Regional Flood and Coastal Committee (RFCC)

Selby District Council falls within the Yorkshire Regional Flood and Coastal Committee (RFCC) area. The RFCC is a committee established by the Environment Agency under the FWMA 2010 that brings together members appointed by LLFAs (such as NYCC) and independent members with relevant experience for 3 purposes:

- To ensure there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines;
- To encourage efficient, targeted and risk-based investment in flood and coastal erosion risk management that represents value for money and benefits local communities; and,
- To provide a link between the Environment Agency, LLFAs, other risk management authorities, and other relevant bodies to build understanding of flood and coastal erosion risks in its area.

4. Planning Policy for Flood Risk Management

This section provides a summary of national planning policy for development and flood risk.

4.1 National Planning Policy Framework

The NPPF is a framework within which councils and local people can produce local and neighbourhood plans that reflect the needs and priorities of their communities.

The NPPF is supported by a series of Planning Practice Documents referred to as the PPG. The PPG: Flood Risk and Coastal Change guidance outlines how LPAs should develop and use SFRAs.

4.2 A Risk Based Approach

All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property.

4.2.1 The Flood Risk Zones

The risk of flooding is a function of the probability that a flood will occur and the consequence to the receptor as a direct result of flooding. The NPPF seeks to ensure the probability of flooding from rivers is appropriately assessed by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 4-1 below.

Table 4-1: Fluvial Flood Zones (PPG, 2021)

Flood Zone	Fluvial Flood Zone Definition	Probability of Flooding
Flood Zone 1	Land having a less than 0.1% annual exceedance probability (AEP) of river or tidal flooding. Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1% (fluvial) / 0.5% (tidal) and 0.1%annual probability of flooding.	Medium
Flood Zone 3a	Land having a 1% (fluvial) / 0.5% (tidal) or greater annual probability of flooding	High
Flood Zone 3b	As defined by the NPPF this is land where water has to flow or be stored in times of flood. Its extent can be defined in different ways, including defined flood storage areas (such as washlands designed to flood) and undefended sections of floodplain where frequent flooding occurs. The functional floodplain is not separately distinguished from Flood Zone 3a on the Environment Agency Flood Map for Planning (Rivers and Sea). LPAs are therefore required to identify areas of functional floodplain as part of their SFRA, in discussion with the Environment Agency.	Functional Floodplain

The Flood Zones do not take into account the presence of flood defences. 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 Zones do not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure. They do not consider climate change. Hence there could still be a risk of flooding from other sources and that the level of flood risk will change over time during the lifetime of a development.

It should be noted that additional flood risk mapping is available on the Environment Agency website which is referred to as 'Risk of Flooding from Rivers and Sea'[16]. This map takes into account the presence of flood defences and how the standard of protection they offer affects the relative risk of flooding to land and property. While flood defences reduce the level of risk, they do not completely remove it as they can be overtopped or fail in extreme weather conditions, or if they are in poor condition. As a result, the maps may show areas behind defences which still have some risk of flooding. This mapping has been made available by the Environment Agency as the primary

[16] Environment Agency 'Risk of Flooding from Rivers and Sea' Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=463722.696&northing=152577.6

method of communicating flood risk to members of the public, however for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information.

4.2.2 The Sequential Test

The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The SFRA will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

The LPA will apply the Sequential Test to strategic allocations. For all other developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test. The LPA should work with the Environment Agency to define a suitable area of search for the consideration of alternative sites in the Sequential Test.

The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land or Employment Land Availability Assessments. Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone it is proposed for. Table 2 of the PPG defines the vulnerability of different development types to flooding. Table 3 of the PPG shows whether, having applied the Sequential Test first, that vulnerability of development is suitable for that Flood Zone and where further work is needed.

The flow diagram presented in Figure 4-1 illustrates how the Sequential Test process should be applied to identify the suitability of a site for allocation, in relation to the flood risk classification

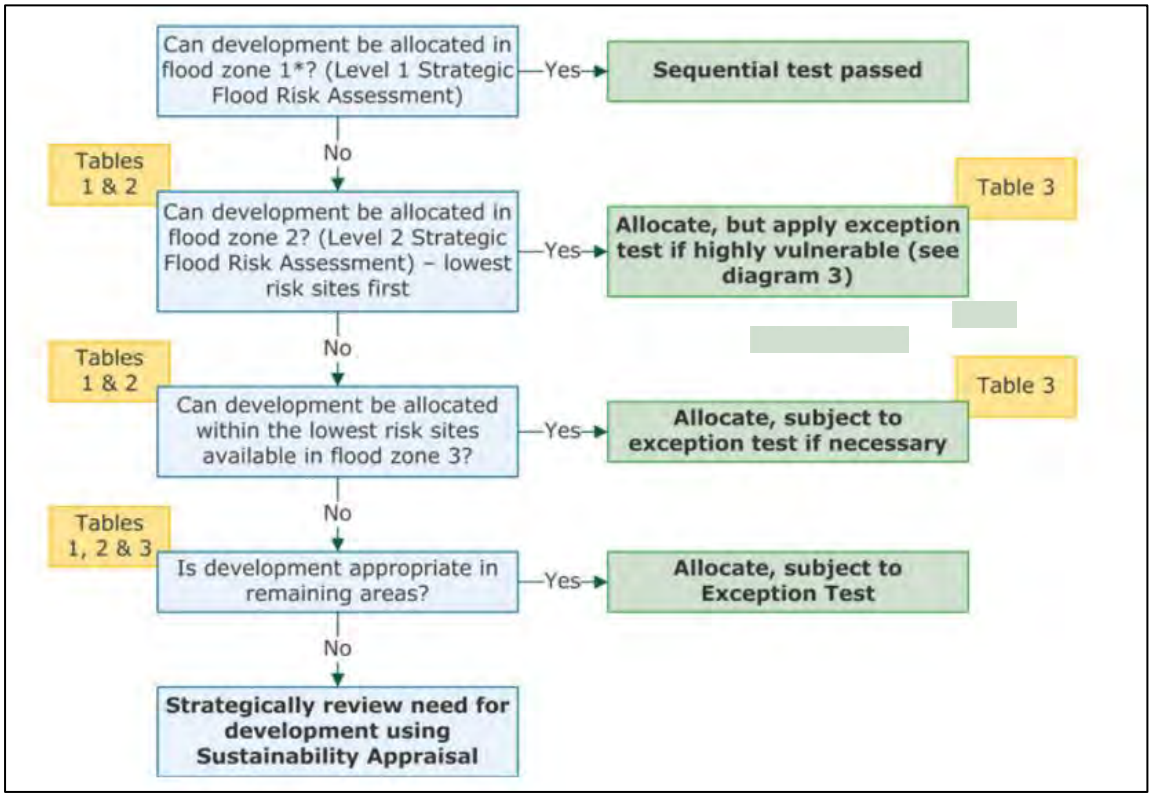


Figure 4-1: Local Plan sequential approach to site allocation[17].

[17] Diagram is an excerpt of Diagram 2 in the Planning Practice Guidance Flood Risk and Coastal Change document. Available here: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/963382/Diagram_2.pdf

4.2.3 The Exception Test

If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted.

Figure 4-2 summarises the Exception Test. An LPA should apply the Exception Test to strategic allocations. For all developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test. This is because when a site-specific Flood Risk Assessment is done, more information on the exact measures that can manage the risk is available.

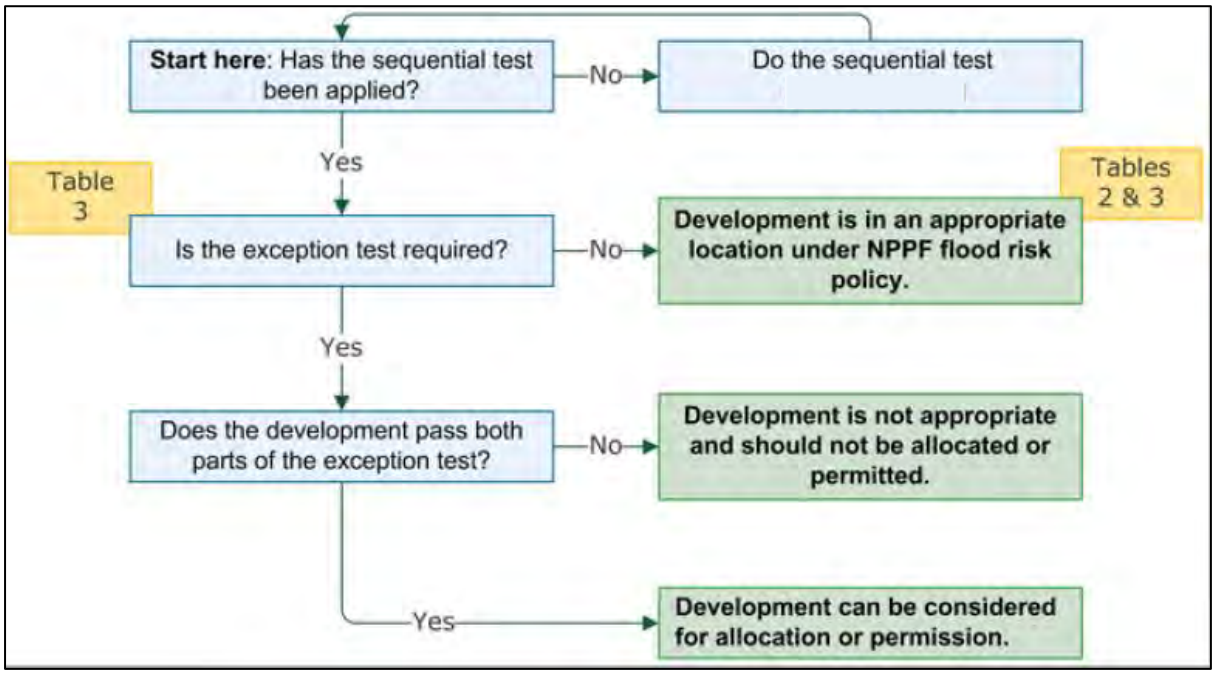


Figure 4-2: The Exception Test[18]

The Exception Test should only be applied following the application of the Sequential Test. It applies in the following instances:

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

[18] Diagram is an excerpt of Diagram 3 in the Planning Practice Guidance Flood Risk and Coastal Change document. Available here: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/963383/Diagram_3.pdf

4.3 NPPF Guidance SuDS Policy (April 2015)

SuDS are an approach to managing direct rainwater and surface water that replicates natural drainage, the key objectives being to manage flow rate and volume of runoff to reduce risk of flooding and water pollution. The NPPF (paragraph 169) states that major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. LLFAs such as NYCC and SDC need to provide advice which must be taken account of with respect to the systems used. SuDS themselves must have appropriate proposed minimum operational standards and have maintenance arrangements in place to ensure acceptable standard or operation for the lifetime of the development. Where possible SuDS should provide multifunctional benefits.

As a LLFA, NYCC is also a statutory consultee for SuDS applications and will need to be consulted on the drainage elements of planning applications for major development to ensure they conform to necessary national and local SuDS standards. The legislation also encourages the use of SuDS in minor developments.

5. SFRA Methodology

5.1 Level 1 SFRA Approach

The Level 1 SFRA is a desk-based study, using readily available existing information and additional modelling datasets to enable the application of the Sequential Test and to identify where the Exception Test may be required. The main tasks in preparing the Level 1 SFRA are described below.

1. **Establishing relationships and understanding the planning context** - Upon project commencement, stakeholder meetings were held to facilitate relationships between the project team, the client group, and third-party stakeholders. The purpose of the meetings was to aid collaborative working and the free exchange of available information and datasets. SDC provided an overview of the current planning context with respect to the preparation of the SFRA and the main flood risk issues in the area were identified and discussed with both SDC and the Environment Agency.
2. **Gathering data and analysing it for suitability** - Under Section 14 of the NPPF, the risk of flooding from all sources must be considered as part of a Level 1 SFRA, including flooding from tidal sources, rivers (fluvial), land (overland flow and surface water), groundwater, sewers and artificial sources. In order to provide this assessment of all sources of flooding in the study area, an extensive set of datasets was referenced or relicensed for use. This information was subject to a quality review and gap analysis by the project team to determine the best datasets for inclusion in the Level 1 SFRA update.
3. **Producing strategic flood risk maps, GIS deliverables and a technical report** - A series of GIS maps have been produced to illustrate flood risk across the study area. The mapping deliverables are included within **Appendix A**.

5.2 Checklist on factors to trigger an update to the Level 1 SFRA

The following list provides examples of when an update to the Level 1 SFRA may be required.

1. A significant flood event occurs, following which relevant information should be detailed within an addendum to the Level 1 SFRA. The following information should be included:
    - The mapped extent of the flooding;
    - The date on which the event occurred;
    - The source of the flooding;
    - If known, the AEP of the flood event – the likelihood of an event of the same magnitude occurring in any given year;
    - Any amendments to medium and high flood risk areas carried out by the Environment Agency as a result of the flooding.
2. The NPPF or PPG are amended, with subsequent impacts on the approach to flood risk, for example:
    - An amendment is made to the application of the Sequential or Exception Test;
    - An amendment is made to the definition of fluvial flood zones;
    - Land use vulnerability definitions, presented in the PPG, are amended;
    - The approach to management of SuDS is amended.
3. The Environment Agency releases updates or amendments to its detailed modelling of the designated Main Rivers or amends its standing advice. An update would be required if:
    - Updates to the models alter the 5% AEP plus climate change (defended), 1% AEP (undefended), 1% AEP plus climate change (defended) or 0.1% AEP (undefended) outline. If this is the case Flood Zone 3b, Flood Zone 3a, Flood Zone 3 with climate change and Flood Zone 2 should be re-mapped within the Level 1 SFRA;

- If any other flood risk data is updated, such that the SFRA does not provide the most relevant and up to date information;
- Environment Agency standing advice is altered so that it is no longer in-line with Flood Risk Management Policy Considerations, or other guidance within this Level 1 SFRA. Should this be the case, it is recommended that the Environment Agency is consulted.

5.3 Flooding from Rivers and Sea

5.3.1 Main Rivers

The Environment Agency 'Statutory Main River Map' has been used to identify Main Rivers within the study area. These rivers are usually larger rivers and streams which are designated by the Environment Agency as Main Rivers. The Environment Agency has permissive powers to carry out maintenance, improvements or other work on Main Rivers to mitigate flood risk.

5.3.2 Ordinary Watercourses

The Ordnance Survey 'OS Open Rivers' mapping dataset has been used to identify Ordinary Watercourses within the Selby District. In the Selby District, Ordinary Watercourses fall under the jurisdiction of:

- Selby IDB - Ordinary Watercourses to the north of the River Aire to the area of Barkston Ash, Church Fenton and Wharfe's Mouth (where the River Wharfe forms a confluence with the River Ouse, responsible for the water level management within the low lying catchment areas of the River Aire and River Ouse;
- Ainsty IDB - Ordinary Watercourses to the north of Barkston Ash, Church Fenton and Wharfe's Mouth to the northern boundary of Selby District;
- Ouse and Derwent IDB - Ordinary Watercourses to the east of the River Wharfe;
- Danvm Drainage Commissioners - Ordinary Watercourses to the south of the River Aire. The IDB is responsible for the water level management of the River Aire, River Went, River Don, Ea Beck, River Dearne, River Dove and Aire & Calder Navigation, which rely upon pumping water from low lying areas; and
- North Yorkshire County Council (watercourses located within Selby District beyond the operational IDB areas).

Appendix A, Figure 3 Surface Waterbodies

5.3.3 NPPF Flood Zones

The 'Flood Map for Planning (Rivers and Sea)', available on the Environment Agency website[19], is the main reference for planning purposes as it maps Flood Zones 1, 2 and 3 in accordance with the PPG (The NPPF Flood Zones are defined in Section 4 , Table 4-1). The 'Flood Map for Planning (Rivers and the Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain.

The 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling (JFLOW) and is now routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys and hydrological and/or hydraulic modelling as well as previous flood events.

It should be noted that the scope of these modelling studies typically covers flooding associated with Main Rivers, and Ordinary Watercourses that form tributaries to the Main Rivers may not always be included in the model. Modelling of Ordinary Watercourses may need to be refined when determining the probability of flooding for an individual site and preparing a site-specific FRA.

Flood Zone GIS layers have been provided by the Environment Agency for the study area and are presented in **Appendix A Figure 8**.

[19] Environment Agency Flood Map for Planning (Rivers and Sea) https://flood-map-for-planning.service.gov.uk/

It should be noted that additional flood risk mapping is available on the Environment Agency website which is referred to as 'Risk of Flooding from Rivers and Sea'[20]. This map takes into account the presence of flood defences and how the standard of protection they offer affects the relative risk of flooding to land and property. While flood defences reduce the level of risk, they do not completely remove it as they can be overtopped or fail in extreme weather conditions, or if they are in poor condition. As a result, the maps may show areas behind defences which still have some risk of flooding. This mapping has been made available by the Environment Agency as the primary method of communicating flood risk to members of the public, however for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information.

5.3.4 Functional Floodplain – Flood Zone 3b

The Functional Floodplain is defined in the NPPF as '*land where water has to flow or be stored in times of flood*'. The Functional Floodplain (also referred to as Flood Zone 3b), is not distinguished from Flood Zone 3a on the Flood Map for Planning (Rivers and Sea). Rather the SFRA is the means by which LPAs should identify areas of Functional Floodplain in discussion with the Environment Agency.

For the purposes of this SFRA, identification of the functional floodplain for the Rivers Aire, Ouse and Wharfe has been undertaken using modelled data to define the land area which would naturally flood with 5% AEP extent or greater in any year and identifying land which is designed to flood (such as a flood attenuation scheme, washland or flood storage area). Details on where modelled data was available are set out in Section 7 of this report. Where modelled data was available to define the extent of Flood Zone 3b for the Selby District, this is shown in **Appendix A Figure 8**.

For watercourses where modelled data for a 5% AEP extent was not available hydraulic modelling should be undertaken as part of a site specific flood risk assessment to establish the extent of the functional floodplain should the site be located within Flood Zone 3.

Areas which would naturally flood with a 5% AEP extent or greater but are prevented from doing so by existing infrastructure or solid buildings will not be defined as functional floodplain. This approach has been discussed with and agreed by the Environment Agency.

Appendix A, Figure 8 Flood Map for Planning

5.4 Flood Defences

The 'Flood Map for Planning (Rivers and Sea)' identifies areas which, in the event of a fluvial flood with a 1% AEP or a tidal flood with a 0.5% AEP, would be protected from flooding by the presence of flood defences. These areas are described as 'Areas Benefitting from Defences' (ABD). Any areas which benefit from defences not owned by the Environment Agency are not represented on this map.

Flood defences and areas benefitting from flood defences in the study area are presented in **Appendix A Figure 8**.

Flood defences are structures which affect flow in times of flooding in order to reduce the risk of water entering property and land. They generally fall into one of two categories described as 'formal' or 'informal':

- A 'formal' flood defence is a structure which has been specifically built to control floodwater. It is maintained by its owner or statutory undertaker so that it remains in the necessary condition to function. In accordance with the Flood and Water Management Act, the Environment Agency has powers to construct and maintain defences to help against flooding.
- An 'informal' defence is a structure that has not necessarily been built to control floodwater and is not maintained for this purpose. This includes road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as water retaining structures or create enclosures to form flood storage areas in addition to their primary function. Natural high ground is not included within **Appendix A Figure 8**.

[20] Environment Agency 'Risk of Flooding from Rivers and Sea' https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=463722.696&northing=152577.6

5.4.1 Standards of Protection

Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in areas at risk of flooding. For example, a flood defence with a 1% AEP SoP means that the flood risk in the defended area behind the defence is reduced to at least a 1% AEP chance of flooding in any given year.

Over time, due to deterioration in condition or increases in flood risk due to climate change, the SoP provided by the flood defence may decrease. The understanding of SoP may also change over time as RMAs undertake more detailed surveys and flood modelling studies.

As part of a detailed FRA developers/planners should consider the actual standard of protection provided by defences and residual risk now and in the future.

5.4.2 Maintenance

As outlined in Section 3, the Environment Agency and Local Authorities have permissive powers to maintain and improve Main Rivers and Ordinary Watercourses, respectively. There is no legal duty to maintain watercourses, defences or assets and maintenance and improvements are prioritised based on risk. The ultimate responsibility for maintaining watercourses rests with the landowner.

Highways Authorities have a duty to maintain public roads, making sure they remain safe, passable, and the impacts of severe weather have been considered. Water Companies have a duty to drain their area and their assets are maintained to common standards. Improvements are prioritised for the parts of the network that do not meet these standards e.g. areas where frequent highway or sewer flooding occurs.

In areas where flood alleviation measures are not maintained regularly there is potential for the risk of flooding to increase. Breaches in raised flood defences are most likely to occur where the condition of a flood defences has deteriorated over time. In urban areas, drainage networks can frequently become blocked with debris which can potentially lead to blockages at culverts or bridges.

Developers should contact the relevant RMA about current and likely future maintenance arrangements for any defence, asset or watercourse and ensure future users of the development are aware of their obligations to maintain watercourses.

Formal structural flood defences are given a rating based on a grading system for their condition. A summary of the grading system used by the Environment Agency for condition is summarised in Table 5-1.

Table 5-1: Environment Agency Grading system to assess flood defence condition

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no effect on performance
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very Poor	Severe defects resulting in complete performance failure.

Source: Condition Assessment Manual – Environment Agency 2006

The flood defences around the River Aire benefit the areas to the north of the river, from Birkin eastwards towards Burn, Camblesforth and Newland, close to the boundary of the District. The flood defences around the River Ouse benefit areas south of the river, along the upper Humber Estuary from Drax, northwest to Wistow. There are also large extents of flood defences along the River Wharfe and its tributary the Fleet, the River Derwent and the River Went.

A study of informal flood defences has not been made as part of this assessment. Should any changes be planned in the vicinity of road or railway crossings over rivers in the study area it would be necessary to assess the potential impact on flood risk to ensure that flooding is not made worse either upstream or downstream. Smaller scale informal flood defences should be identified as part of site specific FRAs and the residual risk of their failure assessed.

A high-level review of formal flood defences has been carried out using data from the Environment Agency Asset Information Management System (AIMS). The AIMS dataset contains details of flood defence assets associated with Main Rivers and tidal defences and provides a good starting point for identifying significant local defences and potential areas benefiting from defences, but the quantity and quality of information provided differs considerably between structures. The AIMS is intended to provide a reasonable indication of the condition of an asset at a point in time and should not be considered to contain consistently detailed and accurate data (this would be undertaken as part of a Level 2 SFRA or site-specific FRA where the need arises).

Appendix A, Figure 8 Flood Map for Planning

5.5 Flood Warning Areas

The Environment Agency provides a free Flood Warning Service[21] for many areas at risk of flooding from rivers and the sea. In some parts of England, the Environment Agency may be able to provide warnings when flooding from groundwater is possible. The Environment Agency has provided a GIS layer of Flood Warning Areas in the study area which are presented in **Appendix A Figure 9**.

Appendix A, Figure 9 Flood Alert and Flood Warning Areas

5.6 Flooding from Surface Water

Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run quickly off land and result in localised flooding.

5.6.1 Historic Records of Surface Water Flooding

Historic flooding records have been compiled from the North Yorkshire County Council Highway Authority. These records have been obtained and used to inform this Level 1 SFRA and where possible, the source of flooding has been identified. Records of flooding which are reported to be from a surface water source are discussed in Section 7.4.

5.6.2 Risk of Flooding from Surface Water

The Environment Agency has undertaken a national scale surface water flood risk mapping exercise identifying those areas at risk of surface water flooding during three annual probability events:

- 3.33% AEP;
- 1% AEP; and
- 0.1% AEP.

The latest version of the mapping is referred to as the 'Risk of Flooding from Surface Water' (RoFSW) and has been generated through a combination of new hydraulic modelling undertaken by the Environment Agency and collation of modelled extents produced by some LLFAs. The modelled extents from the RoFSW data set have been made available for the Level 1 SFRA and the outputs have been mapped.

The RoFSW provides all relevant stakeholders, such as the Environment Agency, LPAs and the public with access to information on surface water flood risk which is consistent across England and Wales[22]. The modelling helps the Environment Agency take a strategic overview of flooding and assists LLFAs in their duties relating to management of surface water flood risk. For the purposes of this SFRA, the mapping provides an understanding of areas within the study area which may have a surface water flood risk using a consistent set of data.

However, it should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas;

[21] Environment Agency (2018) *Flood Warning and Alert Areas,* Available from: https://check-for-flooding.service.gov.uk/alerts-and-warnings [Accessed July 2022]
[22] Environment Agency Flood Risk from Surface Water https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

- It does not show the susceptibility of individual properties to surface water flooding;
- The mapping has significant limitations for use in flat areas;
- No explicit modelling of the interaction between the surface water network, the sewer systems and watercourses is included;
- In a number of areas, modelling has not been validated due to a lack of surface water flood records; and,
- As with all models, the RoFSW is affected by a lack of, or inaccuracies in, available data.

The RoFSW for the study area is presented in **Appendix A Figure 10**.

Appendix A, Figure 10 Risk of Flooding from Surface Water

5.7 Flooding from Groundwater

Groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and often intersects the surface in valley bottoms providing baseflow for rivers and streams.

5.7.1 Areas Susceptible to Groundwater Flooding

This SFRA has used the Environment Agency's dataset 'Areas Susceptible to Groundwater Flooding' (AStGWF) which indicates where groundwater may emerge due to geological and hydrogeological conditions. This information is shown as a proportion of 1km grid squares where there is potential for groundwater emergence. The data does not show where flooding is likely to occur, but instead should be used at a strategic level to indicate areas for further investigation.

Groundwater flooding risks are often highly localised, and dependent upon geological interfaces between permeable and impermeable subsoils. It is therefore essential that an understanding of site-specific ground conditions is achieved through site survey and/or review of detailed borehole data.

The AStGWF dataset has been mapped in **Appendix A Figure 11**. The AStGWF data should not be used on its own to make planning decisions at any scale, and, in particular, should not be used to inform planning decisions at the site scale.

Appendix A, Figure 11 Areas Susceptible to Groundwater Flooding

5.7.2 Source Protection Zones

The Environment Agency has defined Groundwater Source Protection Zones (SPZ), which identify risk of contamination to the groundwater source from activities that may cause pollution in the area. These zones are used to set up pollution prevention measures in areas which are at higher risk, and to monitor the activities of potential polluters nearby.

Table 5-2 shows that SPZs can be one of four zones depending on the time it takes for water to travel to the point of abstraction, or the percentage of the entire resource (whichever is the greater). The SPZs for Selby District have been mapped in **Appendix A Figure 12**.

Table 5-2: SPZ Classifications

SPZ	Classification
Inner Zone (SPZ 1)	This zone is 50 day travel time of pollutant to source with a 50 metres default minimum radius.
Outer Zone (SPZ 2)	This zone is 400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken.
Total catchment (SPZ 3)	This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.
Zone of special interest (SPZ 4)*	This zone is where local conditions require additional protection.

*Note there are no areas classified as being within Zone of special interest (SPZ 4) in the SDC study area

For this Level 1 SFRA, options for infiltration-based SuDS are considered as potentially constrained if the development site is within SPZ 1 due to the potential impact on water abstractions and also where the superficial geology permeability is low. The use of SuDS in these areas will potentially be limited to attenuation features, which are likely to require relatively more surface area to provide the required attenuation volumes.

Appendix A, Figure 12 Groundwater Source Protection Zones

5.8 Flooding from Sewers

During heavy rainfall, flooding from the sewer system may occur if:

1. The rainfall event exceeds the capacity of the sewer system/drainage system:

Sewer systems are typically designed and constructed to accommodate rainfall events with a 3.3% AEP or less. Therefore, rainfall events with an AEP of a frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While YWSL, as the sewerage undertaker for the study area, recognise the impact that more extreme rainfall events may have, it is not cost beneficial to construct sewers that could accommodate every extreme rainfall event.

2. The system becomes blocked by debris, sediment or fat:

Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris (e.g. litter). Fat build up within the main sewer system is also a contributing factor of sewer flooding.

3. The system surcharges due to high water levels in receiving watercourses:

Within the study area there is potential for surface water outlets to become submerged due to high river levels. When this happens, water may be unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will overflow into streets and potentially into houses. Where the local area is served by ‘combined’ sewers i.e. containing both foul and storm water, if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will potentially contain untreated sewage.

5.8.1 Historic Records

YWSL has provided an extract from their DG5 Flood Register for the study area, which records historic internal and external sewer flooding events. Due to data protection requirements the data has not been provided at individual property level; rather the register comprises the number of properties within four digit postcode areas that have experienced flooding either internally or externally within the last 10 years[23].

The DG5 Register of internal and external property flooding has been presented in **Appendix A Figure 13**.

It should be noted that records only appear on the DG5 register where they have been reported to YWSL, and as such they may not include all instances of sewer flooding. Furthermore, given that YWSL target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding in the future.

Appendix A, Figure13 Sewer Flooding Records

5.9 Flooding from Artificial Sources

5.9.1 Risk of Flooding from Reservoirs

The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The PPG encourages LPAs to identify any impounded reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment it is located within, and / or whether emergency draw-down of the reservoir will add to the extent of flooding.

The Environment Agency dataset 'Risk of Flooding from Reservoirs' available online identifies areas that could be flooded if a large[24] reservoir was to fail and release the water it holds. The mapping has been used to identify the risk across the study area and is shown in **Appendix A Figure 14**. There are two flooding scenarios prepared to show reservoir flood risk. They are 'dry-day' and a 'wet-day' scenarios. The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The 'wet-day' scenario predicts how much worse the flooding might be if a river is already experiencing an extreme flood event.

Reservoirs in the UK have an extremely good safety record. The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected, and essential safety work is carried out. These reservoirs therefore present a managed risk.

SDC and North Yorkshire County Council are responsible for working with members of the Local Resilience Forum (LRF) to develop emergency plans for reservoir flooding and ensuring communities are well prepared.

Appendix A, Figure 14 Reservoir Flood Risk

5.9.2 Risk of Flooding from Canals

Canal flooding may occur as a result of their capacities being exceeded and/or as a result of raised embankment failure. The latter can happen suddenly resulting in rapidly flowing, deep water that can cause significant threat to life and major property damage.

There are two canal systems in Selby District, the Aire and Calder Navigation and the Selby Canal, the locations of which are shown in **Appendix A Figure 3**. Further details on the canal systems are provided in Section 2.3.4.

Canal embankment failure has been known to happen occasionally, but the impact is not considered to be as extensive as a failure of a reservoir dam as studies have shown that maximum discharges are limited to the volume held within the canal section between adjacent up and down stream locks (known as a pound) . This residual risk is managed by the Canal and River Trust (CRT) who perform regular towpath side inspections and other inspections.

[23] The record presented in this report covers the period of 2006-2016
[24] A large reservoir is one that holds over 25,000 cubic metres of water, equivalent to approximately 10 Olympic sized swimming pools.

Canals are considered to be controlled waterbodies, so flood risk is deemed to be minimal unless overtopped in storm conditions. There is, however, a residual risk of structural failure in both wet and dry conditions. The CRT is not a flood defence body, although they do manage some critical flood defence structures including flood gates.

Water control manuals have been prepared by the CRT across the country. The principal behind these is to record what actions have to be taken to control feeds and structures in both normal and what is considered by the CRT to be flood conditions.

5.10 Actual and Residual Flood Risk

A Level 2 SFRA (for strategic allocations) or developer site-specific Flood Risk Assessment will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail.

5.10.1 Actual Flood Risk

This is the risk to the site considering existing flood defence or mitigation measures through new development.

The assessment of the actual risk should take into account that:

- The standard of protection provided by existing defences might be less than the appropriate standards and therefore may need to be improved if further growth is considered.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for this to be reviewed.
- The standard of protection provided by a flood defence or mitigation measure must be maintained over the lifetime of the development. The effects of climate change will reduce the current existing standard of protection provided by defences over the lifetime of the development and commitment is required to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained. In addition, land that is required for affordable future flood risk management measures must be secured and safe guarded where necessary.
- It is possible to assess the level of hazard posed by flood events to a development by understanding the depth, velocity, speed of onset and rate of rise of floodwater.

5.10.2 Residual Risk

Residual risk is the risk that remains after the effects of flood risk infrastructure have been taken into account. It is important that residual risks are quantified to confirm that the consequences of flooding can be safely managed. The residual risk can be:

- A larger flood than defences were designed to protect against (the ‘design flood’). This can cause overtopping of flood walls or embankments, failure of flood gates to operate with the level of flow or failure of pumping systems to manage the incoming amount of water; and
- Failure of the defences or flood risk management measures, such as breaches in embankments or walls, failure of flood gates to open or close or failure of pumping stations.

The assessment of the residual risk should take into account:

- The flood hazard, depth and velocity that would result from overtopping or breach of defences. The Environment Agency can provide site-specific development level advice or information, where available, on breach/ overtopping parameters for flood models;
- The design of the development to take account of the highest risk parts of the site e.g. allowing for flood storage within the site or considering the design of the development to keep people safe (e.g. sleeping accommodation above the flood level); and
- A safe means of access and egress from the site including a warning system, where practical, in the event of a flood for users of the site and emergency services.

5.11 Cumulative Impacts

Under the NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRAs), are required to '*consider cumulative impacts in, or affecting, local areas susceptible to flooding*' (para. 160), rather than just to or from individual development sites. In short, whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments within the district may be more severe.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream.

Previous policies have relied on the assumption that if each individual development does not increase the risk of flooding, the cumulative impact will also be minimal. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, in theory they should not increase flood risk downstream. However, if there is a lot of development occurring within one catchment, particularly where there is flood risk to existing properties or where there are few opportunities for mitigation, the cumulative impact may be to change the flood response of the catchment.

The risk of this could be identified at a high level, by comparing potential development site locations with hydrological catchments and areas of existing and historic risk to people and property. These will be the locations where existing communities will be most concerned at the prospect of further development exacerbating existing problems.

The NPPF requirements for consideration of cumulative flood risk can be addressed with:

- Stricter controls on minor extensions due to the potential cumulative impacts on for example fluvial flood storage or on surface water;
- Stricter requirements on the management of surface water, because of the potential cumulative impact of multiple small-scale developments located in a small area in an urban catchment;
- A requirement for local sewer capacity checks to become a material consideration in the planning process with waste utility companies forming part of the regulatory consultee on future planning applications.

Detailed conclusions on cumulative effect however would require certainty on which sites would be likely to be allocated, the size/density of the development[25], and potentially hydraulic modelling to test impacts downstream

[25] Depending on the density of the development this could have greater effects downstream. This could also have impacts on how the Flood Zone boundaries are changed in the future, with previous Flood Zone 1 and 2 sites being upgraded to Flood Zone 3, especially given up-rated climate change allowances.

6. Climate Change Impacts

Climate change projections suggest an increased chance of warmer, wetter winters and hotter, drier summers with a higher likelihood of more frequent and intense rainfall. As a consequence, severe flooding is likely to occur more often in the future.

In accordance with the NPPF, flood risk should be managed now and over the lifetime of a development, taking climate change into account. This section outlines how the impact of climate change should be considered.

6.1 Environment Agency Climate Change Guidance

The Environment Agency published updated climate change guidance in July 2021 and May 2022, on how allowances for climate change should be accounted for in both strategic and site specific FRAs. The guidance uses a risk based approach dependent on the vulnerability of the development.

Climate change allowances are predictions of anticipated change for:

- Peak river flow
- Peak rainfall intensity
- Sea level rise
- Offshore wind speed and extreme wave height

There are allowances for different climate change scenarios over different epochs, over the coming century, including for extreme scenarios.

6.2 Relevant Climate Change Allowances for Selby District

6.2.1 Sea Level Allowances

The climate change sea level allowances for the Humber River Basin District are presented in Table 6-1 below.

For flood risk assessments and strategic flood risk assessments, both the higher central and upper end allowances must be assessed to understand the range of impact.

Table 6-1: Sea level allowances by river basin district for each epoch in mm per year (based on a 1981 to 2000 baseline) – the total sea level rise for each epoch is in brackets[26]

River basin District	Allowance category	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)
Humber	Upper end	6.7 (235)	11 (330)	15.3 (459)	17.6 (528)
	Higher central	5.5 (193)	8.4 (252)	11.1 (333)	12.4 (372)

6.2.2 Peak River Flows

For the purposes of strategic planning and completion of the sequential test, LPAs are advised to use the '2070 to 2125' 100-year development lifetime outlined in Table 6-2 below relating to residential development. For more vulnerable, residential development this correlates to a climate change range of impacts of between + 23% and + 54% increase on the 1% AEP flow.

[26] Environment Agency (2017) *Flood Risk Assessments: Climate Change Allowances,* Available from: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances [Accessed July 2022]

Table 6-2: Climate change allowances for peak flow increase in the Selby District[27]

Management catchment	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2125)
Derwent Humber	Upper end	33%	35%	54%
	Higher central	22%	22%	33%
	Central	18%	17%	24%
Aire and Calder	Upper end	24%	31%	51%
	Higher central	15%	18%	31%
	Central	11%	13%	23%
Wharfe and Lower Ouse	Upper end	22%	29%	48%
	Higher central	14%	18%	31%
	Central	11%	13%	23%

At a site level, when considering peak river allowances the NPPF flood zone and flood risk vulnerability classification needs to be considered to confirm which range of climate change allowances should be assessed. This is set out in Table 6-3 below.

Table 6-3: NPPF Flood Zone and Vulnerability

NPPF flood risk vulnerability classification	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Essential Infrastructure	Higher Central allowance	Higher Central allowance	Higher Central Allowance
Highly Vulnerable	Central allowance	Development should not be permitted	Development should not be permitted
More Vulnerable	Central allowance	Central allowance	Development should not be permitted
Less Vulnerable	Central allowance	Central allowance	Development should not be permitted
Water Compatible	Central allowance	Central allowance	Central allowance

In order to determine which allowance category to use, the development lifetime should be considered. This should be judged based on the characteristics of development and applicants should be able to justify the chosen lifetime.

Typically:

- Residential developments should apply a minimum lifetime of 100 years, unless there is specific justification for considering a shorter period;
- Non- Residential developments should apply a 75-year lifetime.

Therefore, in this locality, if a residential (more vulnerable/100-year lifetime) development were proposed within Flood Zone 3a the 'Central allowance' should be applied typically to the 1% AEP flow to account for the potential impacts of climate change on peak river flows.

[27] Environment Agency (2022) *Climate Change Allowances for peak river flow in England,* Available from: https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow [Accessed July 2022]

6.2.3 Peak Rainfall Intensity Allowances

Although it is possible to make qualitative statements as to whether extreme rainfall is likely to increase or decrease over the UK in the future, there is still considerable uncertainty regarding the magnitude of these changes locally.

Peak Rainfall intensity allowances were recently updated (May 2022) which has redefined the way that peak rainfall intensity is assessed. Peak Rainfall intensity allowances presented below (refer to Table 6-4) apply to the Selby District (by Management Catchment) for catchments less than 5km^2 and urbanised drainage catchments. SDC should be contacted in the case that there is any doubt regarding whether a catchment is urban or rural.

For modelling large areas (larger than 5km^2) with rural land use, direct rainfall modelling is unlikely to be appropriate and fluvial flood risk should be assessed using the peak river flow allowance, presented in Section 6.2.2.

Table 6-4 and Table 6-5 shows the peak rainfall intensity allowances that apply in the Selby District.

Table 6-4: Peak rainfall intensity allowances for small and urban catchments for 3.3% AEP event

Management catchment	Allowance category	Total potential change anticipated for '2050s' (2022 to 2060)	Total potential change anticipated for '2070s' (2061 to 2125)
		3.3% AEP	3.3% AEP
Derwent Humber	Upper end	35%	40%
	Central	20%	25%
Aire and Calder	Upper end	35%	40%
	Central	20%	25%
Wharfe and Lower Ouse	Upper end	35%	40%
	Central	20%	25%

Table 6-5: Peak rainfall intensity allowances for small and urban catchments for 1% AEP event

Management catchment	Allowance category	Total potential change anticipated for '2050s' (2022 to 2060)	Total potential change anticipated for '2070s' (2061 to 2125)
		1% AEP	1% AEP
Derwent and Humber	Upper end	40%	40%
	Central	25%	30%
Aire and Calder	Upper end	40%	45%
	Central	25%	30%
Wharfe and Lower Ouse	Upper end	40%	40%
	Central	25%	30%

6.3 Climate Change and Surface Water Flood Risk

Although it is possible to make qualitative statements as to whether extreme rainfall is likely to increase or decrease over the UK in the future, there is still considerable uncertainty regarding the magnitude of these changes locally.

The Environment Agency Risk of Flooding from Surface Water mapping does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However, a range of three annual probability events have been undertaken, 3.3%, 1% and 0.1% AEP and therefore it is considered appropriate to use the 0.1% AEP event as a substitute dataset (proxy) to provide a worst-case scenario and an indication of the implications of climate change.

When assessing climate change impacts for surface water runoff at a site level, consideration is given to the changes in peak rainfall intensity over the lifetime of the development. For developments with a lifetime beyond 2100 the upper end allowances for peak rainfall intensity must be used for flood risk assessments. Both the 1% AEP and 3.3% AEP events must be assessed for the 2070s epoch. The development must be designed so that for the

upper end allowance in the 1% AEP event there is no increase in flood risk elsewhere and ensuring the development will be safe from surface water flooding[22].

For development with a lifetime of between 2061 and 2100 the central allowance must be used for flood risk assessments. Both the 1% AEP and 3.3% AEP events must be assessed for the 2070s epoch. The development must be designed so that for the central allowance in the 1% AEP event there is no increase in flood risk elsewhere and ensuring the development will be safe from surface water flooding[22].

For development with a lifetime of up to 2060 the central allowance must be used for flood risk assessments. Both the 1% AEP and 3.3% AEP events must be assessed for the 2050s epoch. The development must be designed so that for the central allowance in the 1% AEP event there is no increase in flood risk elsewhere and ensuring the development will be safe from surface water flooding[22].

In some locations the allowance for the 2050s epoch is higher than that for the 2070s epoch. If so, and development has a lifetime beyond 2061, use the higher of the two allowances. Contact Selby District LLFA for advice on which allowance to use.

The rainfall intensity allowances are specified in Table 6-4 and Table 6-5 for the Selby District.

6.4 Climate change modelling for the 2022 SFRA

For the purpose of the 2022 Level 1 SFRA it has been agreed with the Environment Agency that where hydraulic modelling data is available for climate change scenarios, this data is mapped as outlined below and presented in **Appendix A Figure 15**:

Climate Change allowances modelling is available for the River Ouse, River Wharfe and River Aire which uses relevant climate change allowances or suitable proxies that have been agreed with the Environment Agency. These model simulations have used a 1% AEP flow with relevant climate change uplifts.

A tidal sensitivity simulation was completed to assess the associated flooding if a 0.5% AEP tide occurred on the River Ouse. This scenario includes relevant climate change uplifts.

For all other fluvial watercourses in the study area, Flood Zone 2 should be used as a climate change proxy for the 1% AEP event in the absence of specific modelling until such time as detailed modelling is completed for site specific FRAs, or at a future date by the Environment Agency or North Yorkshire County Council as the LLFA.

Appendix A, Figure 15 Climate Change Allowances

6.5 Adaptation for Climate Change

The PPG sections on climate change contain information and guidance on 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.

7. Understanding Flood Risk in the Selby District

This Section provides a strategic summary of flood risk across the Selby District from each of the sources of flooding outlined in the NPPF. For each source of flooding, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This section should be read with reference to the mapping figures in **Appendix A**.

This Chapter should be used by Developers to identify the flood risk issues they need to consider in greater detail in a site-specific Flood Risk Assessment to support a Planning Application.

7.1 Historical Flooding

Where available, flood incident records held by the project stakeholders, including SDC, North Yorkshire County Council, the Environment Agency and YWSL have been provided to support this Level 1 SFRA update. There is a long history of flooding within Selby District and several large events have occurred in the last 60 years, with the main sources of flooding being predominantly from fluvial and surface water sources.

A summary of flood events is shown below in Table 7-1.

Table 7-1: Incidents of Historic Flooding in Selby District

Flood Event	Source of Flooding	Description (record source in brackets, where available)
March 1947	Fluvial (River Ouse)	Selby, Wistow, Kelby, Cawood and Thorpe Willoughby
March 1968	Fluvial (River Wharfe, River Ouse)	Ulleskelf, Bolton Percy, Appleton Roebuck, Acaster Selby, Cawood and Ryther
January 1982	Fluvial and Artificial (River Wharfe, River Ouse)	Tadcaster, Selby.
Autumn 2000	Fluvial (River Derwent)	Over 200 properties in the Derwent catchment were affected by flooding.
October/ November 2000	Fluvial (River Aire)	Serious flooding on whole length of Aire after a long period of heavy rainfall (250mm over a two week period at some locations) throughout the catchment.
November 2000	Surface Water Flooding	Brotherton
November 2000	Fluvial (River Wharfe, and River Ouse)	Tadcaster, Selby, Barlby, Riccall. River Ouse reached its highest recorded level. Additional flood barriers completed in Selby following this event.
February 2002	Fluvial (River Wharfe)	Tadcaster.
August 2002	Fluvial (River Aire)	The River caused flooding at Beal to Birkin Road.
Unknown 2004	Not confirmed	A64/ M1 (Highways England)
Unknown 2005	Not confirmed	A64/ M1 (Highways England)
June 2007	Fluvial (Selby Dam, Whin Dike and Town Dike)	Thorpe Willoughby and South Milford
	Surface Water Flooding	South Milford and Saxton (NYCC Highways)
February 2008	Surface Water Flooding	Brotherton
September 2012	Surface water and sewer flooding	Surface water flooding on Bridge Street, Tadcaster occurred prior to flooding from the River Wharfe and coincided with very high river levels, which prevented the sewer system from discharging. North Yorkshire County Council Flood Investigation Report[28]

[28] North Yorkshire County Council (2017) Flood Investigation Report: Tadcaster. Available from: https://www.northyorks.gov.uk/sites/default/files/fileroot/Environment%20and%20waste/Flooding/Tadcaster%20S19%20Version%204%20final%20for%20publication.pdf [Accessed August 2018]

Flood Event	Source of Flooding	Description (record source in brackets, where available)
	Fluvial (River Wharfe)	Flooding to properties in Tadcaster
	Surface Water Flooding	Bolton Percy (NYCC Highways)
Unknown 2012	Not confirmed	A64/ M1 (Highways England)
Unknown 2013	Not confirmed	A64/ M1 (Highways England)
	Surface Water Flooding	Eggborough (NYCC Highways)
December 2013	Tidal (Tidal River Ouse)	Acaster Selby
Unknown 2014	Not confirmed	A64/ M1 (Highways England)
August 2014	Surface water and sewer flooding	Surface water flooding on Bridge Street, Tadcaster as a result of heavy and localised rainfall that exceeded the design capacity of the drainage network in the area. (NYCC Flood Investigation Report)
August 2015	Surface water and sewer flooding	Surface water flooding on Bridge Street, Tadcaster as a result of heavy and localised rainfall that exceeded the design capacity of the drainage network in the area. (North Yorkshire County Council Flood Investigation Report).
Unknown 2015	Not confirmed	A64/ M1 (Highways England)
December 2015	Surface water flooding	On the 26th of December 2015 14 properties in Brotherton were flooded from surface water after the significant rainfall event on the 25th and 26th December.
	Surface water and sewer flooding	Surface water flooding on Bridge Street and Commercial Street, Tadcaster occurred prior to flooding from the River Wharfe and coincided with very high river levels, which prevented the sewer system from discharging. (North Yorkshire County Council Flood Investigation Report)
	Fluvial (River Wharfe)	79 residential and commercial properties in the area of Wharfe Bank Terrace, Bridge Street, Commercial Street, Mill Lane, Crab Garth, Wharfe Bank, Beech Close, High Street and Church Yard reported internal flooding. The flooding affected residential dwellings, St Mary's Church, commercial properties and also the town's health and medical centres. The flooding and subsequent collapse of Tadcaster Bridge resulted in the closure of A659 at the bridge, separating the two sides of the town either side of the River Wharfe. The flood event AEP has been reported as being in excess of 0.5% AEP (North Yorkshire County Council Flood Investigation Report) In addition, flooding was seen at Cawood and Selby. The floodplains of the rivers Ouse and Aire were extensively inundated and water levels remained above normal for many weeks.
Nov/Dec 2019	Fluvial/ Surface Water	Flooding occurred in the south of the district adjacent to the River Aire and A19.
February 2020	Fluvial	Around 30 homes in the district were flooded following a series of storms during the wettest February on record. Homes in the Hirst Courtney area were flooded, after the Aire washlands filled to capacity. At the time of writing a section of the A19 remains closed due to catastrophic damage caused by high water levels and strong winds that led to almost tidal type erosion. Flooding also seriously affected an important railway line

Flood Event	Source of Flooding	Description (record source in brackets, where available)
		Agricultural land was damaged between Newlands and Byram
January 2021- Storm Christoph	Fluvial (River Ouse)	Flooding present in parts of Selby and Cawood where channel capacity was exceeded. Flood waters encroached onto areas where there were no raised defences preventing water from flooding out of the channel
February 2022- Storm Franklin	Fluvial (River Wharfe)	Approximately 60 properties were flooded in Tadcaster and Bridge Street was under water for a time preventing access to the road bridge across the River Wharfe. Flooding occurred due to rainfall associated with Storm Franklin.
Unknown	Surface Water Flooding	Myrtle Avenue, Selby (NYCC Highways)
		Green Lane, Brayton (NYCC Highways)

The flooding records show that since 1947 extensive flooding has occurred around the centre of Selby town, which is at the confluence of a number of tributaries and the River Ouse and downstream of the confluence of the Rivers Ouse and Wharfe. Flooding is also shown to have occurred from the River Wharfe, around the region of Kirkby Wharfe to Church Fenton, and in areas around the River Aire.

The historic flooding records (location and/or extent) relating to flooding incidents since 1947, provided by the Environment agency, NYCC and other stakeholders, are presented in **Appendix A Figure 16.**

Appendix A, Figure 16 Historical Flooding Incidents (reported)

7.2 Tidal and Fluvial Flood Risk

Over half of the Selby District is defined as Flood Zone 1 (57%), with 13% of the District in Flood Zone 2 and 30% defined as Flood Zone 3. The main source of fluvial flood risk in the District arises from the tributaries of the Rivers Aire and Ouse, in the southeast of the District around the areas of Burn, Camblesforth and Drax. The majority of these areas are defined as Flood Zone 3a, though they are also areas which have been identified as benefitting from flood defences.

Within Selby district tidal influences affect both the River Ouse and the River Aire. The tidal limit of the River Ouse is located at Naburn Weir (NGR SE 592 445) whilst the River Aire is tidally influenced for 26 km downstream of the lock and weir at Chapel Haddlesey, (NGR SE 581 259).

Although a high astronomical tide may not be sufficient on its own to cause flooding, when it coincides with a fluvial event or storm surge, river levels can be raised locally resulting in overtopping and subsequent inundation.

The main fluvial flood risk in Selby district is predominantly from the River Ouse, particularly the town of Selby which is located at the confluence of the River Ouse with a number of tributaries, including Selby Dam, and downstream of Selby to the south east of the district between the River Ouse and the River Aire. Upstream of Selby, the River Ouse presents a flood risk to the Riccall, Cawood and Acaster Selby areas whilst the flood risk from Selby Dam is less significant with properties at risk of flooding in Brayton and Thorpe Willoughby during lower AEP events. Bishop Dike, a tributary of the River Ouse upstream of Cawood, presents a less significant fluvial flood risk to several smaller villages adjacent to the channel, including Sherburn in Elmet, Little Fenton and Biggin. Flooding from Bishop Dike also floods the B1222 between Little Fenton and Cawood potentially effecting access to local settlements along the route.

To the north west of the district there is a significant flood risk to Tadcaster from the River Wharfe whilst downstream of Tadcaster the River Wharfe poses a flood risk to the settlements of Kirby Wharfe, Ulleskelf, Saxton, Church Fenton, Ozendyke, Ryther and Nun Appleton. The Cock Beck, The Foss, and The Fleet, all tributaries of the River Wharfe, present a less significant fluvial flood risk to the district, however properties located in close proximity of

the watercourses in the smaller villages of Stutton (Cock Beck), Bolton Percy (The Foss) and Appleton Roebuck (The Fleet), adjacent to the channels, are considered to be at risk during fluvial flood events.

To the south of the district, the River Aire presents a significant risk of fluvial flooding to settlements located predominantly to the north of the river, including Chapel Haddlesey, West Haddlesey, Birkin and Beal. To the south of the River Aire flooding from the watercourse poses a risk to properties in Kellington and Hensall.

Flooding from the River Went, located to the far south of the district, does not pose a significant flood risk to the district. The floodplain for the River Went is not extensive and impacts predominantly rural land local to the watercourse, however, the watercourse poses a flood risk to the settlement of Little Smeaton and the A19.

The River Derwent, flowing along the eastern boundary of Selby district does not pose a significant flood risk to the area, however, there is a risk that properties located to the east of Thorganby will flood during a low AEP flood event. Smaller tributaries of the River Derwent within the Selby district have the potential to flood properties in the smaller settlements of Thorganby (Southmoor Drain), South Duffield (along Folly Drain / Dyon Drain and Scarcemoor Dike) and North Duffield (local to the Ladyfield / Westmoor Drain System).

There are many smaller, named watercourses throughout the district where the risk of flooding is to predominantly rural areas but pose a risk of fluvial flooding to smaller settlements. These settlements include Stillingfleet and Escrick along the Stillingfleet Beck / Bridge Dike / Halfpenny Dike system, Wormesley (Wormesley Beck), Smeaton Bridge (Birka Drain), Ricall (from the Dam Dike) and more isolated rural properties located in the floodplain of Pallion Dike / Holmes Dike to the east of the A19.

There are many smaller tributaries and brooks throughout the borough that raise a smaller flood risk, the majority of which remain unnamed watercourses.

Mapped flood extent data provided by the Environment Agency is presented as **Figure 8 in Appendix A**.

7.2.1 Fluvial Flooding and Climate Change

Appendix A Figure 15 shows the modelled flood extents for the 1% AEP with relevant climate change uplifts. Climate change model simulations have been completed for the River Ouse, River Wharfe, and River Aire. A summary of the increased risk of flooding associated with the 1% AEP with climate change allowances compared to the 1% AEP present day flood extents is as follows:

- Flood extents associated with the 1% AEP with relevant climate change show more extensive flooding around Church Fenton and other small neighbouring villages which is associated with Selby Dam.
- There is more extensive flooding in Holme Fleet and Appleton Roebuck associated with The Fleet.
- The extent of flooding associated with the River Ouse is greater in the vicinity of Stillingfleet, Riccall, Hart's Nook, Skipwith, Cawood and Wistow.
- Within Selby urban area there is an increased flood extent to the north west of the area (bounded by the B1223) associated with Holmes Dike and the associated flood storage area which borders the River Ouse.
- There are additional areas flooding to the west of Selby bounded by the railway line and the A1238 and the River Ouse. This additional area of flooding is caused by overtopping of the River Ouse localised defences.
- To the east of Selby, the overtopping of the River Ouse results in additional flooding in the area known as East Common.
- There is more extensive flooding along the River Aire at Kelington and West Haddlesey upstream of the Temple Hirst Railway embankment. Downstream of the Temple Hirst Railway embankment flooding becomes much more extensive with climate change allowances, but most areas which flood are not urbanised. However, the western side of Carlton floods which did not occur with the present day scenario.

For all other fluvial watercourses in the study area, Flood Zone 2 should be used as a climate change proxy for the 1% AEP event in the absence of specific modelling until such time as detailed modelling is completed for site specific FRAs, or at a future date by the Environment Agency or North Yorkshire County Council as the LLFA.

A flood outline associated with a 0.5% AEP tidal event with relevant climate change allowances is presented in **Appendix A Figure 15**. Tidal flooding is more extensive around Drax, Newland, Carlton and Selby when compared to present day flood risk.

With the exception of coarse JFlow[29] modelling used to inform the Environment Agency Flood Maps for Planning no detailed hydraulic modelling of the flood risk from Ordinary Watercourses has been undertaken to date across the Selby District. Therefore, future flood risk is based on the potential risk that might arise based on knowledge of known flooding hotspots and potential mechanisms for flooding. In addition, the Environment Agency RoFSW mapping (described in Section 7.4) may help to highlight where flood risk from Ordinary Watercourses could occur.

Appendix A, Figure 15 - Flood Extents including Climate Change allowances for 1% AEP event

7.2.2 Residual Risk of Tidal/ Fluvial Flooding from a Defence Breach

Breach modelling was undertaken as part of the SFRA update and included five breach locations within the Selby District. The breach analysis reviewed four potential breach locations on the River Ouse and one on the River Aire. The impact of a breach in the flood defences was modelled for a 1% AEP fluvial flood event with relevant climate change allowances.

The maximum flood extent outlines are presented **in Appendix A Figures 17 – 21**. Each breach scenario shows risk from a breach in a specific location therefore a breach in another location (not modelled) will show a different breach extent. It should be noted that just because a location is not included within one of the modelled breach extents does not mean there is no risk from a breach in the flood defences.

Appendix A, Figure 17 – 21 Flood Extents associated with Breach modelling

7.3 Flood Alerts and Warnings

The Environment Agency is the lead organisation for providing warnings of river flooding. The Environment Agency provides the free Flood Warning Service[30] to homes and business within Flood Zones 2 and 3.

Within the Selby District, there are 41 Environment Agency Flood Warning Areas, as shown in **Appendix A Figure 9**. The most extensive Flood Warning Area is located in Selby town, at the centre of the confluence of tributaries to the River Ouse. There is also a large Flood Warning Area to the north of the District near Tadcaster, where flooding occurred in December 2015 due to overtopping of the River Wharfe, and to the south east of the District near Drax power station, located adjacent to the River Ouse. There are also 11 Flood Alert areas within the SDC area, as shown in **Appendix A Figure 9**.

7.4 Flooding from Surface Water

Surface water runoff, also known as ‘pluvial’ flooding, occurs when high intensity rainfall (e.g. thunderstorms) generates runoff which flows over the surface of the ground and accumulates in low lying areas. The presence of impermeable surfaces, saturated soils, and insufficient capacity within the drainage network or high-water levels in watercourses that can cause local drainage networks to back up can further exacerbate surface water flooding.

Localised flooding can be attributed to topographic depressions, insufficient capacity within Ordinary Watercourses and culverts, as well as obstructions to surface water flow paths. Flooding from surface water can also be associated with the failure in the management of the drainage network during high rainfall events.

The Environment Agency Risk of Flooding from Surface Water mapping (RoSFW) dataset, provided in **Appendix A Figure 10,** shows that a number of communities are at risk of flooding from surface water. The mapping shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys and can pond in low-lying areas. Whilst in the majority of cases the risk is confined to mostly rural areas and roads, there are notable prominent run-off flow routes.

[29] JFlow is a broad scale 2D modelling approach used by the EA to determine Flood Zone extents using LiDAR information.
[30] Environment Agency (2018) *Flood Warning and Alert Areas,* Available from: http://apps.environment-agency.gov.uk/wiyby/37835.aspx [Accessed July 2022]

Increased ponding can be identified in the dataset to the north of the District, particularly around Bilbrough and Colton where the topography changes from high to low. There are also areas of ponding in low elevation areas around Stillingfleet and Thorganby, further south towards South Duffield, and in the very south of the District around Balne.

Appendix A, Figure 10 Risk of Flooding from Surface Water

7.5 Flooding from Groundwater

Groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather.

Groundwater flooding can be caused by:

- High water tables, influenced by the type of bedrock and superficial geology;
- Seasonal flows in dry valleys, which are particularly common in areas of chalk geology;
- Rebounding groundwater levels, where these have been historically lowered for industrial or mining purposes; and
- Where there are long sections of culverted watercourse that prevent water easily getting into watercourses.

Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to intersect the surface at valley bottoms.

Groundwater flooding is much slower to occur than river flooding and it can happen days, weeks or even months after heavy or prolonged rainfall and is therefore much harder to predict and provide warnings for.

The Environment Agency's Areas Susceptible to Groundwater Flooding (AStGWF) mapping presented in **Appendix A Figure 11** indicates where groundwater may emerge due to certain geological and hydrogeological conditions. The mapping does not show where flooding is likely to occur, but instead is used at a strategic level to indicate areas for further investigation.

The mapping indicates that areas in proximity to the River Wharfe, River Ouse and River Aire are shown to be more susceptible to groundwater flooding. Therefore, areas to the north, south-west and south-east of Selby District are more susceptible to groundwater flooding. These areas generally coincide with the Sherwood Sandstone Group bedrock and Alluvium superficial deposits, which are classified as Principal and Secondary A aquifers, respectively. The British Geological Survey provides further information on groundwater flooding on their website.

Appendix A, Figure 11 Areas Susceptible to Groundwater Flooding

7.5.1 Source Protection Zones

The SPZs for each potential development area option have been assessed using the Environment Agency Groundwater Source Protection Zones map[31]. Table 5-2 shows that SPZs can be one of four zones depending on the time it takes for water to travel to the point of abstraction, or the percentage of the entire resource (whichever is the greater).

Appendix A Figure 12 shows there are twelve SPZs within the Selby District, which are mainly concentrated to the northwest, near Tadcaster, and to the southeast, near Carlton. Two SPZs are located to the west of Brayton, one to the west of Great Heck, two near Cridling Stubbs and one near Thorganby. As stated in Section 5.6.2, options for infiltration-based SuDS will be considered potentially constrained in these areas, and the use of SuDS will potentially be limited to attenuation (not infiltration) features.

[31] Environment Agency, *Source Protection Zones,* Available from: https://magic.defra.gov.uk/MagicMap.aspx [Accessed 18 July 2022]

7.6 Flooding from Sewers

Sewer and surface water flooding are often interconnected; insufficient drainage capacity in the sewer network can result in surface water flooding and, by the same rationale, large volumes of surface water can overload the public sewers, causing the sewer network to back up, surcharge and ultimately flood. Flooding from sewers can also occur when sewers cannot discharge to watercourses due to high water levels or caused by blockages, collapses, equipment failure or groundwater leaking into sewer pipes.

In line with the Sewers for Adoption guidelines, new surface water sewers are designed to have capacity for a rainfall event with a 3.33% AEP, although until recently this did not apply to smaller private systems. This means that sewers will often be overwhelmed during larger rainfall and flood events.

Existing sewers can also become overloaded as surface water discharge from new developments add to the total runoff from their catchment, or as a consequence to urban creep (i.e. incremental increases in roofed and paved surfaces at the individual property scale). Sewer flooding is therefore a problem that can occur in many locations across the Selby district.

Information on flooding from sewers has been provided by YWSL. This data highlights that the areas to the north, north east and south west of the District have experienced a greater number of external sewer flooding incidents than the rest of the District. Only one property is recorded as having experienced internal flooding in the Selby district.

There are historic records of sewer flooding (September 2012, August 2014, August 2015 and December 2015) listed in Table 7-1 that do not appear on the DG5 register. North Yorkshire County Council Flood Investigation Reports indicate a combination of sewer and surface water flooding on these dates. It is therefore possible that these events are not recorded on the DG5 Register if YWSL consider them to be an extreme event in excess of the 3.33% AEP event design standard.

Appendix A Figure 13 shows the DG5 Register that has been supplied by YWSL for the SFRA.

Appendix A, Figure 13 Sewer Flooding Records

7.6.1 Sewer Flooding and Climate Change

Climate change is anticipated to increase the potential risk from sewer flooding as summer storms become more intense and winter storms more prolonged. This combination is likely to increase the pressure on the existing efficiency of sewer systems, thereby reducing their design standard and leading to more frequent localised flooding incidents. Any sewer flooding that may occur could be exacerbated as a result of surface water runoff during extreme rainfall events.

7.7 Flooding from Artificial Sources

7.7.1 Risk of Flooding from Reservoirs

The Environment Agency Flood Risk from Reservoirs map[32] identifies areas that could be flooded if a large[33] reservoir was to fail and release the water it holds. There are two flooding scenarios of reservoir flood risk. They are 'dry-day' and a 'wet-day' scenarios. The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The 'wet-day' scenario predicts how much worse the flooding might be if a river is already experiencing an extreme flood event. Reservoir flood risk across the District is presented in **Appendix A Figure 14**. The data shows that there are areas at risk of reservoir flooding throughout the District, particularly along the course of the Main Rivers in the catchments of the Rivers Aire, Ouse and Wharfe. Table 2-1 lists 16 reservoirs from which flood risk arises in the Selby District should one of the reservoirs fail. Of the 16 identified reservoirs, ten are located outside of Selby District, predominantly in the Upper Wharfe catchment and Yorkshire Dales, whilst 6 are located within the District, comprising mainly of washlands / or flood storage areas. To date there have been no recorded incidents of reservoir flooding within Selby District.

Appendix A, Figure 14 Reservoir Flooding

7.7.2 Risk of Flooding from Canals

Canals are regulated waterbodies under the jurisdiction of the Canal and River Trust (CRT) and are unlikely to flood, unless there is a sudden structural failure of an embankment or a large ingress of water from a river in areas where they interact closely. Canal embankment failure can be caused by numerous issues, including:

- Animal burrowing;
- Culvert collapse;
- Subsidence or sudden failure e.g. collapse of former mine workings;
- Overtopping of the canal embankment;
- Works located close to or encroaching onto the canal embankment footings (e.g. development, utilities related).

Flooding from a breach of a canal embankment is dependent on the canal and adjacent ground levels, the construction of the canal embankment, the nature of the breach and the volume of water that can discharge into the low-lying areas behind the embankment from the canal. The volume of water released during a breach is dependent on the distance between locks (pound length) at the breach location and how quickly operating authorities can react to prevent further water loss by repairing the breach or restricting the length of the canal that can empty through the breach,

The Aire and Calder Navigation flows eastwards from Leeds along the River Aire to the Bank Dole Junction, near Knottingley. It then splits into two branches. The northern branch forms the Selby Canal, which is 18.8 km in length and flows to the north east towards Selby Town. The southern branch follows the Knottingley and Goole Canal eastwards to join the River Ouse at Goole.

The CRT has recorded one incident of flooding from the Aire and Calder Navigation at Ferrybridge Lock on 26th June 2007. Exceptionally heavy rainfall resulted in the overtopping of the flood defences, causing flooding of the lock and damage to the site electrics.

[32] Environment Agency, *Long term flood risk service*, Available at: https://check-long-term-flood-risk.service.gov.uk/map, [Last accessed: 12 July 2022]
[33] A large reservoir is one that holds over 25,000 cubic metres of water, equivalent to approximately 10 Olympic sized swimming pools.

7.8 Cumulative Impact of Development

As outlined in Section 5.10, when allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream.

Local planning policies can be used to identify areas where the potential for development to increase flood risk is highest and identify opportunities for such new development to positively contribute to decreases in flood risk downstream.

Catchments within the study area that have the potential to influence existing flood risk issues in neighbouring Local Authorities are identified below, as well as catchments in the study area that may be influenced by development in catchments in neighbouring Local Authorities.

7.8.1 Strategic Catchment Management

Catchment Flood Management Plans (CFMP) give an overview of the flood risk in each river catchment and sets out plans for sustainable flood risk management across sub areas. Selby District falls within the following Catchment Flood Management Plans discussed in this section below.

Selby District occupies sub-areas 4, 6 and 8 of the River Ouse CFMP. Within sub area 4 it is noted that the washlands to the south of York play a key role in managing the risk in downstream areas such as Selby whilst within sub area 8 surface water runoff is a mechanism for flooding. Flood risk within sub area 6 is predominantly from fluvial, fluvial/tidal combinations and surface water. The preferred policy in sub area 4 is Policy 5, which states further action is required to reduce flood risk. York City Council is currently undertaking a programme of works to improve the standard of protection afforded by flood defences along the River Ouse. Within sub area 6, the preferred policy option is Policy 4, which recognises that flood risk is already being managed effectively but there will need to be future improvements to management strategy to keep pace with the increased flood risk as a result of climate change. In sub area 8 the preferred policy is Policy Option 3 which maintains the current level of flood risk management.

Sub area 8 of the River Aire CFMP is partly located within Selby District. Flood risk in this sub area will increase in the future and the preferred policy, Policy Option 6 states that the condition and function of the washlands will be improved to reduce runoff rates and the high frequency of local flood events.

A small area to the south of Selby District is located within sub area 7 of the River Don CFMP. This area is largely rural with the small settlements of Kirk Smeaton and Little Smeaton. The preferred option for this sub area is Policy Option 3 which maintains the current level of flood risk management.

7.8.2 Assessment of Cross-Boundary Issues

When catchment areas and the topography of Selby District are compared this shows that the catchments to the north, north west and south west drain into the district, whilst the catchments located to the east and south east drain out of the district. This means that development in Selby District is more likely to have the potential to increase flood risk to eastern neighbouring authorities, whereas development in northern and western neighbouring local authorities is more likely to impact Selby District. The neighbouring Local Authorities that contain catchments which drain into Selby District are City of York Council, Leeds City Council and Wakefield Metropolitan Borough Council.

The neighbouring Local Authorities that catchments located within Selby District drain into are Doncaster Metropolitan Borough Council and East Riding of Yorkshire Council. Consequently, there are a number of catchments and sub-catchments that exist within Selby district where future development may impact flood risk in the neighbouring Local Authorities mentioned above, particularly where there are existing flood risk issues.

It is recommended that Selby District Council consults neighbouring authorities to identify and review potential cross-boundary issues.

7.8.3 Potential for Cumulative Impact

Development in neighbouring authorities has the potential to affect flood risk in Selby District, especially if the catchment is draining towards the study area.

Potential development within the City of York Council area to the north of Selby District is unlikely to exacerbate flooding within the district due to the extensive washlands located along the River Ouse between York and Selby. The impact of cumulative development on flood risk in this instance is more likely to come from the proposed developments located in the Ouse catchment area within Selby District itself, in particular:

- Selby. where there is a concentration of larger allocated sites in proximity to Selby Canal;

A very small area of Selby District is located within the Derwent catchment, to the north east, and the Went catchment to the south. The majority of each catchment area is located largely outside of the study area. These areas, part of a predominantly rural area in the wider catchments have a small number of properties and are less likely to be affected by an increase in flood risk caused by development upstream. Flooding in November 2019 affected land adjacent to the A19 in close proximity to the River Went. Development upstream of this area within the Doncaster Metropolitan Borough Council area has the potential to exacerbate flooding in this area from both fluvial and surface water sources.

Tadcaster has a history of fluvial flooding with the most recent significant flood event occurring in 2015. The River Wharfe enters Selby District from the North Yorkshire County Council area, whilst Cock Beck, a tributary of the River Wharfe that confluences with the Main River downstream of Tadcaster, enters Selby District from the Leeds City Council area. Any allocated development, both within Selby District, but in particular upstream of Selby District has the potential to increase the risk of flooding to Tadcaster itself and areas downstream of the town such as Ulleskelf, where the risk of flooding is set to increase with climate change.

Smaller settlements along the River Aire, such as Beal and Hirst Courtney were affected by flooding in 2002 and 2020 respectively and the River Aire, both within, upstream and downstream of Selby District, has a long record of historical flood events. Development upstream of Selby District within the Wakefield Metropolitan Borough Council Area combined with the cluster of potential development sites in the Eggborough, Burton Salmon and Brotherton areas of Selby District could increase the risk of flooding to both local authority areas along the River Aire corridor and the Aire and Calder Navigation. The risk of flooding from surface water sources would also increase in these areas where there are numerous proposed development sites concentrated within a small settlement.

Local Plans for the neighbouring Local Authorities and the New Local Plan for Selby will ensure compliance with the NPPF, promote appropriate sustainable drainage and outline flood risk policies proposed within each authority area.

Based on this high-level review, areas of Selby District that are at increased risk of flooding from cumulative development are:

- Selby – fluvial, fluvial/ tidal combined events and surface water sources;
- Tadcaster - fluvial and surface water sources;
- Sherburn in Elmet – surface water sources;
- Eggborough - fluvial and surface water sources;
- Smaller settlements near or adjacent to minor watercourses such as Appleton Roebuck, Stillingfleet, Church Fenton and Carlton.

8. Guidance for the Application of the Sequential and Exception Tests in Selby District

8.1 Overview

This Section guides the application of the Sequential Test and Exception Test in the plan-making and planning application processes. Not all development will be required to undergo these tests, as described below, but may still be required to undertake a site-specific FRA, guidance about which is included in Section 9.

The sequential approach is a decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to sites at higher risk. This will help avoid the development of sites that are inappropriate on flood risk grounds. The subsequent application of the Exception Test where required will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability drivers and where development can be made safe from flooding and not increase the risk of flooding elsewhere.

The sequential approach can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new developments (with the exception of Water Compatible development) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

8.2 Applying the Sequential Test for the Local Plan

As the LPA, SDC must demonstrate that throughout the site allocation process a range of possible sites have been considered in conjunction with the flood risk and vulnerability information from the SFRA, and that the Sequential Test, and where necessary the Exception Test, has been applied.

The Sequential Test requires an understanding of flood risk from all sources in the study area and the vulnerability classification of the proposed developments. Flood Zone definitions for all sources of flooding are provided in Table 8-1. Flood risk vulnerability classifications are defined in Table 2 of the PPG.

The NPPF states that "*All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property*."

If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

The flow diagram presented in Figure 8-1 illustrates how the Sequential Test process should be applied to identify the suitability of a site for allocation, in relation to the flood risk classification.

Table 8-1: Flood Risk Definitions for Sequential Test

Risk	Fluvial / Tidal Flood Zone	Other Sources of Flood Risk			
		Surface Water	Groundwater	Sewer Consideration	Reservoir
Low	Flood Zone 1	RoFSW Very Low	"Not considered to be at risk of groundwater flooding" OR "Limited potential for groundwater flooding"	YWSL to assess the sewer network on a site by site basis.	Use Environment Agency Flooding from Reservoirs map
Medium	Flood Zone 2	RoFSW Low to Medium	"Potential for groundwater flooding of property below ground surface" OR "Potential for groundwater flooding at surface"		
High	Flood Zone 3a	RoFSW High	Historic records of groundwater flooding		
Very High	Flood Zone 3b	N/A	N/A		

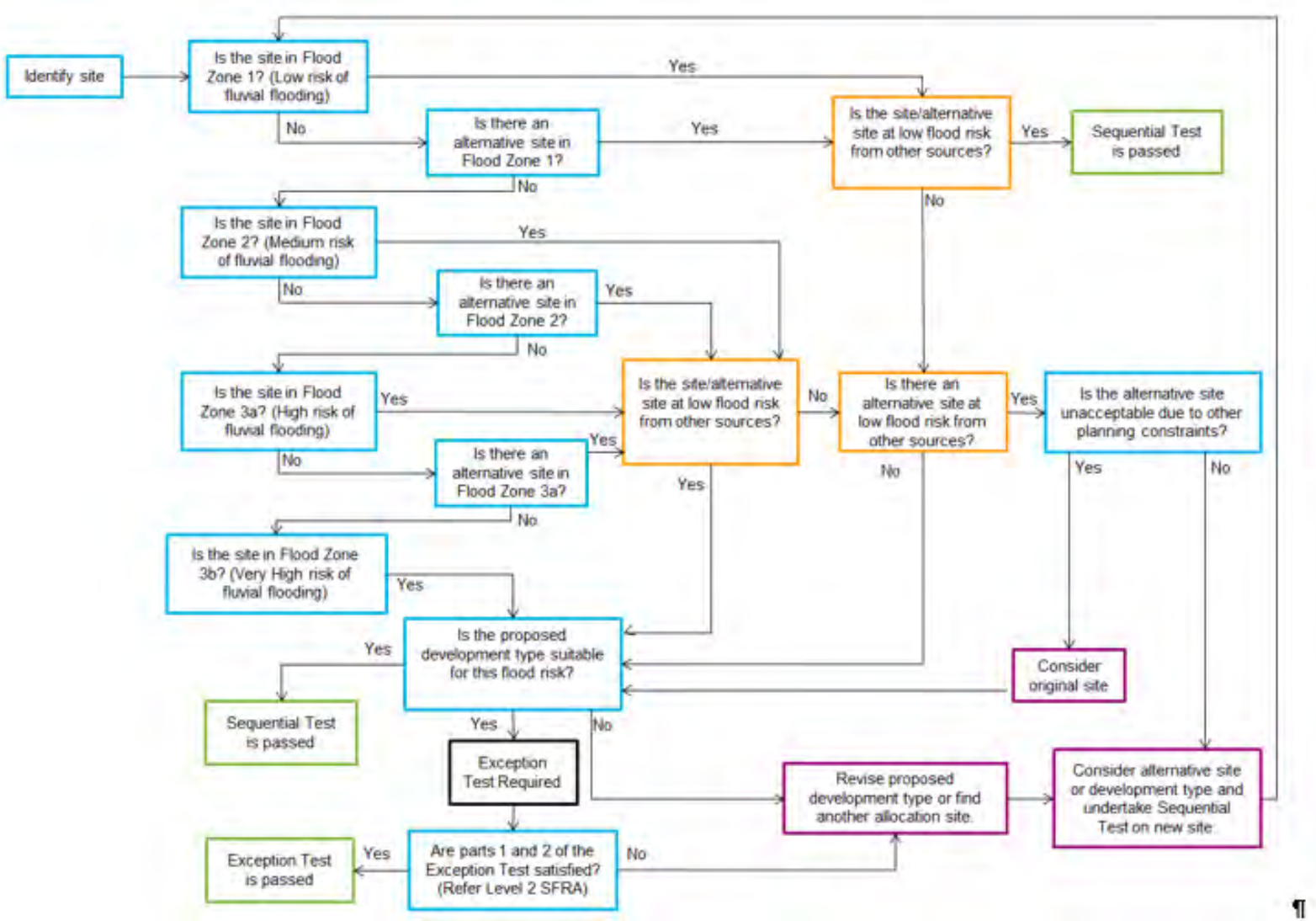


Figure 8-1: Application of Sequential Test for Local Plan preparation

The recommended steps in undertaking the Sequential Test are detailed below. This is based on the Flood Zone and the Flood Risk Vulnerability Classification.

8.2.1 Recommended Stages for LPA application of the Sequential Test

The information required to address many of these steps is provided in the accompanying maps presented in Appendix A.

Whilst preparing the New Local Plan, a database of the potential allocation sites across the Selby District was generated and information for each site populated using the GIS layers presented in the maps. This database can now be used by SDC when applying the steps below.

4. The location and identification of the potential development type(s) should be recorded.
5. Assign potential developments with a flood risk vulnerability classification (as defined in Table 2 of the PPG). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.
6. The Flood Zone classification of potential development sites should be determined based on a review of the Flood Map for Planning (Rivers and Sea). Where a site spans more than one Flood Zone, all zones should be noted, preferably using percentages.
7. The risk of flooding from other sources should also be identified, based on readily available datasets and local information as set out in Section 7 of this report and the Figures in Appendix A.
8. The design life of the development should be considered with respect to climate change:
    - 100 years – up to 2125 for residential developments; and
    - Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.
9. Identify existing flood defences serving the potential development sites. However, it should be noted that for the purposes of the Sequential Test, Flood Zones ignoring defences should be used.
10. Highly vulnerable development should be directed, where possible, to the areas at lowest risk from all sources of flooding. If these cannot be located in areas of low risk, because the identified sites are unsuitable or there are insufficient sites in areas of low risk, sites in medium flood risk area can then be considered. Highly Vulnerable developments in medium flood risk areas will require application of the Exception Test. If sites in medium flood risk areas are inadequate, then the LPA may have to identify additional sites in lower flood risk areas to accommodate development or seek opportunities to locate the development outside their administrative area. It should be noted that Highly Vulnerable development is not appropriate in high flood risk areas including Zones 3a and 3b – Functional Floodplain.
11. Once all Highly Vulnerable developments have been allocated to a development site, consideration can be given to those development types defined as More Vulnerable. In the first instance More Vulnerable development should be located in any unallocated sites in low flood risk areas. Where these sites are unsuitable or there are insufficient sites remaining, sites in medium flood risk areas can be considered. If there are insufficient sites in low- medium flood risk areas to accommodate More Vulnerable development, sites in Flood Zone 3a can be considered. More Vulnerable developments in high flood risk areas will require application of the Exception Test. It should be noted that More Vulnerable development is not appropriate in Flood Zone 3b – Functional Floodplain.
12. Once all More Vulnerable developments have been allocated to a development site, consideration can be given to those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located in any remaining unallocated sites in low flood risk areas, continuing sequentially with medium flood risk areas, then high flood risk areas. Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.
13. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in medium, high and very high flood risk areas, provided the Exception Test is satisfied.
14. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however, it is appreciated that Water Compatible development by nature often relies on access and proximity to water bodies.
15. Where the development is Highly Vulnerable, More Vulnerable, Less Vulnerable or Essential Infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood

sources should be investigated further regardless of any requirement of the Exception Test. It is noted that for any development at risk of flooding, a site-specific FRA will be required.

8.2.2 Stages for LPA application of the Sequential Test in Plan-Making – Defended Sites

For sites that are within Flood Zone 3a, but are protected by the presence of flood defences, it is recommended that SDC use additional flood risk information to consider the variation in flood risk within the Flood Zone when applying the Sequential Test. In this case, flood hazard mapping should be used to apply the Sequential Test to ensure that development is directed towards areas of Low hazard prior to the consideration of areas at Moderate, Significant and Extreme hazard.

The flow diagram presented in Figure 8-1 illustrates how the Sequential Test process can be applied to identify the suitability of a defended site for allocation, in relation to the flood risk classification.

8.2.3 Windfall Sites

Windfall sites are those which have not been specifically identified as available in the Local Plan process. They comprise sites that have unexpectedly become available. In cases where development needs cannot be fully met through the provision of site allocations, a realistic allowance for windfall development should be assumed, based on past trends. It is recommended that the acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms.

8.3 Applying the Sequential Test for Planning Applications

It is necessary to undertake a sequential test for a planning application if both of the following apply:

1. The proposed development is located in Flood Zone 2 or 3.
2. A Sequential Test has not already been done for a development of the type you plan to carry out on your proposed site.

The Environment Agency publication 'Demonstrating the Flood Risk Sequential Test for Planning Applications[34]' sets out the procedure for applying the Sequential Test to individual applications as follows:

- Identify the geographical area of search over which the test is to be applied; this could be the District area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area).
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan.
- State the method used for comparing flood risk between sites; for example, the Environment Agency Flood Map for Planning, the SFRA mapping, site specific FRAs if appropriate, other mapping of flood sources.
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s).
- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- Where necessary, apply the Exception Test.
- Apply the Sequential approach to locating development within the site.

It should be noted that it is for SDC, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence what area of search has been used when making the application.

[34] Environment Agency (2012) Demonstrating the flood risk Sequential Test for Planning Applications, Version 3.1. Available from: https://www.gov.uk/guidance/flood-risk-assessment-the-sequential-test-for-applicants, [Last Accessed: 12 July 2022]

Ultimately, after applying the Sequential Test, SDC needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere. This needs to be demonstrated within a FRA and is necessary regardless of whether the Exception Test is required.

8.4 Sequential Test Exemptions

It should be noted that the Sequential Test does not need to be applied in the following circumstances:

- Individual developments proposed on sites which have been allocated in development plans through the Sequential Test.
- Minor development, which is defined in the NPPF as:
  - Minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m^2;
  - Alterations: development that does not increase the size of buildings e.g. alterations to external appearance;
  - Householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats;
- Change of Use applications, unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site;
- Development proposals in low flood risk areas unless the SFRA, or other more recent information, indicates there may be flooding issues now or in the future (for example, the site was identified as being at risk of surface water or through the impact of climate change);
- Redevelopment of existing properties (e.g. replacement dwellings), provided they;
  - Will not be placed at an unacceptable level of flood risk, irrespective of the risk posed to the existing dwelling;
  - Do not increase the number of dwellings in an area of flood risk (i.e. replacing a single dwelling with an apartment block); and
  - Do not increase the net footprint of the building(s) unless accompanied by adequate floodplain compensation or suitable under floor voids.
- Redevelopment, for example replacement dwellings, will be expected to meet current Flood Risk Management best practice standards. Where this is not feasible due to conflicting planning reasons, designs should be as close to best practice as possible. Under no circumstances will a worsening of flood risk compared to the existing case be accepted.

8.5 Sequential Approach to Site Layout

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas. Development should be sequentially allocated within the site boundary to areas firstly within low flood risk areas and then medium flood risk areas where ‘less vulnerable’ development uses would be more appropriate. Residential developments (‘more vulnerable’) should be restricted to areas at low probability of flooding and the following types of ‘water compatible’ development can be placed on lower ground with a higher probability of flooding (ie Flood Zones 3a and 3b):

- Car parks;
- Green Infrastructure (i.e. open spaces, proposed landscaped areas, nature conservation);
- Outdoor sports and recreation;
- Flood control infrastructure; and
- Water and sewerage transmission infrastructure.

Should development pressure create a need to develop in areas within Flood Zone 3 (plus an allowance for climate change) appropriate minimum floor levels to adopt in agreement with the Environment Agency should be determined.

It is required that any flood volume displaced as a result of development within the entire Flood Zone 3 plus an allowance for climate change envelope (encapsulating Flood Zones 3a (High Probability) and 3b (Functional Floodplain) be compensated for elsewhere within the site boundary on a 'level for level' and 'volume for volume' basis. Any proposed layout and location for such compensation should take into account the flow routing to ensure adequate conveyance.

Appropriate mitigation measures should be incorporated, such that the risk of flooding to surrounding areas is not increased, and where opportunity exists reduction is sought.

In addition to mitigating the impact of any fluvial flows displaced as described above, consideration should be given to the impact of any development on pluvial flow routes and areas susceptible to ponding (see Appendix A Figure 10) informed by a review of the local topography, geology and any structures that may influence the movement of water over the surface. Following the sequential approach to the layout of buildings the provision of SuDS (as outlined in the North Yorkshire County Council SuDS Design Guidance document[35]) will assist in mitigating any increase in risk from surface water to surrounding areas.

8.6 Exception Test

The Exception Test, if required, should be undertaken following the guidance provided in Section 4.2.3 is to ensure that new development in Selby District is only permitted in medium and high flood risk areas where flood risk is clearly outweighed by other sustainability factors and where the development will be safe during its lifetime, considering climate change.

When determining planning applications, SDC should ensure that flood risk is not increased elsewhere. In order to consider development to be appropriate in an area at risk of flooding, it should be informed by a site-specific FRA, follow the Sequential Test, and if required the Exception Test, before demonstrating the following:

- Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location;
- Development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including any emergency planning carried out by the resident and/or owner; and it gives priority to the use of sustainable drainage systems.

There are a number of ways a new development can be made safe:

- Avoiding flood risk by not developing in areas at risk from flooding;
- Substituting higher vulnerability land uses for lower vulnerability uses in higher flood risk locations and locating higher vulnerability uses in areas of lower risk on a strategic scale, or on a site basis;
- Providing adequate flood risk management infrastructure which will be maintained for the lifetime of the development; and
- Mitigating the potential impacts of flooding through design and resilient construction.

Further guidance for managing and mitigating flood risk is provided in Section 10.

[35] North Yorkshire County Council, (2018),*North Yorkshire county Council SuDS Design Guidance 2018 Update, Available at:* NYCC SuDS Design Guidance 2018 Update.pdf (northyorks.gov.uk), [Last Accessed: 14 July 2022]

9. Site Specific Flood Risk Assessment - Guidance for Developers

9.1 Requirements for Site Specific Flood Risk Assessments

9.1.1 What is a Flood Risk Assessment?

A site specific Flood Risk Assessment (FRA) is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and where possible will reduce flood risk overall in accordance with paragraph 167 of the NPPF and PPG.

A FRA must be prepared by a suitably qualified and experienced person and must contain all the information needed to allow SDC to satisfy itself that the requirements have been met.

9.1.2 When is a Flood Risk Assessment required?

Site specific FRA is required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1; or
- In an area within Flood Zone 1 which is greater than 1ha or has critical drainage problems (as notified to the LPA by the Environment Agency[36]); and,
- All proposals for new development (including minor development[37] and change of use) in Flood Zones 2 and 3; or
- Where proposed development or a change of use to a more vulnerable classification may be subject to other sources of flooding.

The Environment Agency Guidance Note[38] for FRAs in Flood Zone 1 should be consulted for advice on the approach and content of the site-specific FRA.

A 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 actually in Flood Zone 1);
- Where evidence of historical or recent flood events have been passed to the LPA; and
- In an area of significant surface water flood risk.

9.1.3 Objectives of a Flood Risk Assessment

The PPG states that a site-specific FRA should be proportionate to the degree of flood risk, the scale and nature of the development, its vulnerability classification and the status of the site in relation to the Sequential and Exception Tests.

Site-specific FRAs should therefore establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether a proposed development will increase flood risk elsewhere;
- whether the mitigation proposed to deal with the effects and risks are appropriate;

[36] A critical drainage area in this context is defined under the Town and Country Planning Order 2006 as an area within Flood Zone 1 which has critical drainage problems and has been notified to the Local Planning Authority (LPA) by the Environment Agency. This is separate to critical drainage areas (CDAs) that may be highlighted in Surface Water Management Plans (SWMP) which are defined by a local authority when there is a cluster of surface water flood hotspots

[37] According to the PPG, minor development means:
minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m2
alterations: development that does not increase the size of buildings e.g. alterations to external appearance.
householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats

[38] Environment Agency, *Flood Risk Assessment in Flood Zone 1 and Critical Drainage Areas,* Available at: https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zone-1-and-critical-drainage-areas, [Last Accessed: 14 July 2022]

- the evidence (where required in the PPG) for the local planning authority to apply the Sequential Test; and
- whether the development will be safe and pass the Exception Test (if applicable) as required by NPPF.

9.1.4 Environment Agency Data Requests

Site specific FRAs should also make optimum use of readily available information, for example the mapping presented within this SFRA and available on the Environment Agency website, however in some cases additional modelling or detailed calculations will need to be undertaken.

The Environment Agency offers a series of 'products' for obtaining flood risk information suitable for informing the preparation of site specific FRAs as described on their website https://www.gov.uk/planning-applications-assessingflood-risk.

- **Products 1 – 4** relate to mapped deliverables including flood level and flood depth information and the presence of flood defences local to the proposed development site;
- **Product 5** contains the reports for hydraulic modelling of the Main Rivers, or breach modelling;
- **Product 6** contains the model output data so the applicant can interrogate the data to inform the FRA;
- **Product 7** comprises the hydraulic model itself; and
- **Product 8** contains flood defence breach hazard mapping.

9.2 Flood Risk Assessment Checklist

Table 9-1 provides a checklist for site specific FRAs including the likely information that will need to be provided along with references to relevant information sources. The exact level of detail required under each heading will vary according to the scale of development and the nature of the flood risk. It is expected that this checklist is completed for all planning applications.

Table 9-1 Site Specific Flood Risk Assessment Checklist (building on guidance in PPG)

What to include in the FRA		Source(s) of Information
1. Site Description		
Site address	-	-
Site description	-	-
Location plan	Including geographical features, street names, catchment areas, watercourses and other bodies of water.	OS Mapping
Site plan	Plan of Site showing development proposals and any structures which may influence local hydraulics e.g. bridges, pipes/ducts crossing watercourses, culverts, screens, embankments, walls, outfalls and condition of channel.	OS Mapping Site Survey
Topography	Include general description of the topography local to the site. Where necessary, Site survey may be required to confirm site levels (in relation to Ordnance datum). Plans showing existing and proposed levels.	Site Survey
Geology	General description of geology local to the Site.	Ground Investigation Report
Watercourses	Identify Main Rivers and Ordinary Watercourses local to the Site.	OS Mapping
Status	Is the development in accordance with the Council's Local Plan?	Seek advice from SDC if necessary.
2. Assessing Flood Risk		
The level of assessment will depend on the degree of flood risk and the scale, nature and location of the proposed development. Not all of the prompts listed below will be relevant for every application.		

What to include in the FRA		Source(s) of Information
Tidal Flooding	Provide a plan of the Site and Flood Zones. Identify any historic flooding that has affected the Site, including dates and depths where possible. How is the Site likely to be affected by climate change? Determine flood levels on the Site for the 0.5% AEP flood event including an allowance for climate change. Determine flood hazard risk on the Site (in terms of flood depth and velocity). If necessary, undertake new hydraulic modelling and/or breach modelling to determine the flood level, depth, velocity, hazard, and rate of onset of flooding on the Site.	SFRA Appendix A Figures 8 and 15 Environment Agency Flood Map for Planning (Rivers and Sea) Environment Agency Products 1-8 Breach modelling in SFRA Appendix A Figures 17 -21 Hydraulic modelling required (where Environment Agency data not available).
Flooding from Rivers	Provide a plan of the site and Flood Zones. Identify any historic flooding that has affected the Site, including dates and depths where possible. How is the Site likely to be affected by climate change? Determine flood levels on the Site for the 1% AEP flood event including an allowance for climate change. Determine flood hazard on the Site (in terms of flood depth and velocity). Undertake new hydraulic modelling and/or breach modelling to determine the flood level, depth, velocity, hazard, rate of onset of flooding on the Site.	SFRA Appendix A Figures 8, 15 and 16 Flood Map for Planning (Rivers and Sea) (Environment Agency website) Environment Agency Products 1-7 Hydraulic modelling required (where Environment Agency data not available).
Flooding from Surface water	Identify any historic flooding that has affected the Site. Review the local topography and conduct a Site walkover to determine low points at risk of surface water flooding. Review the Environment Agency Risk of Flooding from Surface Water mapping. Where necessary, undertake modelling to assess surface water flood risk.	SFRA Appendix A Figure 10 and 16 Refer to SFRA Sections 5.6 and 7.4 Site walkover Risk of Flooding from Surface Water mapping (Environment Agency website).
Flooding from Groundwater	Desk based assessment based on high level BGS mapping in the SFRA. Ground survey investigations. Identify any historic flooding that has affected the Site.	SFRA Appendix A Figures 11 and 12 Refer to SFRA Sections 5.7 and 7.5 Ground Investigation Report
Flooding from Sewers	Identify any historic flooding that has affected the Site.	SFRA Appendix A Figure 13 Refer to SFRA Sections 5.8 and 7.6 Where appropriate an asset location survey can be provided by Yorkshire Water Services Ltd
Reservoirs, canals and other artificial sources	Identify any historic flooding that has affected the Site. Review the Risk of Flooding from Reservoirs mapping.	SFRA Appendix A Figure 14 and 16 Refer to SFRA Sections 5.9 and 7.7. Risk of Flooding from Reservoirs mapping (Environment Agency website).

3. Proposed Development

What to include in the FRA		Source(s) of Information
Current Use	Identify the current use of the Site	-
Proposed Use	Will the proposals increase the number of occupants/Site users such that it may affect the degree of flood risk to these people?	-
Vulnerability Classification	Determine the vulnerability classification of the proposed development. Is the vulnerability classification appropriate within the Flood Zone? Where proposed developments comprise a range of developments with differing vulnerabilities (e.g. a mixed use development), the highest vulnerability should be used in the assessment.	Table 2 of PPG.
4. Avoiding Flood Risk		
Sequential Test	Determine whether the Sequential Test is required. Consult SDC to determine if the site has been included in the Sequential Test. If required, present the relevant information to SDC to enable their determination of the Sequential Test for the site on an individual basis.	SFRA Section 8
Exception Test	Determine whether the Exception Test is necessary. Where the Exception Test is necessary, present details of: Part 1) how the proposed development contributes to the achievement of wider sustainability objectives as set out in in the SDC Sustainability Appraisal Report[39]. Details of how Part 2 can be satisfied are addressed in the following Part 5 'Managing and Mitigating Flood Risk'.	SFRA Section 8.6 Refer to the SDC sustainability objectives.
5. Managing and Mitigating Flood Risk		
Section 10 of the SFRA presents measures to manage and mitigate flood risk and when they should be implemented. Where appropriate, the following should be demonstrated within the FRA to address the following questions: • How will the Site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime? • How will you ensure that the proposed development and the measures to protect your Site from flooding will not increase flood risk elsewhere? • Are there any opportunities offered by the development to reduce flood risk elsewhere? • What flood-related risks will remain after you have implemented the measures to protect the site from flooding (i.e. residual risk) and how and by whom will these be managed over the lifetime of the development (e.g. flood warning and evacuation procedures)?		
Development Layout and Sequential approach	Plan showing how sensitive land uses have been placed in areas within the Site that are at least risk of flooding.	SFRA Section 10.2
Finished Floor Levels	Plans showing finished floor levels in the proposed development in relation to Ordnance Datum taking account of indicated flood depths.	SFRA Section 10.6
Flood Resistance	Details of flood resistance measures that have been incorporated into the design. Include design drawings where appropriate.	SFRA Section 10.7
Flood Resilience	Details of flood resilience measures that have been incorporated into the design. Include design drawings where appropriate	SFRA Section 10.7
Safe Access/Egress	Provide a figure showing proposed safe route of escape away from the site and/or details of safe refuge. Include details of signage that will be included on Site. Where necessary this will involve mapping of the flood hazard associated with river and/or tidal flooding. This	SFRA Section 10.8

[39] Waterman (2010) Selby District Draft Submission Core Strategy. Sustainability Appraisal Report

What to include in the FRA		Source(s) of Information
	may be available from Environment Agency modelling, or may need to be prepared as part of hydraulic modelling study specific for the proposed development Site.	
Floodplain Compensation Storage	Provide calculations or results of a hydraulic modelling study to demonstrate that the proposed development provides compensatory flood storage and either a) will not increase flood risk to neighbouring areas or b) will result in an overall improvement. This should be located and designed to achieve level for level and volume for volume compensation, should be provided on land that is in hydrological continuity with the Site within the applicant's ownership and subject to appropriate maintenance regimes for its lifetime. Include cross sectional drawings clearly showing existing and proposed site levels.	SFRA Section 10.3
Flow Routing	Provide evidence that proposed development will not impact flood flows to the extent that the risk to surrounding areas is increased. Where necessary this may require a hydraulic modelling study.	SFRA Section 10.3
Surface Water Management	Details of the following within a FRA for all major development proposals in Flood Zones 1, 2 or 3: • Calculations (and plans) showing areas of the Site that are permeable and impermeable pre and post-development • Calculations of pre and post-development runoff rates and volumes including consideration of climate change over the lifetime of the development. • Details of the methods that will be used to manage surface water (e.g. permeable paving, swales, wetlands, rainwater harvesting). • Reference the supporting Outline or Detailed Drainage Strategy for the Site. • Information on proposed management arrangements	SFRA Section 10.9 and Section 11 SDC Local Planning Guidance and NYCC SuDS guidance.
Flood Warning and Evacuation Plan	Where appropriate reference the Flood Warning and Evacuation Plan or Personal Flood Plan that has been prepared for the proposed development (or will be prepared by site owners).	SFRA Section 10.8

9.2.1 Pre-application Advice

At all stages, SDC, NYCC, appropriate IDB, and where necessary, the Environment Agency, YWSL and the Rivers and Canals Trust should be consulted to ensure the FRA provides the necessary information to fulfil the requirements for planning applications.

The Planning Practice Guidance Section 10 on flood risk and coastal change provides detail on the requirements of a site-specific flood risk assessment, and the application of the sequential and exception tests:

- Planning Practice Guidance section 10: http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment/

It additionally includes the considerations that need to be made to meet the wider sustainability benefits to the community and the safety of the development if it is to satisfy the exceptions test.

The Environment Agency provides guidance on the requirements of, and how to complete, an FRA as part of a planning application:

- Environment Agency Planning Application Advice: https://www.gov.uk/planning-applications-assessing-flood-risk
- Alternatively for planning application advise, the Yorkshire Sustainable Places team inbox can be contacted using the following email address

This also includes information on when an FRA is required and advice on the contents of FRAs for different development types in Flood Zones 1, 2 and 3. Applicants for planning permission within SDC area should follow both the PPG and EA advice when preparing a site-specific FRA.

General Flood Risk Standing Advice can also be useful to consult as it is this guidance which SDC will use in combination with the PPG to assess your application: https://www.gov.uk/flood-risk-standing-advice-frsa-for-local-planning-authorities

Additionally, the Environment Agency can provide pre-application advice to developers, at a cost. Further information is available here:

- Pre-planning application advice: https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion
- Detailed planning advice: https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions

10. Managing and Mitigating Flood Risk

10.1 Overview

The NPPF notes that it may not always be possible to avoid locating development in areas at risk of flooding. This Section builds on the findings of the SFRA to provide guidance on the range of measures that could be considered on site in order to manage and mitigate flood risk, thereby satisfying Part 2 of the Exception Test. These measures should be considered when preparing a site-specific FRA as described in Section 9. This section outlines the approach SDC should adopt in relation to flood risk planning and development management decisions.

It is essential that the development control process influencing the design of future development within the study area carefully mitigates the potential impact that climate change may have upon the risk of flooding. As a result, mitigation measures should be designed with an allowance for climate change over the lifetime of proposed development.

10.2 Development Layout and Sequential Approach

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. Most large development proposals include a variety of land uses of varying vulnerability to flooding.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from higher risk areas to higher ground, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning. Reference could be made to breach modelling (**Appendix A Figures 17-21**) to provide further detail of residual fluvial and tidal flood risk within Flood Zones, where appropriate. Each breach scenario shows risk from a breach in a specific location therefore a breach in another location (not modelled) will show a different breach extent. It should be noted that just because a location was not included within one of the modelled breach extents does not mean there is no risk from a breach in the flood defences.

Waterside areas, or areas along known flow routes, can act as Green Infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

The Environment Agency requires an 8-metre-wide undeveloped buffer strip either side of main fluvial rivers, or 16m for a tidal river, for maintenance purposes and would also ask developers to explore opportunities for riverside restoration as part of any development.

North Yorkshire County Council and SDC will seek a 5-metre-wide undeveloped buffer strip to be retained either side of an Ordinary Watercourse. New development located within 9 metres of the bank top of a watercourse under the jurisdiction of an IDB (7 metres for the Selby Area IDB) will require consent from the IDB under local drainage byelaws.

10.3 Modification of Ground Levels

Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment. Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken as raising land above the floodplain could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain) as shown in Figure 10-1. It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated).

Floodplain compensation must be considered in the context of the 1% AEP flood level including an allowance for climate change. When designing a scheme flood water must be able to flow in and out and must not pond.

A site-specific FRA must demonstrate that there is no loss of flood storage capacity and include details of an appropriate maintenance regime to ensure mitigation continues to function for the life of the development. Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA C624[40] Publication.

Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment. Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

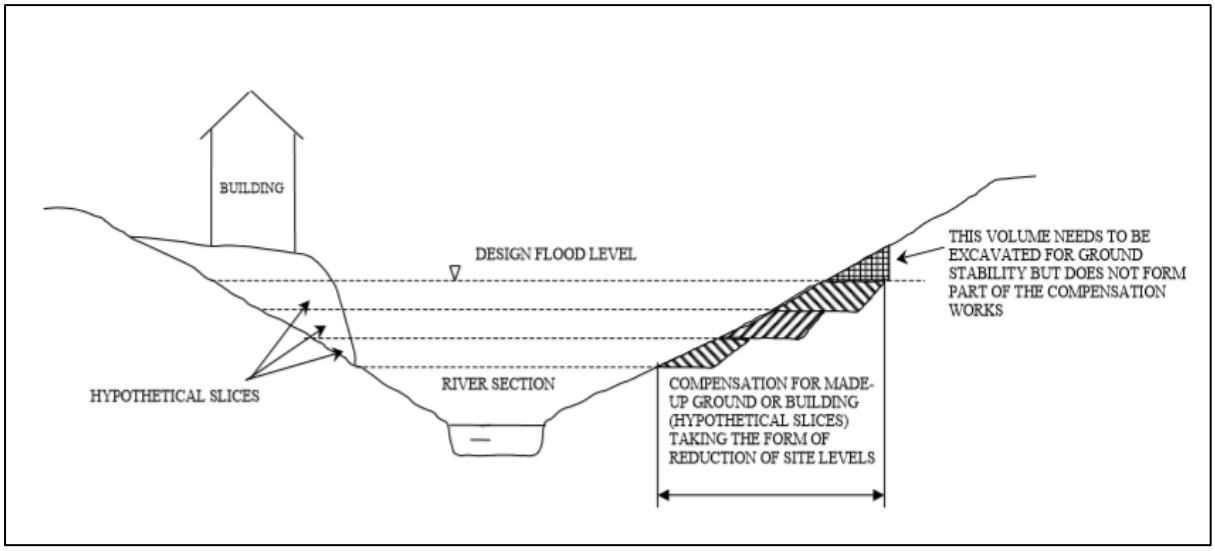


Figure 10-1: Compensatory Flood Storage, Improving Flood Performance, DCLG 2007

10.3.1 Underfloor Voids

The use of under-floor voids with adequate openings beneath the raised finished floor levels can be considered for development in Flood Zone 2 and 3 associated with fluvial flooding. They are generally considered to provide indirect compensation or mitigation, but not true compensation for loss of floodplain storage. The use of under-floor voids will typically require a legal agreement or planning condition and maintenance plan for them to remain open for the lifetime of the development and agreement that SDC will enforce. Sole reliance on the use of under-floor voids to address the loss of floodplain storage capacity is generally not acceptable.

Should it not be possible to achieve all the level for level compensation required, the Environment Agency may consider that the remainder be provided through the use of under-floor voids instead. The amount of level for level compensation would need to be maximised and any under-floor voids would need to be appropriately designed and kept clear to enable them to function effectively.

10.3.2 Car Parks

Where car parks are specified as areas for the temporary storage of surface water and fluvial floodwaters, flood depths should not exceed 300mm given that vehicles may be moved by water of greater depths. Where greater depths are expected, car parks should be designed to prevent the vehicles from floating out of the car park. Signs should be in place to notify drivers of the susceptibility of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary.

The Environment Agency recommends that in areas where under croft parking is provided, occupants should also sign up to flood alerts. Due to the nature of flood warnings, it is possible that under croft parking areas may have flooded before a flood warning has been issued.

[40] CIRIA (2004) CIRIA Report 624: Development and Flood Risk - Guidance for the Construction Industry

10.4 Development and raised defences

Construction of raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. It is always best to position development away from areas which need to be protected from flooding. Compensatory storage must be provided where raised defences remove storage from the floodplain. However, if a development is to include the construction of flood defences, designs should include details of access for pedestrians and vehicular access to the elevation of the development, impacts on the streetscape and challenges of perceived isolation, land-take for the use of access routes and embankments and challenges to site drainage and surface water runoff.

Land raising can ensure that development is located above the design flood level. However, land raising can increase risk to neighbouring communities, reduce community place-making and can require high land-take. Where land raising is proposed within flood risk areas, compensatory storage should be provided on a level for level/volume for volume basis.

Where development is located behind, or in an area benefitting from defences, the residual risk of flooding must be considered.

Developers should engage as early as possible with SDC and the Environment Agency to confirm whether new defences and/or land raising would be acceptable in principle. This reduces the potential for abortive work, delays in relevant planning permissions and completion of development.

10.5 Future Flood Alleviation Schemes

It is known that a Flood Alleviation Scheme is being developed in Tadcaster due to the need to upgrade flood defences in the town. The project is still in the outline design and business case phases, and it is anticipated that construction will begin in 2024. The scheduled completion date of the scheme is the end of 2026. Any developments occurring within the vicinity of Tadcaster should contact the Environment Agency and Selby District Council to understand how the flood alleviation scheme could affect the development. If any planned development is located behind flood defences, there may be a requirement to complete residual breach risk analysis.

It is advised that Selby District Council and the Environment Agency are contacted before hydraulic modelling work is completed on any Flood Risk Assessment to understand if any new flood defences have been constructed which could influence a proposed development.

10.6 Finished Floor Levels

Where developing in Flood Zone 2 and 3 is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) and Highly Vulnerable land uses, is to ensure internal floor levels are raised and include a freeboard level above the design flood level. Internal floor levels should be raised 600mm above the known or modelled 1% AEP flood level for rivers or 0.5% AEP flood level for tidal sources, including a suitable allowance for climate change (see Environment Agency Standing Advice). Floor levels may not need to be raised for other types of development where buildings can be designed to be floodable e.g. Less Vulnerable development.

Development Type	Flood Zone 3	Flood Zone 2
Minor residential development	Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development should be incorporated OR, Floor levels within the extension will be set 300mm above the known or modelled 1% AEP flood level including climate change for fluvial flood risk and the 0.5% AEP event including climate change for tidal flood risk.	Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development should be incorporated.

Development Type	Flood Zone 3	Flood Zone 2
Other development - residential	Where appropriate, subject to there being no other planning constraints (e.g. restrictions on building heights), finished floor levels should be set at whichever level is higher: • 600mm above existing ground level of the site plus 300mm of flood proof / resilient construction. • 600mm above the highest recorded flood level plus 300mm of flood proof / resilient construction. • 300mm above the known or modelled 1% AEP flood level including the appropriate climate change allowance for fluvial flood risk and the 0.5% AEP flood level including climate change for tidal flood risk. This means that habitable ground floors are not allowed, even if they are not designed as sleeping accommodation. For defended fluvial floodplain, flood levels in the event of a breach should be derived for the 1% AEP event plus climate change and for defended tidal floodplain, flood levels should be derived for the 0.5% AEP event plus climate change. For a habitable use to be acceptable there must be no more than 300mm depth of internal flooding. If internal flood depths are greater than 300mm development cannot be considered to have safe internal access or egress, and so would not be appropriate for habitable use. Where ground floor levels cannot be set above the estimated river or tidal level, sleeping accommodation should be restricted to the first floor or above to offer the required 'safe place'. Internal ground floors below this level could however be occupied by either Less Vulnerable commercial premises, garages or non-sleeping residential rooms (e.g. kitchen, study, lounge) (i.e. applying a sequential approach within a building).	
Other development – non residential	Finished floor levels may not need to be raised. For example, Less Vulnerable developments can be designed for water entry instead of raising floor levels, and this may be beneficial to help minimise the impact of the development on the displacement of floodwater and the risk of flooding to the surrounding area. However, it is strongly recommended that internal access is provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. Such refuges will have to be permanent and accessible to all occupants and users of the site and a Flood Warning and Evacuation Plan should be prepared to document the actions to take in the event of a flood. Other flood resilience and resistance measures may also be required.	
Basement dwellings	Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units are not permitted in Flood Zone 3b. Self-contained residential basements and bedrooms at basement level are not permitted in Flood Zone 3a. Internal access to a higher floor situated 300mm above the 1% AEP flood level including climate change must be provided for all other basements, basement extensions and conversions.	All basements, basement extensions and conversions must have internal access to the basement via floor situated 300mm above the 1% AEP flood level including climate change.

In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. The Environment Agency has provided Standing Advice on extensions and floor levels.

Where an area benefits from the presence of flood defences, the fluvial and/or tidal risk is considered to be residual.

The Environment Agency has prepared updated guidance on the methodology used to assess, record and address the residual uncertainties associated with final floor levels and freeboard allowances[41].

10.6.1 Basement Dwellings

Basement dwellings are classified as Highly Vulnerable under the NPPF and as such the following should be adhered to within the FRA:

- Basements dwellings are discouraged within areas at risk of fluvial, surface water or groundwater flooding risk;

[41] Environment Agency (2021) Accounting for residual uncertainty: updating the fluvial freeboard guide. Available at: https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/accounting-for-residual-uncertainty-an-update-to-the-fluvial-freeboard-guide

- Basement dwellings are not permitted within Flood Zone 3a and Flood Zone 3b;
- For Flood Zone 2, basement dwellings must pass the Sequential and Exception Tests;
- Where basement dwellings are constructed, access must be situated 300mm above the design flood level, and developers are required to install protection to prevent surcharge from the public sewer network into the property. This is often achieved by the installation of a positively pumped system in the basement;
- Waterproof construction techniques should be employed to avoid seepage during flood events;
- An assessment of ground conditions is required to inform the structural integrity of the basement construction. This should include consideration of groundwater conditions, as well as flow paths and the potential for excessive surface water to pond at the side of buildings with the potential to infiltrate and compromise structural integrity;
- Surface water flow paths should be assessed to inform the strategic location of SuDS and techniques to route flows around the edge of buildings.

10.7 Resistance and Resilience Measures

The consideration of resistance and resilience measures should not be used to justify development in inappropriate locations.

There will be instances where developments, such as those that are water compatible and essential infrastructure are permitted in high flood risk areas. The mitigation measures outlined in Section 8.3 should be considered before resistance and resilience measures are relied on.

Property Flood Resilience (PFR) is an important part of the response to existing and predicted flood risks, particularly in areas where it is not possible to protect communities by structural flood defences or where it is necessary to manage residual flood risk. PFR measures provide a way to reduce the risks to people and property enabling homeowners and businesses to reduce damage in the event of flooding, speed up recovery and potentially obtain insurance cover more easily and affordably.

PFR includes a portfolio of approaches to provide flood resistance and resilience that can be installed as part of preparing for flooding, or during the repair of buildings after they have been flooded. Resistance measures (dry proofing) such as flood barriers and gates are aimed at preventing water from entering properties. Flood resilience measures accept that water will enter the building and aim to limit or reduce the damage caused (wet proofing). Resilient materials and building construction methods reduce the probability of permanent damage being caused, maintain structural integrity and aid recovery.

CIRIA have produced a 'Code of Practice (CoP)[42] and Guidance for Property Flood Resilience[43]' document which will enable the LPA Development Management Officers to specify and deliver cost effective PFR.

The CoP and guidance will provide a robust and integrated framework covering the four key stages of PFR, which includes:

- Engagement with those managing the flood risk;
- The assessment of property flood risk and specification of PFR approaches, including the development of the overall design philosophy;
- Installation of measures, including the provision of appropriate post installation support; and
- Survey and certification of the installation to ensure it is built as specified.

The following measures are available:

- Permanent barriers - measures include built up doorsteps, rendered brick walls and toughened glass barriers;
- Temporary barriers - consisting of moveable flood defences which can be fitted into doorways and/or windows. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water;

[42] CIRIA (2021) Code of practice for property flood resilience C790F)
[43] CIRIA (2021) Guidance on the code of practice for property flood resilience - (C790b)

- Community resistance measures - these include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood; and
- Flood resilience measures - measures that aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuits installed at a higher level and water-resistant materials for floors, walls and fixtures. Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[44].

The effectiveness of resistance and resilience measures are often dependant on the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. The proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate.

10.8 Flood Warning and Evacuation Plans

The revised NPPF places more emphasis on emergency plans within site specific FRAs. Paragraph 167[e] outlines how there is now specific reference to the need to prepare and submit an 'agreed' emergency plan.

There is a requirement that the plans are now agreed, and consideration will need to be given to the appropriate parties to this agreement. These will vary according to the specific circumstances and the nature of the risk and emergency that is being addressed.

Evacuation is where flood alerts and warnings provided by the Environment Agency enable timely actions by residents or occupants to allow evacuation to take place unaided, i.e. without the deployment of trained personnel to help people from their homes, businesses and other premises. Rescue by the emergency services is likely to be required where flooding has occurred, and prior evacuation has not been possible.

Flood Warning and Evacuation Plans should include:

<u>How flood warning is to be provided, such as:</u>

- Availability of existing flood warning systems (refer to Sections 5.5 and **Appendix A Figure 9**);
- Where available, the rate of onset of flooding and available flood warning time; and
- How flood warning is given.

<u>What will be done to protect the development and contents, such as:</u>

- How easily damaged items (including parked cars) or valuable items (important documents) will be relocated;
- How services can be switched off (gas, electricity, water supplies);
- The use of flood protection products (e.g. flood boards, airbrick covers);
- The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc.; and
- The time taken to respond to a flood warning.

<u>Ensuring safe occupancy and access to and from the development, such as:</u>

- Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate;
- Safe access route to and from the development for pedestrians without passing through flood waters to where the hazard is greater than "very low" according to Defra / Environment Agency guidance FD2320/TR2;
- If necessary, the ability to maintain emergency services during an event;
- Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible; and

[44] DCLG (2007) *Improving the Flood Performance of New Buildings, Flood Resilient Construction*, Available from: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf?bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=flood_performance.pdf [Accessed July 2022]

- Expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.)

10.8.1 Safe Refuge

In exceptional circumstances, dry access above the 1% AEP flood level including climate change associated with fluvial flooding, and above the modelled breach flood levels for tidal flooding, may not be achievable. In these circumstances the Environment Agency and SDC should be consulted to ensure that the safety of the site occupants can be satisfactorily managed.

This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed egress route. For example, this may entail the designation of a safe place of refuge on an upper floor of a building, from which the occupants can be rescued by emergency services. It should be noted that sole reliance on a safe place of refuge is a last resort, and all other possible means to evacuate the site should be considered first. Provision of a safe place of refuge will not guarantee that an application will be granted.

There is no statutory requirement for the Environment Agency or the emergency services to approve evacuation plans. SDC and NYCC are accountable via planning condition or agreement to ensure that plans are suitable. This should be done in consultation with emergency planning staff.

10.9 Surface Water Management

All major developments (10 or more dwellings and 100m^2 floor space or equivalent non-residential or mixed development) should not result in an increase in surface water runoff, and where possible, should demonstrate betterment in terms of rate and volumes of surface water runoff.

SuDS should be used to reduce and manage surface water runoff to and from proposed developments as near to source as possible in accordance with the requirements of the Technical Standards and supporting guidance published by DLUHC and Department for the Environment, Food and Rural Affairs (Defra)[45]. In line with the SDC Core Strategy, SuDS must be implemented for all development sites unless it is demonstrated that SuDS are not suitable.

It is essential that the design of SuDS is considered early in the design process for a development area to ensure that a coordinated and integrated system can be implemented. In the revised NPPF (2021) the requirement for SuDS has been strengthened, both in paragraph 167c and also given a full paragraph (paragraph 169) outlining the requirement to:

- Take advice from the LLFA;
- Have appropriate proposed minimum operational standards;
- Have maintenance arrangements in place; and
- Where possible provide multifunctional benefits.

Where site conditions are more challenging the type of SuDS may need to be adapted to the site's opportunities and constraints and used in combination with traditional techniques if absolutely necessary.

At a strategic level, this means identifying SuDS opportunities according to geology, soil type, topography, groundwater conditions etc., their potential impact on land take, and setting out local SuDS guidance and opportunities for adoption and maintenance.

Further information on the non-statutory Technical Standards and the guidance on the application of SuDS in North Yorkshire is detailed in Section 11 of this SFRA.

As of 6 April 2015, all major development should include provision for SuDS and, as the LLFA, NYCC is a statutory consultee on surface water management drainage issues for all such major developments. NYCC has set out clear advice and guidance documents on their website[46].

[45] Sustainable drainage systems: non-statutory technical standards - https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards; PPG Flood Risk and Coastal Change - http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/reducing-the-causes-and-impacts-of-flooding/why-are-sustainable-drainage-systems-important/

[46]North Yorkshire County Council, North Yorkshire County Council SuDS design guidance 2018 update, Available at: NYCC SuDS Design Guidance 2018 Update.pdf (northyorks.gov.uk) , [Last accessed: 15 July 2022]

Applicants are strongly encouraged to discuss their proposals with both NYCC and SDC at the pre-application stage.

For smaller schemes located within Flood Zones 2 and 3, SuDS will need to be addressed as part of an FRA and will be assessed by SDC.

10.10 Natural Flood Management

There has been an additional reference in the revised NPPF (2021) with regards to the use of Natural Flood Management (NFM) techniques to reduce the causes and impacts of flooding. Paragraph 151 states "*All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by c) using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management)"*

NFM is when natural processes are used to reduce the risk of flooding and coastal erosion. Examples include restoring bends in rivers, changing the way land is managed so soil can absorb more water and creating saltmarshes on the coast to absorb wave energy. NFM works best when a 'catchment-based approach' is taken, where a plan is developed to manage the flow of water along the whole length of a river catchment from its source to sea. This way, natural processes can be used upstream and on the coast to compliment engineered flood defences – such as walls and weirs – in populated areas.

NFM not only reduces flood risk it can also achieve multiple benefits for people and wildlife, helping restore habitats, improve water quality and helping make catchments more resilient to the impacts of climate change.

The Environment Agency's Working with Natural Processes (WWNP) Evidence Directory[47] has been developed to help flood and coastal erosion risk management (FCERM) authorities understand, justify, develop and implement FCERM schemes with WWNP to reduce flood risk.

The evidence directory is supported by Working with Natural Processes Mapping. The maps are indicative and signpost a range of areas for managing flood risk by protecting, restoring and emulating the natural regulating function of catchments and rivers. The maps highlight potential for WWNP derived from national datasets such as the Environment Agency maps showing the risk of flooding from rivers, sea and surface water. They have been used to target areas where rivers have been disconnected from their floodplain, or areas of high flow accumulations where it would be effective to temporarily store and hold back water to reduce flood peaks further downstream. The maps introduce new science on characterising slowly permeable soils, based on geological datasets, where tree planting could increase hydrological losses and reduce surface run-off.

The maps do not cover a comprehensive list of WWNP measures, and they are not prescriptive as to how these measures could be designed. The maps identify potential areas for:

- Floodplain reconnection;
- Run-off attenuation features and gully blocking; and
- Woodland planting covering floodplain planting, riparian planting and wider catchment woodland.

The effectiveness of NFM measures is site-specific and depends on many factors, including the location and scale at which they are used. It may not always be possible to guarantee that NFM measures alone will deliver a specified standard of defence. Consequently, flood risk management measures are normally chosen from options ranging from traditional forms of engineering through to more natural systems, with a wide range of responses in between.

[47] Defra (2018) Working with Natural Processes – Evidence Directory SC150005

11. Surface Water Management and SuDS

11.1 Introduction

SuDS are surface water drainage solutions designed to manage surface water runoff and mitigate the adverse effects of urban storm water runoff by reducing flood risk and controlling pollution[48]. SuDS techniques allow surface water runoff from development to be controlled in ways which imitate natural drainage by controlling the rate of discharge to a receiving watercourse. SuDS are typically softer engineering solutions inspired by natural drainage processes, such as ponds and swales, which manage water as close to its source as possible. SuDS may also provide valuable habitat and amenity value when carefully planned for in development.

The PPG, which accompanies the NPPF, indicates that priority should be given to the use of SuDS in new developments. Appropriate deployment of SuDS within a development can offer benefits in terms of reductions in flood risk, improvements to water quality, quicker replenishment of groundwater and improved visual amenity. Opportunities to achieve these benefits can also be greatly improved through retrofitting of SuDS into areas of existing urban development.

11.2 North Yorkshire County Council SuDS Design Guidance

The NYCC SuDS Design Guidance note[49] aims to direct developers to relevant design guidance for the successful implementation of SuDS and is the basis against which planning consultations from LPAs will be assessed. The guidance is based on the Non-Statutory Technical Standards[50] (NS), the NPPF and the PPG.

11.2.1 Outline Planning Application

To ensure a satisfactory consultation, NYCC requires the following information to be included in an outline planning application:

A. Site location and layout plans;

B. Topographical survey of the existing site's catchment to include contours at 1m interval and existing surface water flow routes, drains, sewers and watercourses;

C. Site plan showing areas of Main River and surface water flooding;

D. Flood Risk Assessment;

E. Site Drainage Strategy to include:

- SuDS proposals;
- Infiltration test results;
- Outfall locations;
- Rates of discharge;
- On-site storage requirements; and

- Maintenance, funding and operation proposals for the SuDS.

11.2.2 Full Planning Application, Reserved Matters, Discharge of Conditions

To ensure a satisfactory consultation, the NYCC requires the following information to be included in a full planning application, reserved matter and discharge of conditions:

A. Proposed site plan showing exceedance flow routes;

B. Drainage layout plan (to include SuDS, sewer, drains and watercourse);

[48] Defra, Environment Agency (2015) *Cost Estimation for SuDS – Summary of Evidence, Available at: Cost Estimation for SuDS – Summary of Evidence, [Last accessed: 15 July 2022]*
[49] North Yorkshire County Council (2018) *North Yorkshire County Council SuDS Design Guidance 2018 update*, Available from: NYCC SuDS Design Guidance 2018 Update.pdf (northyorks.gov.uk) [Accessed 14 July 2022]
[50] Environment Agency, *Non-statutory technical standard for sustainable drainage systems,* Available at: Sustainable drainage systems: non-statutory technical standards - GOV.UK (www.gov.uk), [Last accessed: 15 July 2022]

C. A condition survey of any drainage assets, infrastructure or watercourse to be utilised;

D. Design calculations as necessary to demonstrate the functionality of the SuDS;

E. Detailed design drawings;

F. SuDS flow calculations (.mdx files compatible with Microdrainage software if that software has been used);

G. Cross sections including design levels;

H. Specification of materials;

I. Phasing of development including Construction Management Plan;

J. Construction phase Surface Water Management Plan;

K. Construction details;

L. Details of inlets and outlets and flow controls;

M. Whole life cycle costing for the SuDS to include replacement cost;

N. Details of the organisation responsible for the SuDS;

O. Details of funding arrangements for SuDS maintenance;

P. Maintenance and operation manual for the SuDS, to include physical access arrangements for maintenance and establishment of legal rights of access in perpetuity; and

Q. Health and Safety Risk Assessment for construction, operation and maintenance of the SuDS.

11.3 The SuDS Manual

The SuDS Manual[51] identifies four processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities for storm water control, flood risk management, water conservation and groundwater recharge:

A. **Infiltration:** the soaking of water into the ground. This is the most desirable solution as it mimics the natural hydrological process. The rate of infiltration will vary with soil type and condition, the antecedent conditions and with time. The process can be used to recharge groundwater sources and feed base flows of local watercourses, but where groundwater sources are vulnerable or there is risk of contamination, infiltration techniques are not suitable. The use of traditional infiltration techniques that infiltrate to the ground is dependent on the underlying ground conditions. However, it is also possible to use shallow infiltration techniques in combination with storage techniques on sites which have impermeable geology, and therefore these techniques should not be overlooked.

B. **Detention/Attenuation:** the slowing down of surface flows before their transfer downstream, usually achieved by creating a storage volume and a constrained outlet. In general, though the storage will enable a reduction in the peak rate of runoff, the total volume will remain the same, just occurring over a longer duration. Detention measures are not constrained by geology, though in areas of permeable geology, there will also be a degree of infiltration of runoff taking place.

C. **Conveyance:** the transfer of surface runoff from one place to another, e.g. through open channels, pipes and trenches.

D. **Water Harvesting:** the direct capture and use of runoff on site, e.g. for domestic use (flushing toilets) or irrigation of urban landscapes. The ability of these systems to perform a flood risk management function will be dependent on their scale, and whether there will be a suitable amount of storage always available in the event of a flood.

[51] CIRIA (2015), *The SuDS Manual (C753),* Available at: https://www.ciria.org/CIRIA/Memberships/The_SuDS_Manual_C753_Chapters.aspx

As part of any SuDS scheme, consideration should be given to the long-term maintenance of the SuDS to ensure that it remains functional for the lifetime of the development. Table 11-1 has been reproduced from the SuDS Manual, C753 and outlines typical SuDS techniques.

Table 11-1: Typical SuDS Components

Technique	Description	Conveyance	Detention	Infiltration	Harvesting
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.		Y	Y	*
Filter Drains	Linear drains/trenches filled with a permeable material, often with perforated pipe in the base of the trench. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site.	Y	Y		
Filter Strips	Vegetated strips of gently sloping ground designed to drain water evenly from impermeable areas and filter out silt and particulates.	*	*	*	
Swales	Shallow vegetated channels that conduct and/or retain water, and can permit infiltration when unlined.	Y	Y	*	
Ponds	Depressions used for storing and treating water.		Y	*	Y
Wetlands	As ponds, but the runoff flows slowly but continuously through aquatic vegetation that attenuates and filters the flow. Shallower than ponds. Based on geology these measures can also incorporate some degree of infiltration.	*	Y	*	Y
Detention Basin	Dry depressions designed to store water for a specified retention time.		Y		
Soakaways	Sub-surface structures that store and dispose of water via infiltration.			Y	
Infiltration Trenches	As filter drains, but allowing infiltration through trench base and sides.	*	Y	Y	
Infiltration Basins	Depressions that store and dispose of water via infiltration.		Y	Y	
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation. It is noted that the use of brown/green roofs should be for betterment purposes and not to be counted towards the provision of on-site storage for surface water. This is because the hydraulic performance during extreme events is similar to a standard roof (CIRIA C697).		Y		
Rainwater Harvesting	Storage and use of rainwater for non-potable uses within a building, e.g. toilet flushing. It is noted that storage in these types of systems is not usually considered to count towards the provision of on-site storage for surface water balancing because, given the sporadic nature of the use of harvested water, it cannot be guaranteed that the tanks are available to provide sufficient attenuation for the storm event.	*	*	*	Y

Note: (Y = primary process, * = some opportunities, subject to design)

The application of SuDS is not limited to a single technique per site. Often a successful SuDS solution will utilise a combination of techniques, providing flood risk, pollution and landscape/wildlife benefits. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS. It should be noted, each development site must offset its own increase in runoff and attenuation cannot be "traded" between developments.

Other measures may also be required in relation to water and sewerage infrastructure that might include pipes and below ground storage required as part of a wider strategic scheme, to deal with surface water flood risk. Options may include:

- Increasing capacity in drainage systems;
- Separation of foul and surface water sewers;
- Improved drainage maintenance regimes; and,
- Managing overland flows.

11.4 Management Train

The concept used in the development of drainage systems is the surface water 'management train'[52] whereby different techniques can be used in series to change the flow and quality characteristics of runoff in stages that attempt to mimic natural drainage. The hierarchy of techniques that should be considered in developing the management train are[53]:

1. Prevention – the use of good site design and site housekeeping measures to prevent runoff and pollution (e.g. sweeping to remove surface dust and detritus from car parks), and rain water reuses/harvesting. Prevention policies should generally be included within the site management plan.
2. Source Controls – control of runoff at or very near its source (e.g. soakaways, other infiltration methods, green roads, pervious pavements).
3. Site Controls – management of water in a local area or site (e.g. routing water from building roofs and car parks to a large soakaway, infiltration or detention basin).
4. Regional Controls – management of runoff from a site or several sites, typically in a balancing pond or wetland.

Generally, the aim should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:

A. Into the ground (infiltration)
B. To a surface water body
C. To a surface water sewer, highway drain, or another drainage system
D. To a combined sewer

Where possible, storm water should be managed in small, cost-effective landscape features located within small sub-catchments rather than being conveyed to and managed in large systems at the bottom of drainage areas. The techniques that are higher in the hierarchy are preferred to those further down so that prevention and control of water at the source should always be considered before site or regional controls. However, where upstream control opportunities are restricted, a number of lower hierarchy options should be used in series. Water should only be conveyed elsewhere if it cannot be dealt with at the site.

The passage of water between stages of the management train should be considered through the use of natural conveyance systems (e.g. swales and filter trenches) wherever possible. Pipework and sub-surface proprietary produce may still be required, especially where space is limited. Pre-treatment (i.e. the removal of silt and sediment loads) and maintenance is vital to ensure the long-term effectiveness of SuDS. Overland flow routes will also be required to convey and control floodwaters safely and effectively during extreme flood events. Generally, the greater

[52] Susdrain, *SuDS management train,* Available at: http://www.susdrain.org/delivering-suds/using-suds/suds-principles/management-train.html, [Last accessed: 15 July 2022]
[53] DEFRA (2015*) Sustainable drainage systems: non-statutory technical standards*, Available from: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards [Last accessed 15 July 2022]

the number of techniques used in a series the better the performance is likely to be and the lower the risk of overall system failure.

SuDS can be applied in all development situations, although individual site constraints may limit the potential of some sites achieving full benefits for all functions. The variety of SuDS available allows planners and designers to make full potential of the local land and consider the needs of local people when implementing the drainage design. The wishes of all the relevant stakeholders needs to be balanced in additional to the risk associated with each design option.

11.5 National SuDS Standards

A set of NS Standards[54] have been published which set the requirements for the design, construction, maintenance and operation of SuDS nationally. The NS Standards are intended to be used alongside the NPPF and PPG.

The NS Standards that are of chief concern in relation to the consideration of flood risk to and from development relating to runoff destinations, peak flow control and volume control are presented below:

Peak Flow Control

- SuDS NS2 '*For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 100% AEP rainfall event and the 1% AEP rainfall event must not exceed the peak greenfield runoff rate for the same event*'.
- SuDS NS3 '*For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 100% AEP rainfall event and the 1% AEP rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event'*.

Volume Control

- SuDS NS4 '*Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1% AEP 6 hour rainfall event should never exceed the greenfield runoff volume for the same event'*.
- SuDS NS5 '*Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1% AEP 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event'*.
- SuDS NS6 '*Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with SuDS NS4 or SuDS NS5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk'*.

Flood Risk Mitigation within the Development

- SuDS NS7 '*The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 3.33% AEP rainfall event'*.
- SuDS NS8 *'The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1% AEP rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development'*.
- SuDS NS9 '*The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1% AEP rainfall event are managed in exceedance routes that minimise the risks to people and property*'.

[54] Defra, (2015), *Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems,* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

11.6 Use of Infiltration SuDS

Improper use of infiltration SuDS can lead to contamination of superficial deposits and bedrock aquifers, leading to deterioration of groundwater quality, or increased flood risk. On the other hand, appropriate use of infiltration SuDS may improve groundwater quality status and decrease the flood risk.

The locations most appropriate for infiltration SuDS exist where there is a combination of high ground and permeable geology. However, when implementing this type of SuDS, it is vital that the impact on properties down gradient is considered. Increasing infiltration in an area will lead to increased groundwater levels, thus an increased susceptibility to groundwater flooding down the catchment.

At each development site groundwater levels should be assessed prior to the implementation of SuDS. This will help confirm their potential function (e.g. soakaways) even after long periods of rainfall. This is particularly important where superficial deposit dominate as their thickness is unpredictable. If they are thick and impermeable, shallow soakaways may not intercept the underlying permeable bedrock. If they are thin and permeable, but perched over impermeable bedrock, they may not receive the additional recharge from the infiltration SuDS.

Infiltration SuDS should not be implemented near to areas of historic landfill, any other areas of known contamination or in SPZs. This is to ensure that drainage does not re-mobilise latent contamination which would exacerbate the risk to groundwater quality.

If ground conditions are not suitable for infiltration SuDS techniques, then surface waters can still be managed using surface infiltration techniques in combination with attenuation SuDS measures. These measures attenuate surface runoff to reduce flood risk both within the site and to the surrounding areas. Furthermore, areas upstream of critical flood areas can be used to install attenuation SuDS to slow the flood of water reaching the high-risk area.

12. Summary and Recommendations

12.1 Site Allocation Process

The outputs from this Level 1 SFRA Update should be used as an evidence base from which to sequentially direct new development to areas of lower flood risk. Where development cannot be located in low flood risk areas, the Council should use the flood maps to apply the Sequential Test to their remaining land use allocations.

Where the need to apply the Exception Test is identified, due to there being an insufficient number of suitable sites for development within zones of lower flood risk, the scope of the SFRA may need to be widened to a Level 2 assessment. The need for a Level 2 SFRA cannot be fully determined until the Council has applied the Sequential Test. It is recommended that as soon as the need for the Exception Test is established, a Level 2 SFRA is undertaken by a suitably qualified technical expert so as to provide timely input to the overall plan making process.

12.2 Council Policy

The New Local Plan and supporting guidance documents should continue to include policies to:

- Protect the functional floodplain from development;
- Direct vulnerable development away from flood affected areas taking account of all flood sources;
- Ensure all new development is ‘safe’. Dry pedestrian access to and from the development must be possible without passing through flood waters where the hazard is greater than “very low” according to Defra / Environment Agency guidance FD2320/TR2, and emergency vehicular access must be possible;
- Promote the use of strategic, integrated and maintainable SuDS in all flood zones for both brownfield and greenfield sites. Space should be set-aside for SuDS and they should be designed to support and enhance biodiversity; and
- Reduce flood risk from all sources where possible, for example through reduction of surface water runoff rates and volumes, increasing floodplain storage, setting development back from watercourses, natural flood risk management, and de-culverting of watercourses.

12.3 Emergency Planning

It is recommended that the SDC and North Yorkshire County Council’s Emergency Response Plans are reviewed and, if necessary, updated in light of the findings of the SFRA to ensure that they are informed by the most up-to-date flood risk information available.

It is further recommended that the Council works with the Environment Agency to promote the awareness of flood risk and encourage communities at risk to sign-up to the Environment Agency Flood Warning Service.

12.4 Future Updates to the SFRA

This SFRA has been updated building heavily upon existing knowledge with respect to flood risk within the District. The Environment Agency review and update the Flood Map for Planning (Rivers and Sea) on a quarterly basis and a rolling programme of detailed flood risk mapping is underway. Future new modelling of watercourses in the area will improve the current knowledge of flood risk within the District and may marginally alter predicted flood extents within parts of the District in the future, (refer to Appendix C for details of on-going hydraulic modelling studies in the area).

New information may influence future development management decisions within these areas. Therefore, it is important that the SFRA is adopted as a ‘living’ document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk within the District.

12.5 Level 2 SFRA

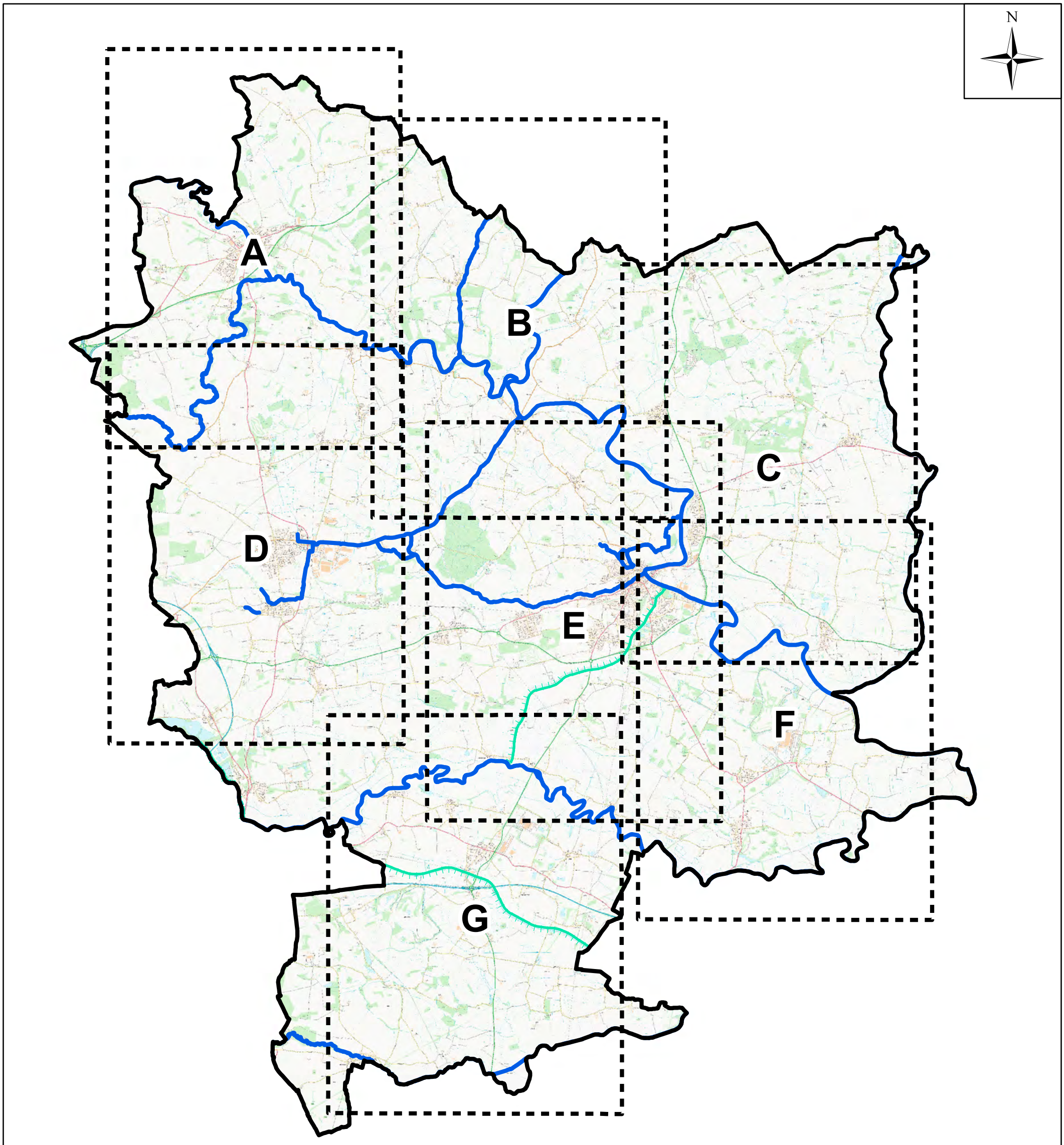
This Level 1 SFRA will allow SDC to assess their proposed site allocations using the Sequential Test. This will act as a ‘sieving’ process, allocating as many sites as possible to low flood risk areas. Where it is found that some sites can only be placed in medium and high flood risk areas, the Exception Test will need to be applied as described in Section 8.6, and SDC begin the preparation of a Level 2 SFRA.

The Level 2 SFRA should be viewed as rather more site specific than a Level 1 SFRA, addressing flood risk to potential development sites which have gone through the Sequential Test and have been located in medium or high flood risk areas. The data required for a Level 2 SFRA will therefore depend upon which, if any, of the Council's list of preferred sites remain in medium or high flood risk areas following application of the Sequential Test and hence where the Exception Test needs to be applied.

It is important that a Level 2 SFRA considers the variation of flood risk within a Flood Zone due to flood risk management measures i.e. flood defences. This increased scope involves a more detailed review of flood hazard (flood probability, flood depth, flood velocity, rate of onset of flooding). If development is to be located behind defences, or downstream of flood storage reservoirs, it may be necessary to model constructional failure of the defence (breach) and water levels rising to exceed the level of the defence (overtopping). It is not necessary to carry out such scenarios behind all existing defences, if no new development is to be located behind these structures. In some instances, improvements to existing flood defences may be required to manage residual flood risks. Here, the SFRA should include an appraisal of the extent of works to provide or raise the flood defence to appropriate standard.

Appendix A SFRA Mapping

Appendix A SFRA Mapping



Legend

- Selby District Council Boundary
- Inset Maps
- Main Rivers
- Canals

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: MAIN RIVER AND CANAL OVERVIEW

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	14/07/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A1		A3

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Drawing Number: FIGURE A1 - A		A3	

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Title: MAIN RIVER AND CANAL OVERVIEW - INSET A

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Legend

- Selby District Council Boundary
- Main Rivers
- Canals

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Title:	MAIN RIVER AND CANAL OVERVIEW - INSET B
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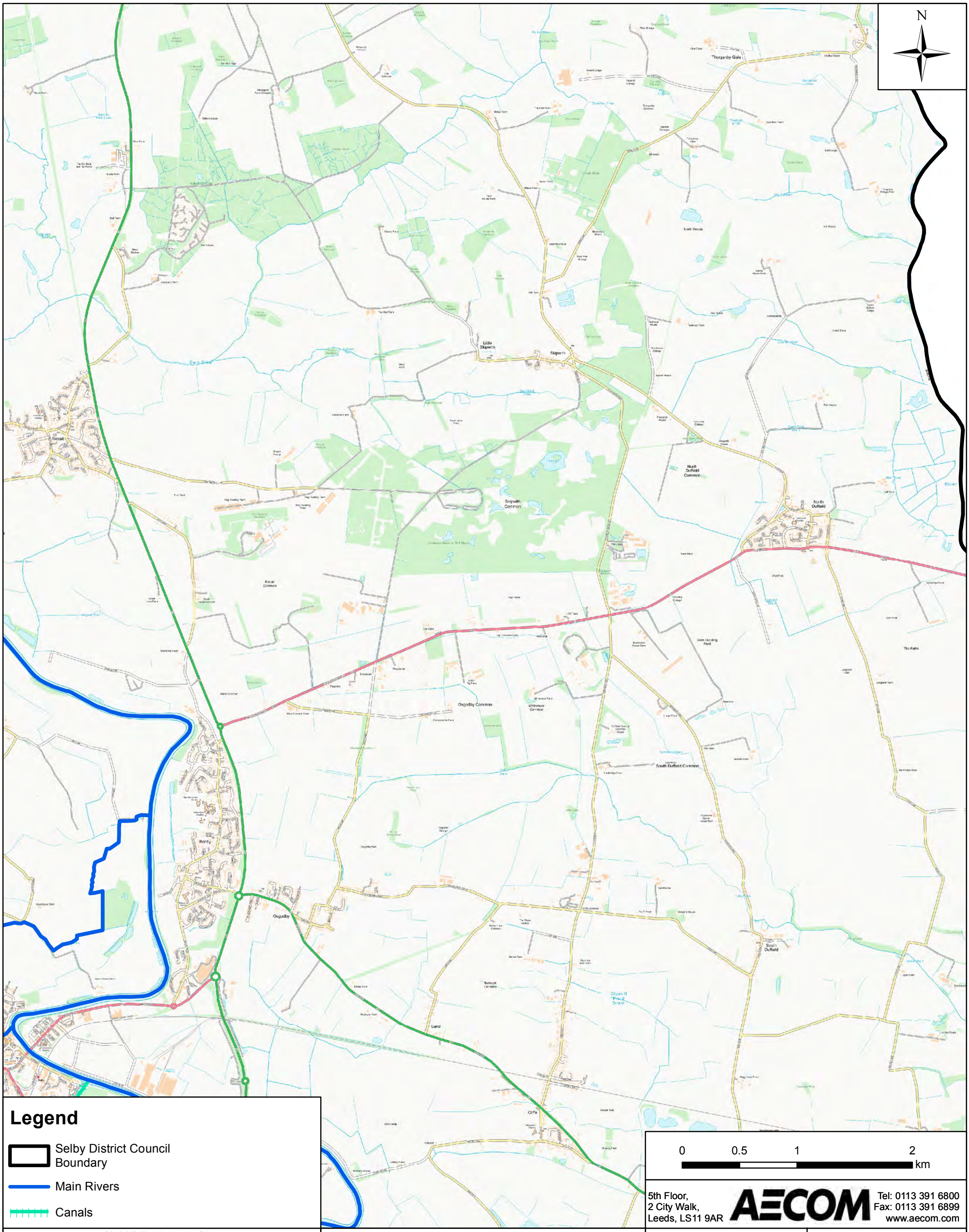

Legend

- Selby District Council Boundary
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- Canals

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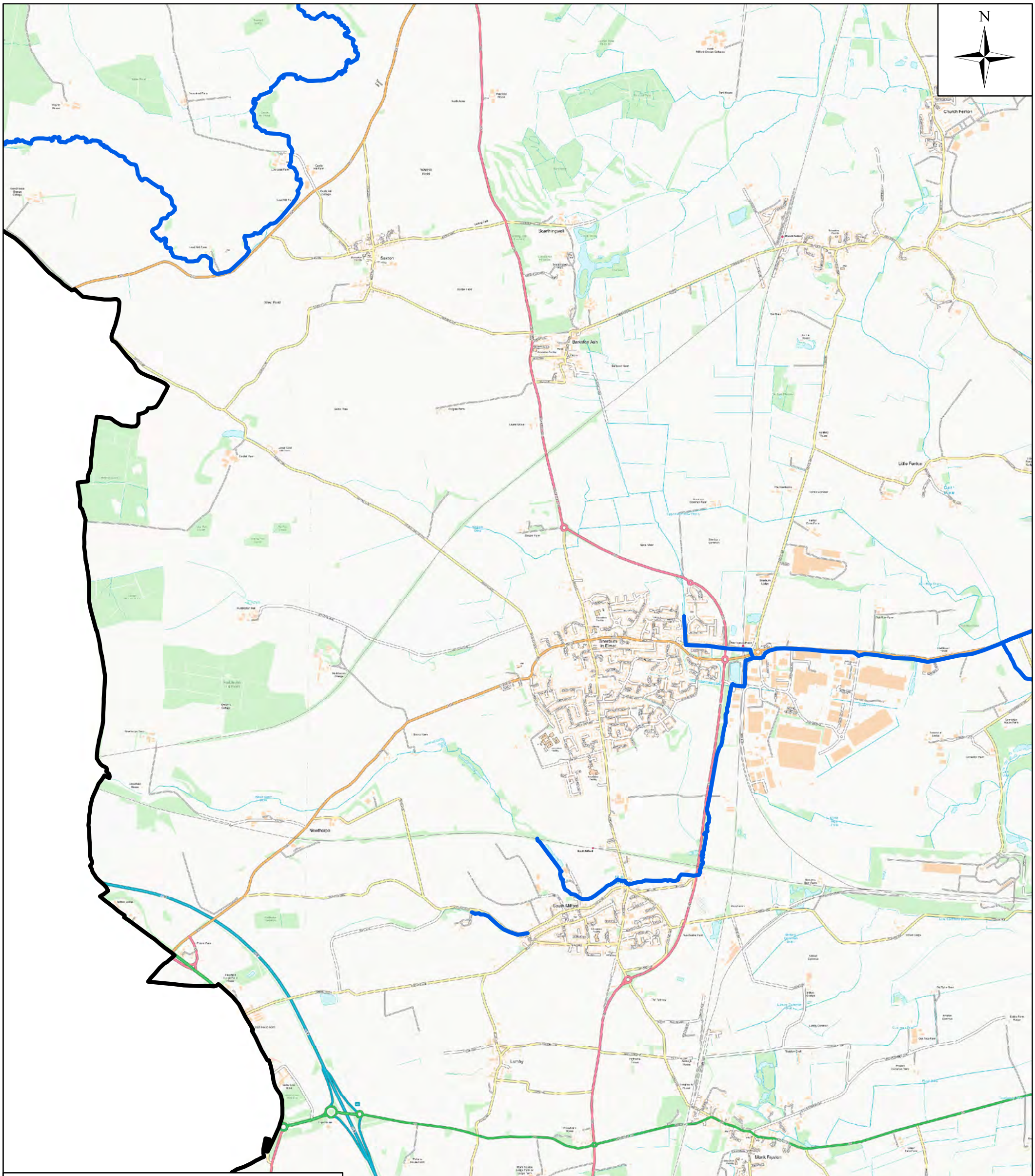

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

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Project:	Selby District Council Level 1 Strategic Flood Risk Assessment Update
Title:	MAIN RIVER AND CANAL OVERVIEW - INSET D
Drawn:	TC
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Approved:	IB
Date:	26/05/2022
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Drawing Number:	FIGURE A1 - D
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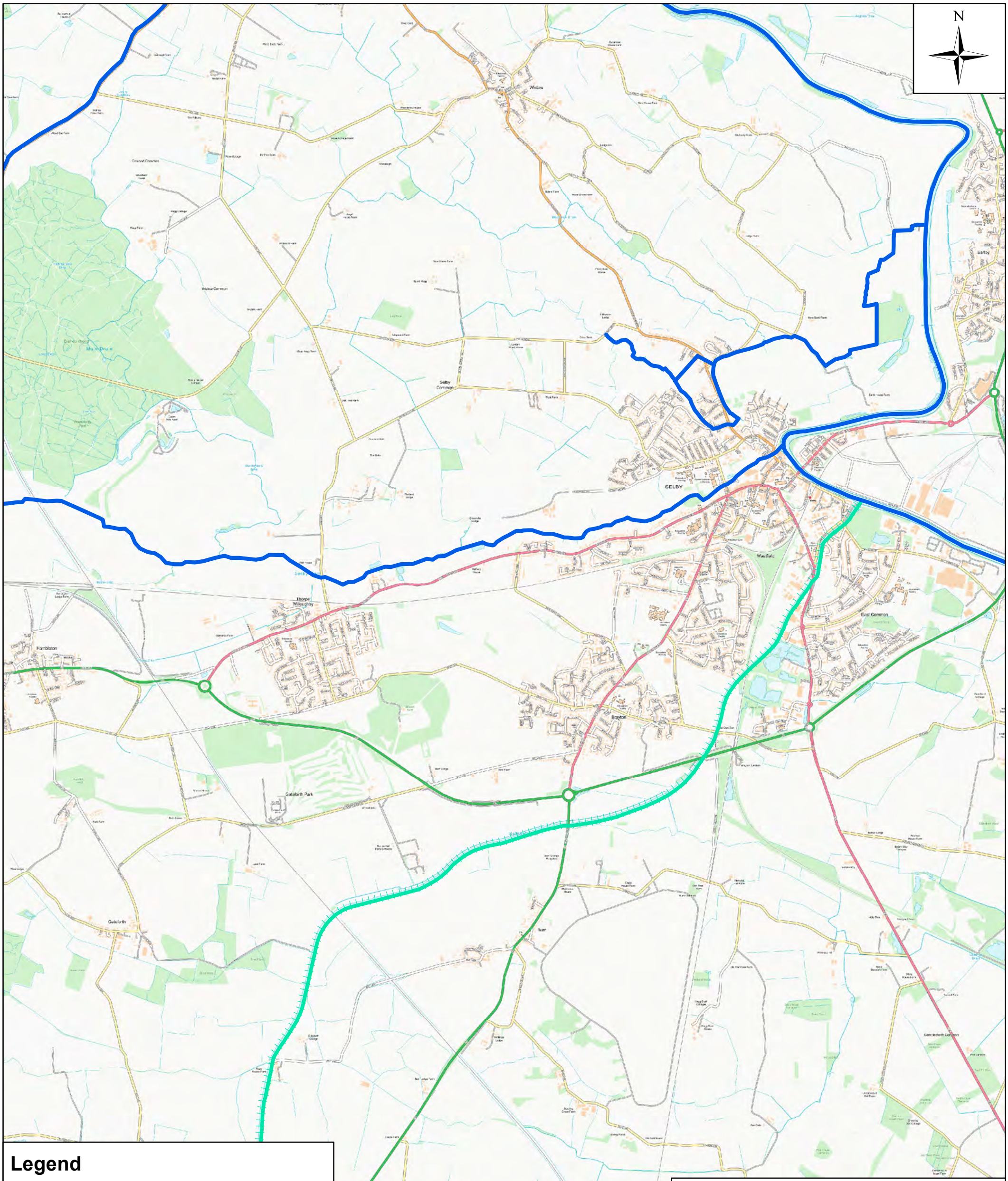

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Title: MAIN RIVER AND CANAL OVERVIEW - INSET E

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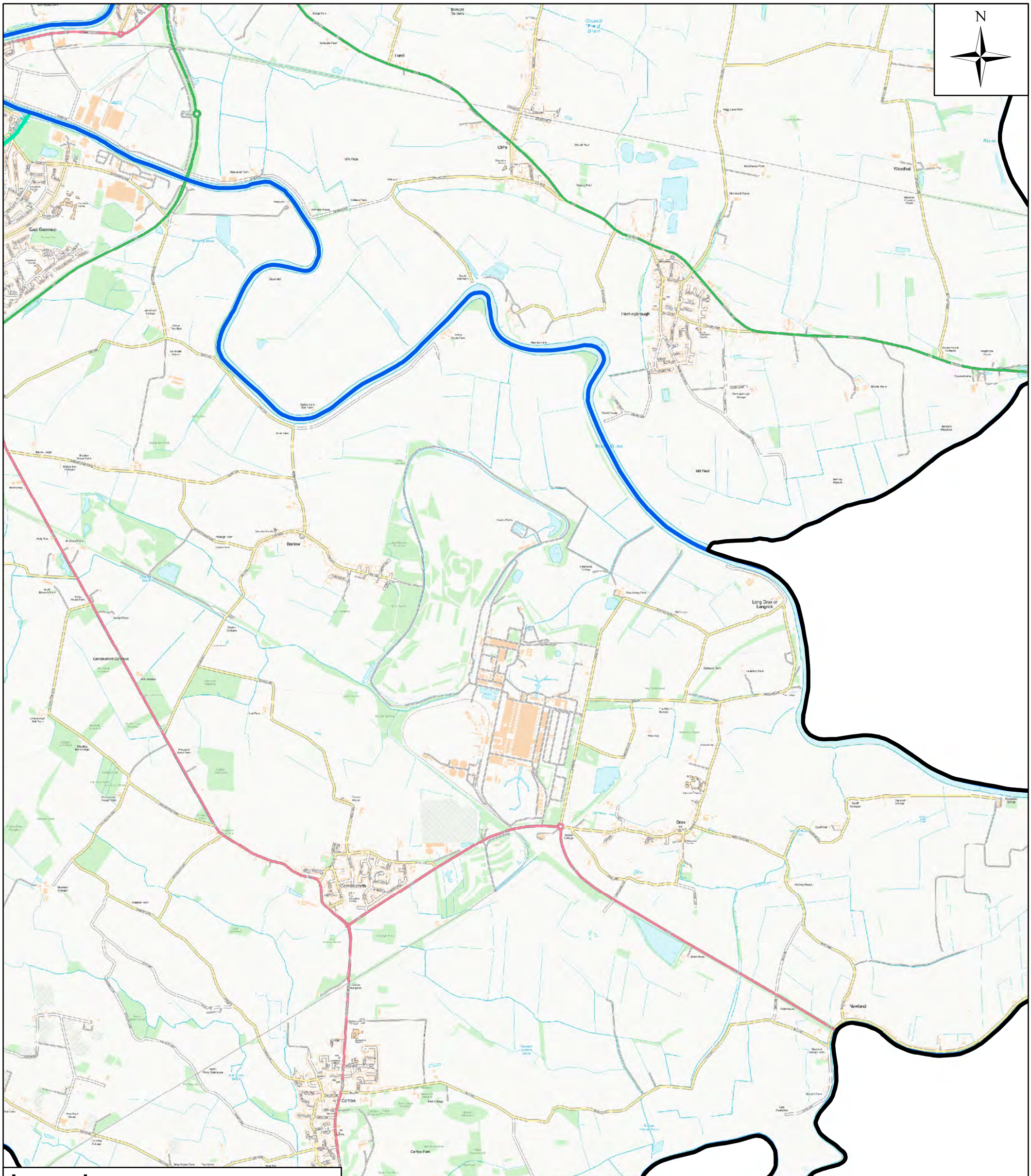

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

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Title: MAIN RIVER AND CANAL OVERVIEW - INSET F

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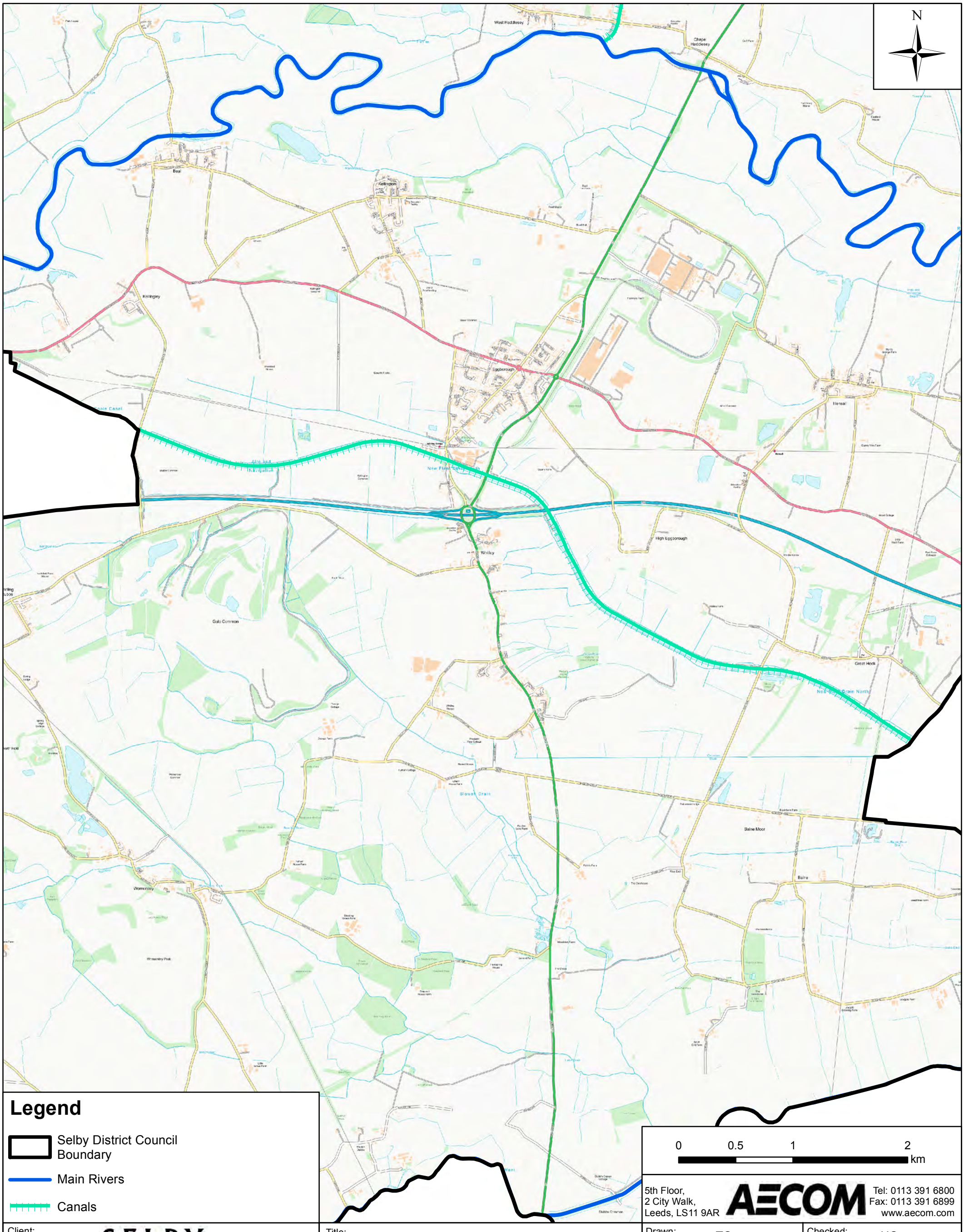

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

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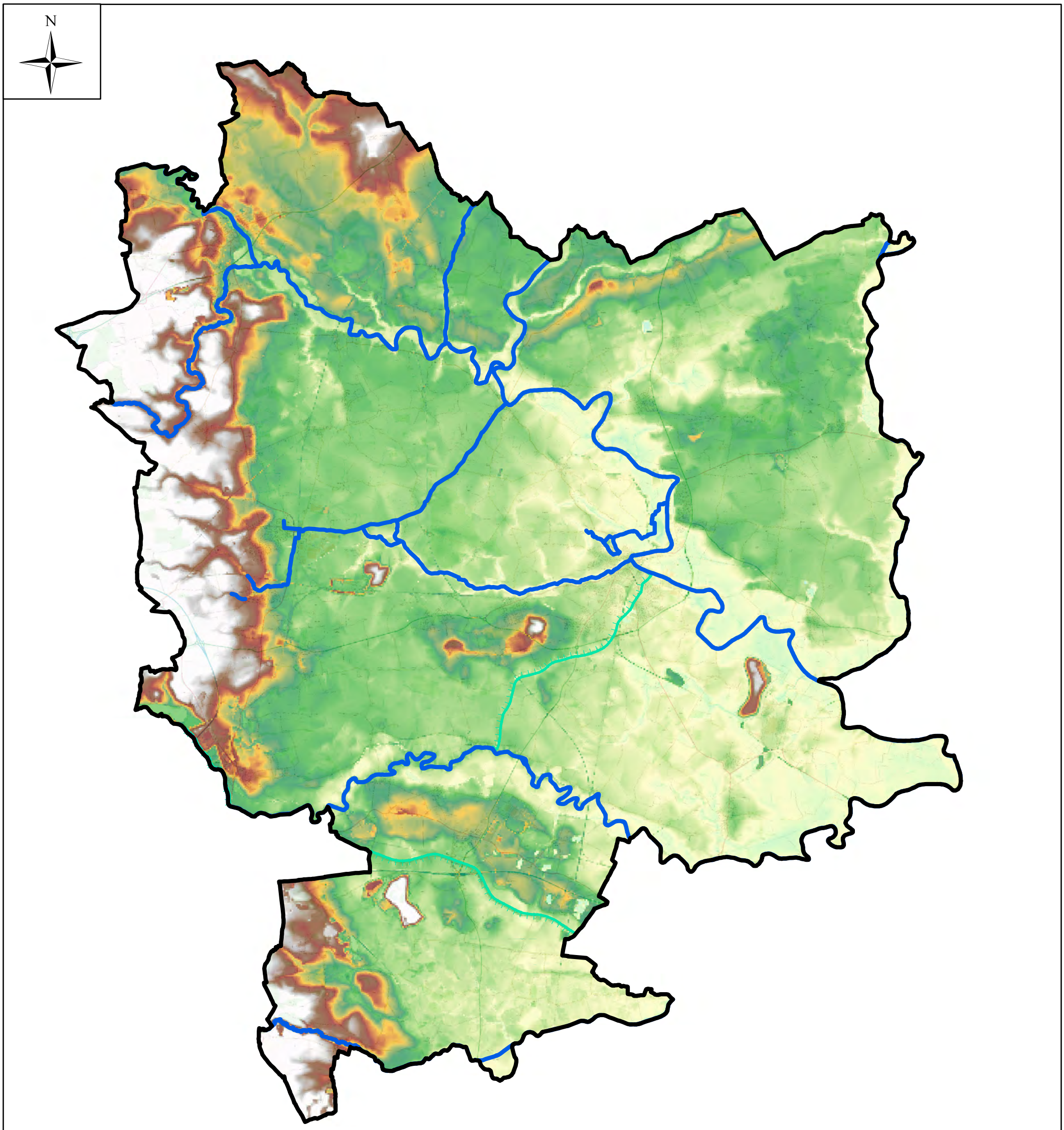

Legend

Selby District Council Boundary

Main Rivers

Canals

Elevation (mAOD)

High : 84.7

Low : -2.7

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Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update		Date: 25/05/2022	Scale at A3: 1:125,000
		Drawing Number: FIGURE A2	A3

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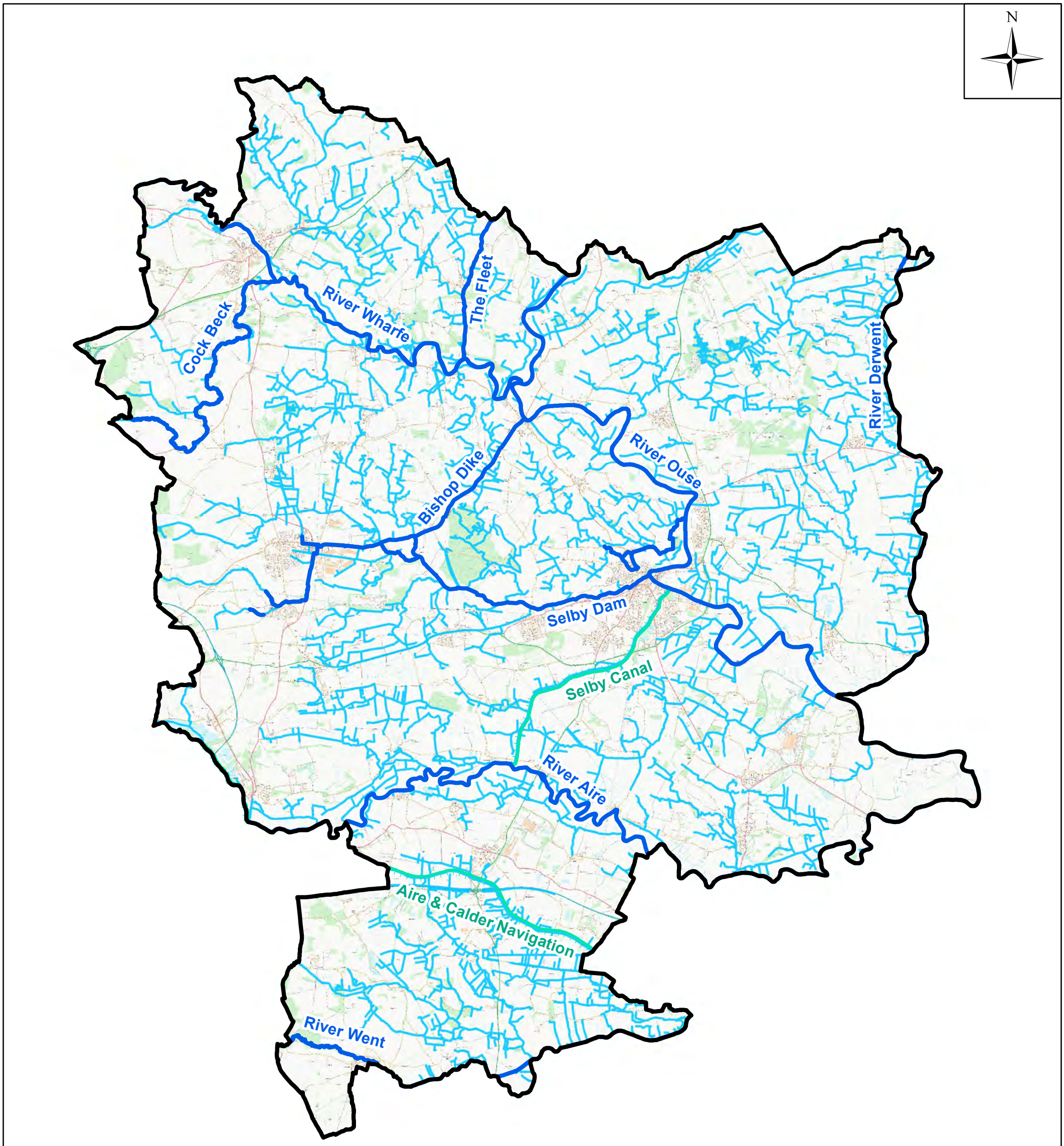

Legend

- Selby District Council Boundary
- Main Rivers
- Canals
- Ordinary Watercourses

0 2.5 5 10 km

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Title: SURFACE WATER BODIES

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Date:	25/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A3		A3

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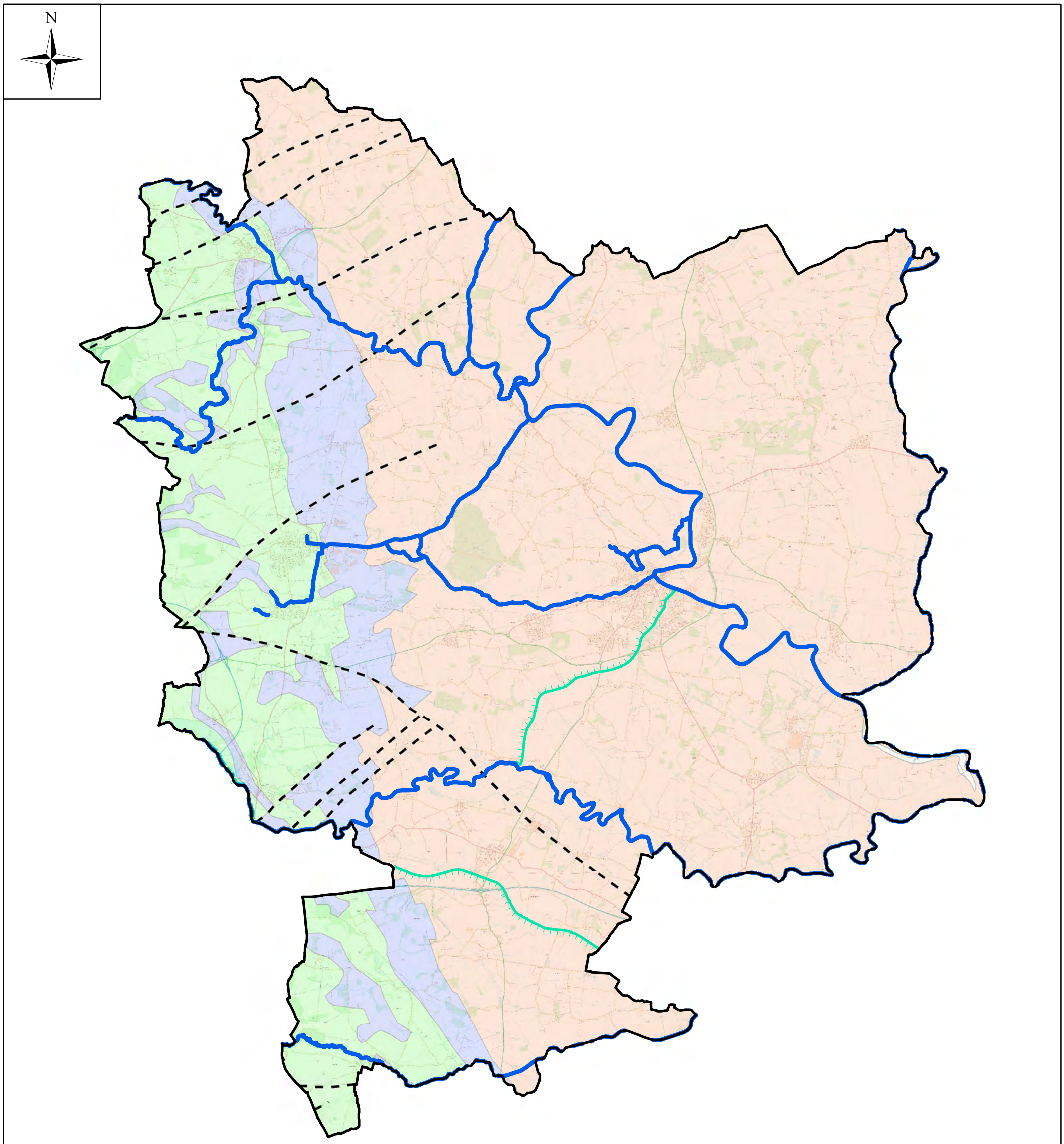

Legend

- Selby District Council Boundary
- Main Rivers
- Canals
- Fault Line

Bedrock Geology

- Pennine Upper Coal Measures Formation
- Permian Rock (undifferentiated)
- Triassic Rocks (undifferentiated)
- Zechstein Group

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Title: BEDROCK GEOLOGY

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	25/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A4		A3

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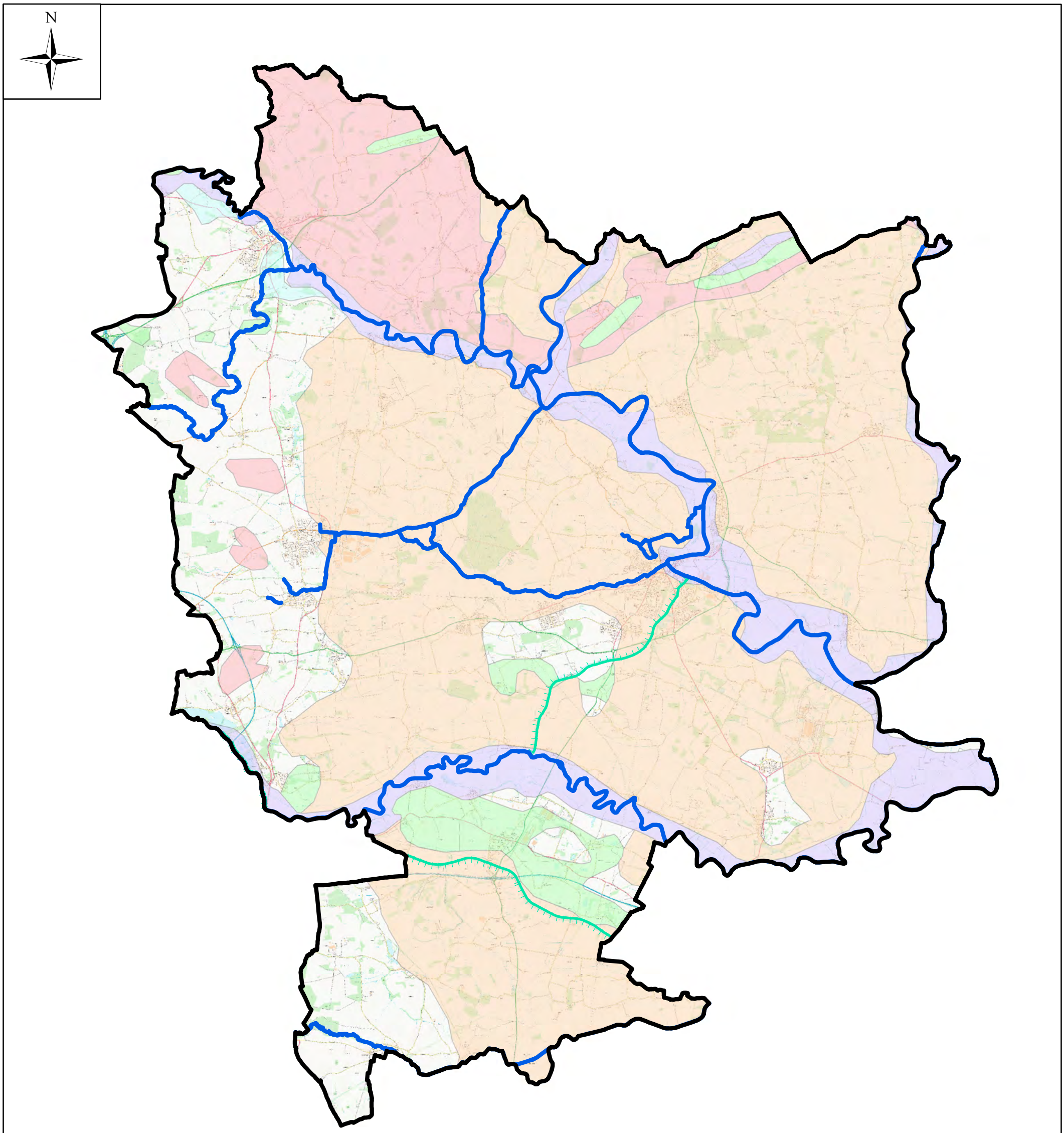

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Superficial Geology

- Alluvium
- Glacial Sand and Gravel
- Lacustrine Deposits (undifferentiated)
- River Terrace Deposits (undifferentiated)
- Till

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Title: SUPERFICIAL GEOLOGY

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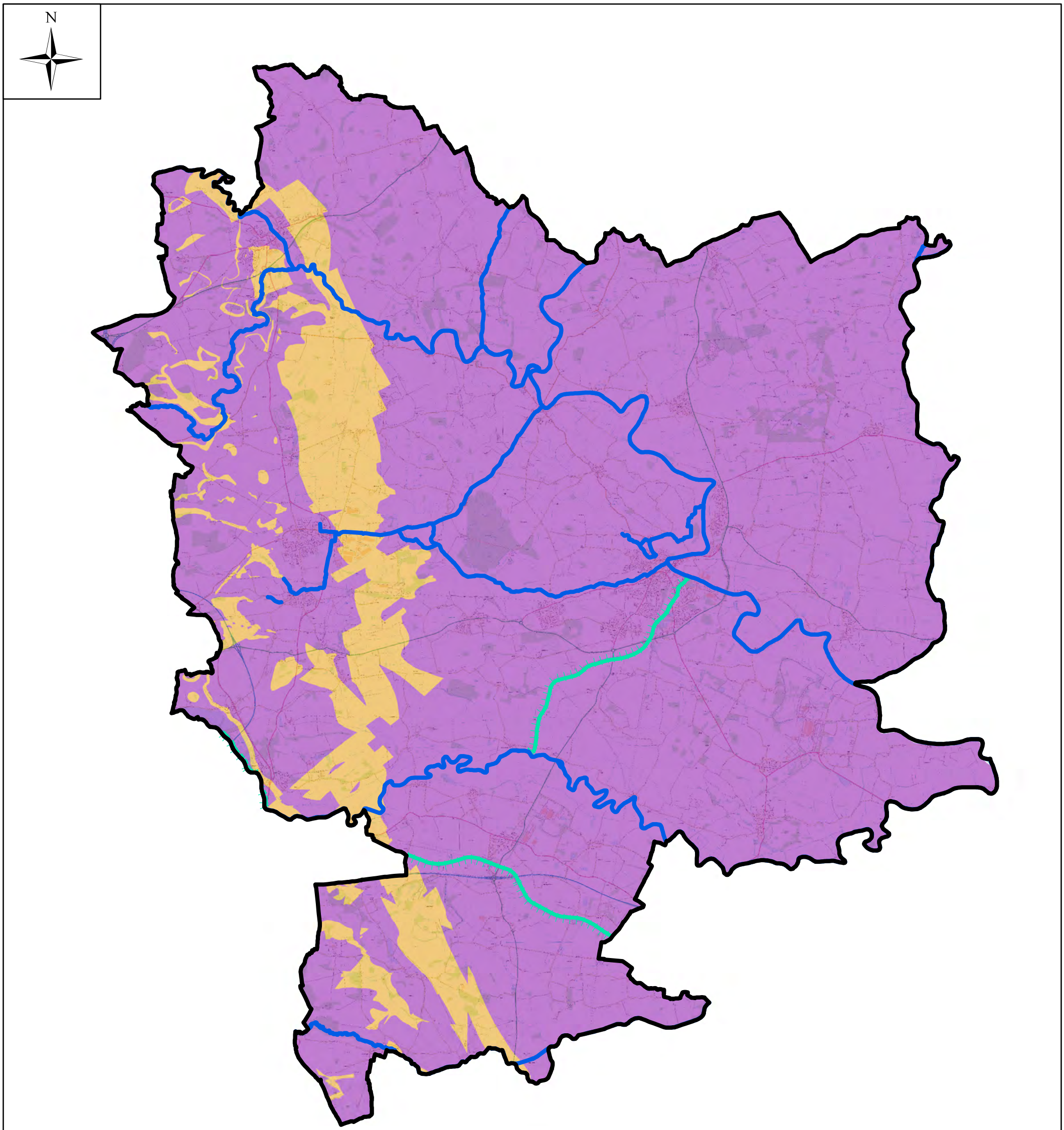

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Aquifer Designation

- Principal
- Secondary A
- Secondary B

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		Verified: CS	Approved: IB
Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update		Date: 25/05/2022	Scale at A3: 1:125,000
		Drawing Number: FIGURE A6	A3

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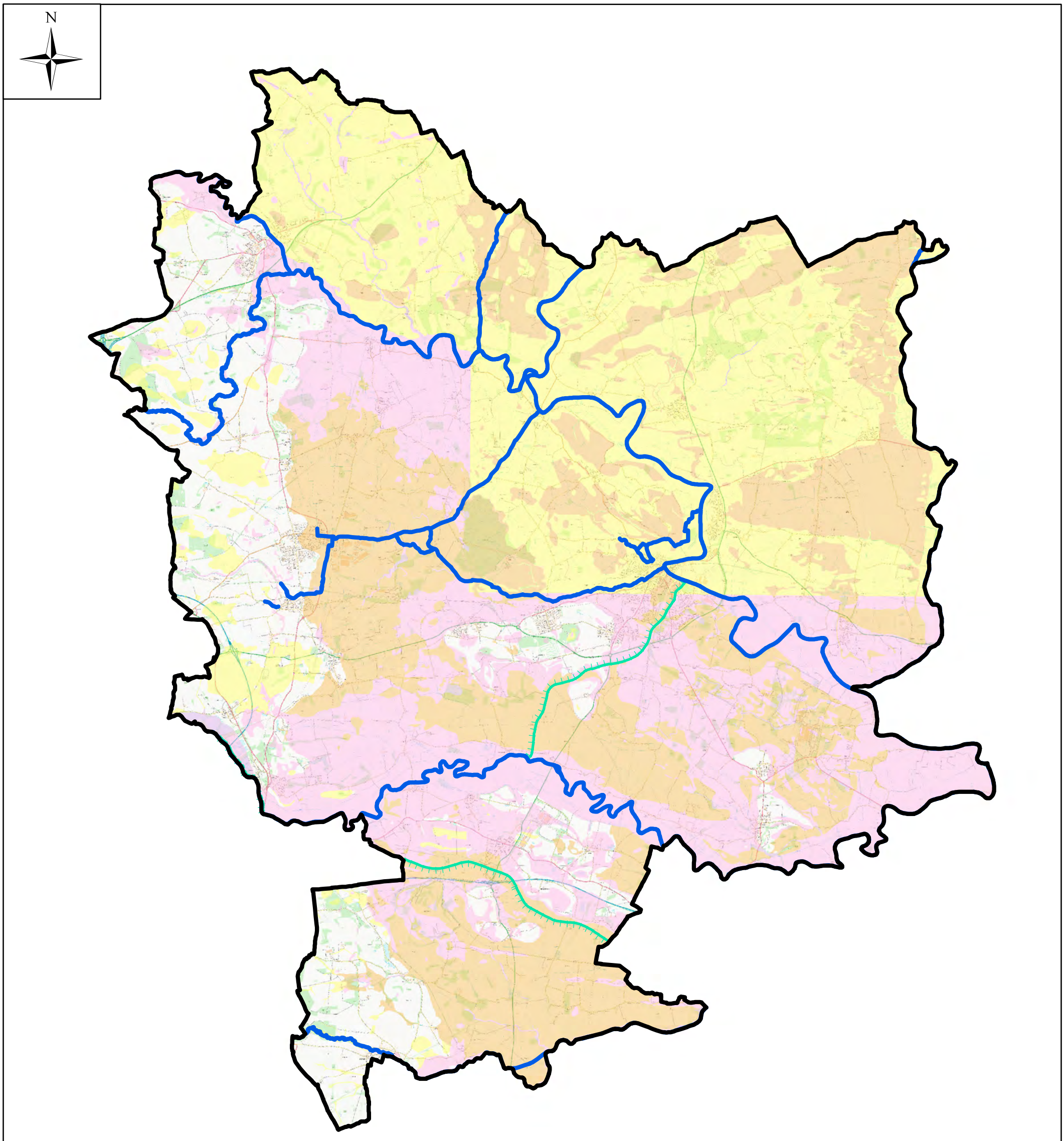

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Aquifer Designation

- Secondary A
- Secondary (undifferentiated)
- Unproductive

0 2.5 5 10 km

5th Floor,
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Client: SELBY DISTRICT COUNCIL	Title: AQUIFER DESIGNATION- SUPERFICIAL
Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update	

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	25/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A7		A3

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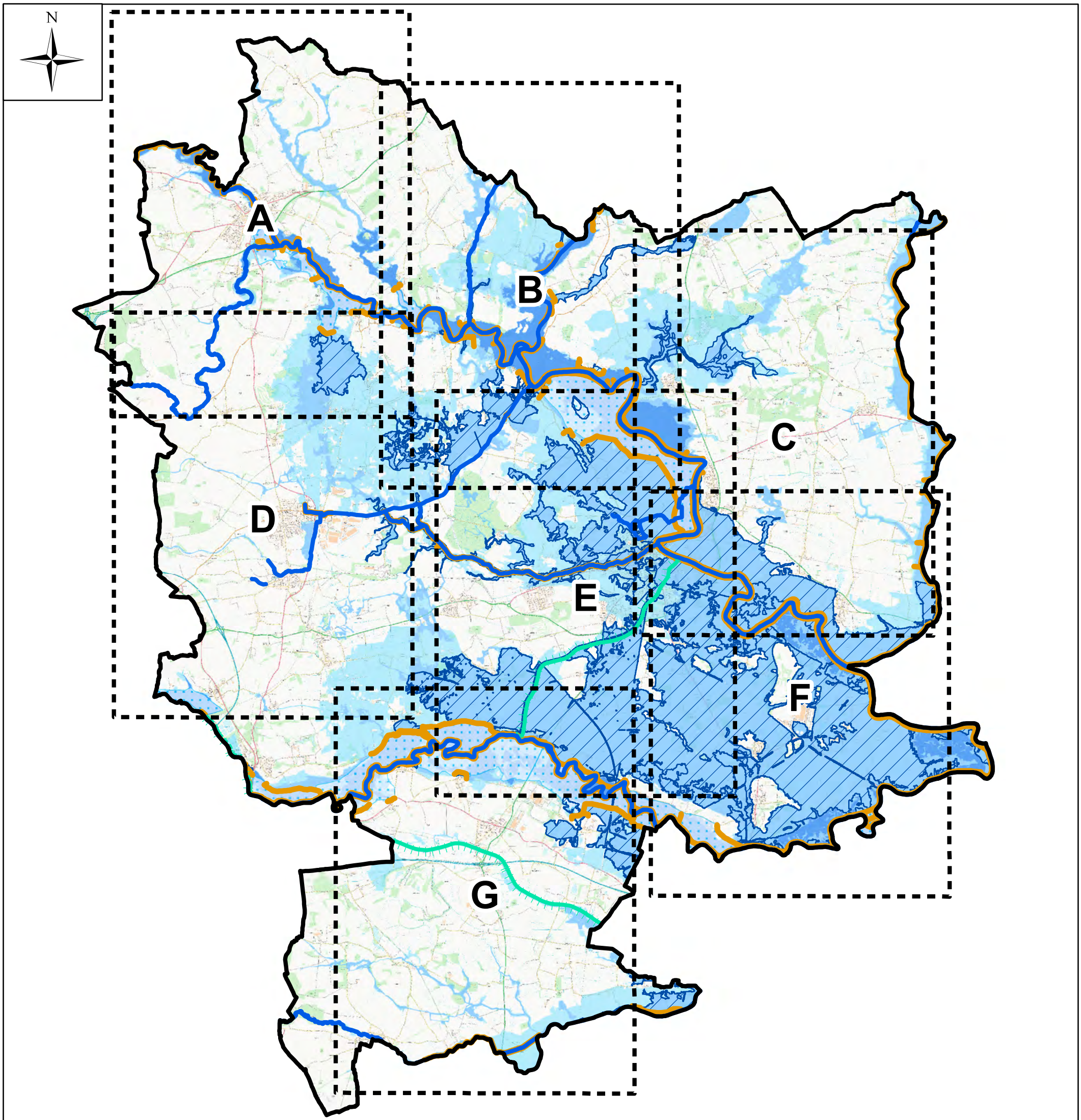

Legend

- Selby District Council Boundary
- Inset Maps
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

0 2.5 5 10 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- OVERVIEW

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	14/07/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A8		A3

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Legend

- Selby District Council Boundary
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

0 0.5 1 2 km

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Leeds, LS11 9AR
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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET A

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/08/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A8 - A		A3

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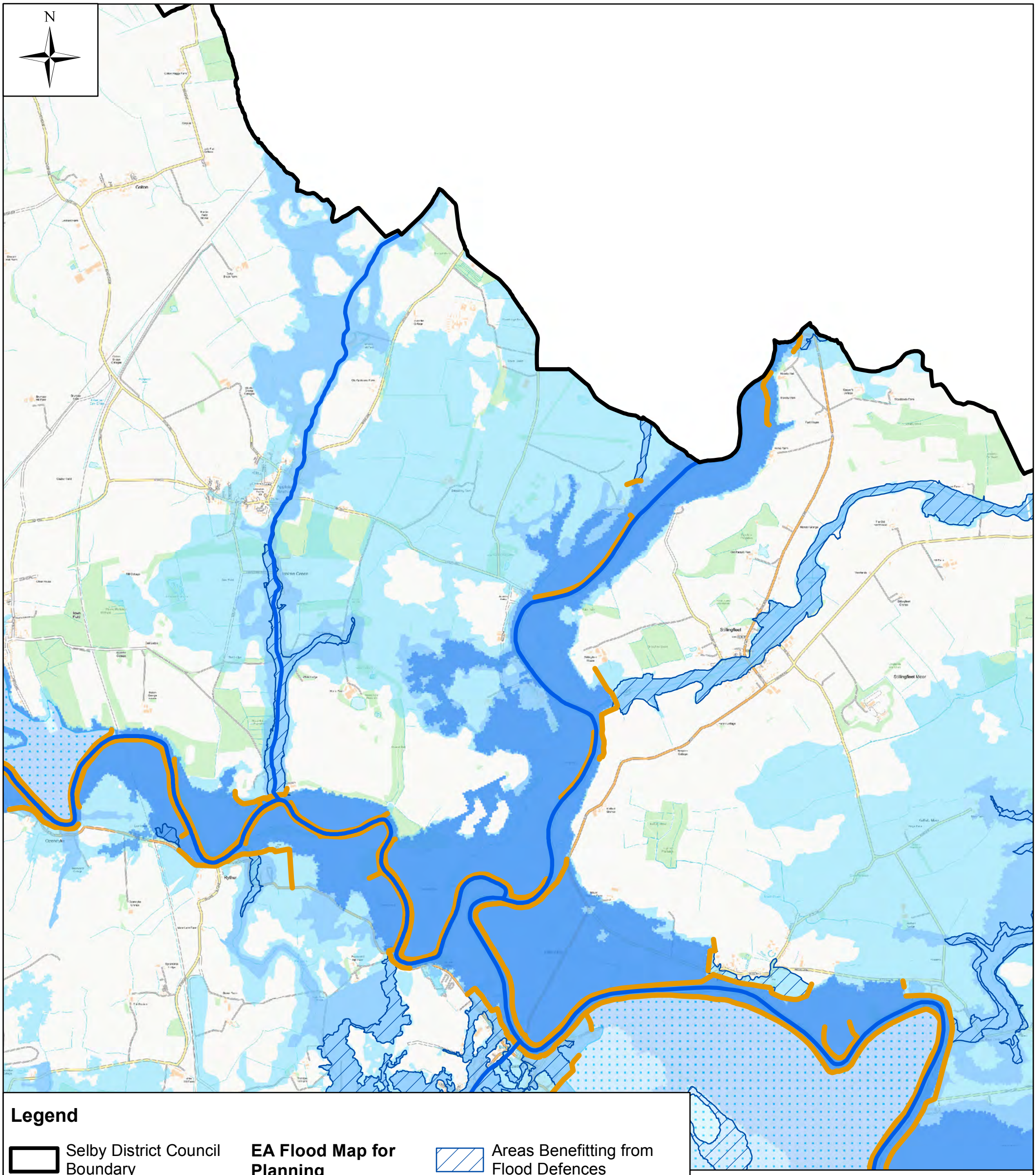

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET B

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/08/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A8 - B		A3

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Legend

- Selby District Council Boundary
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET C

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/08/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A8 - C		A3

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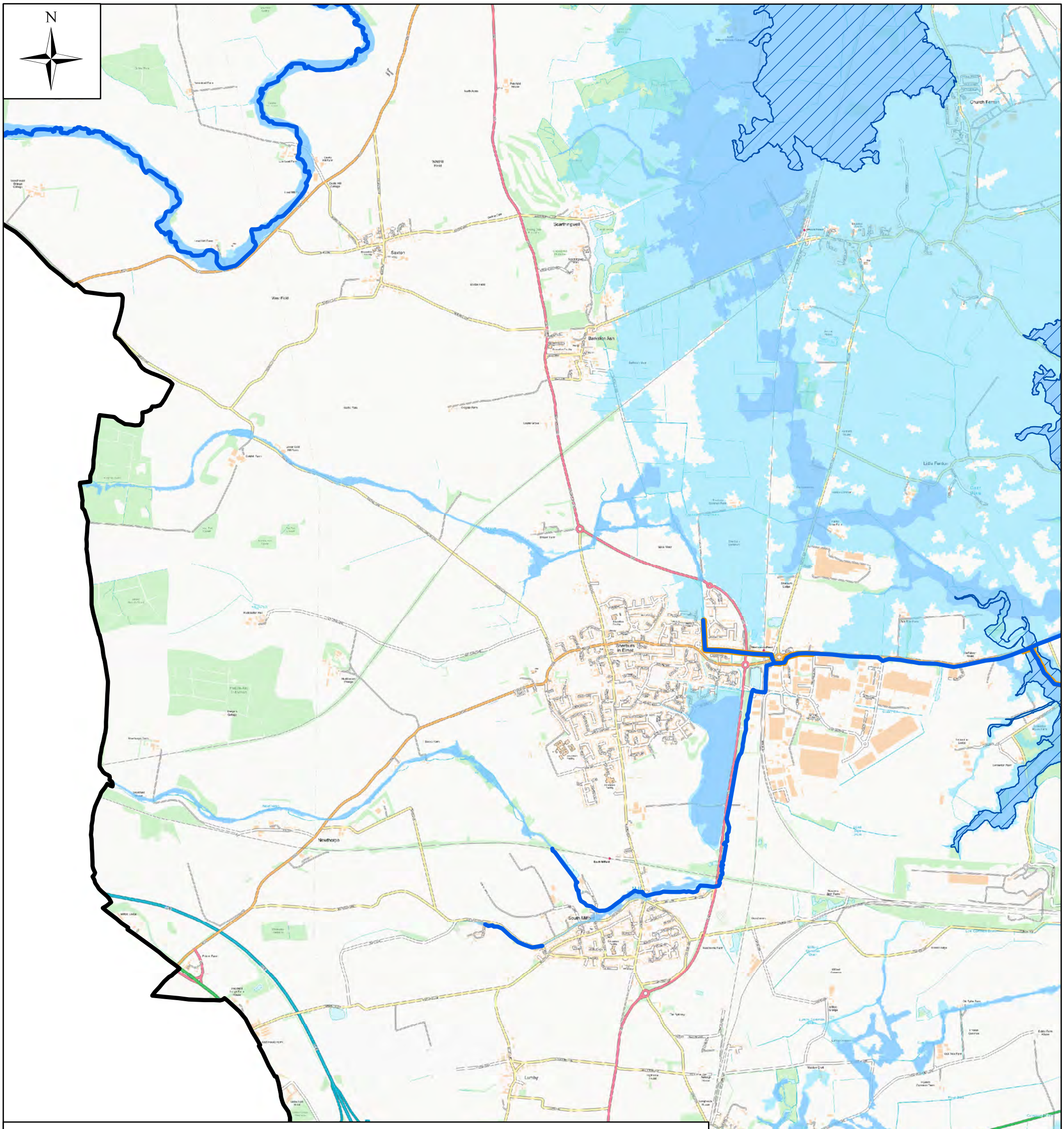

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET D

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/08/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A8 - D		A3

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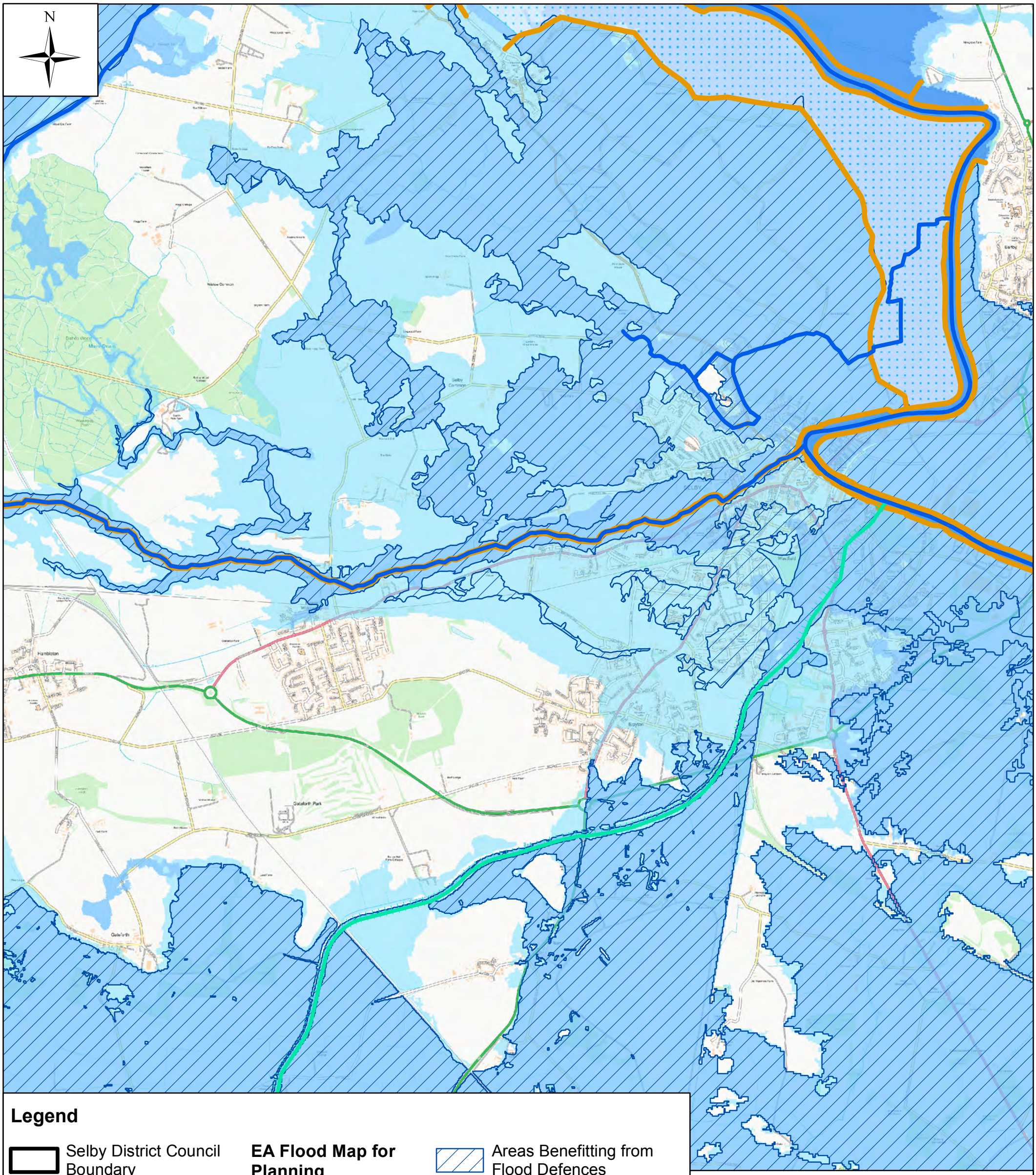

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL	Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET E
Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update	

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/08/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A8 - E		A3

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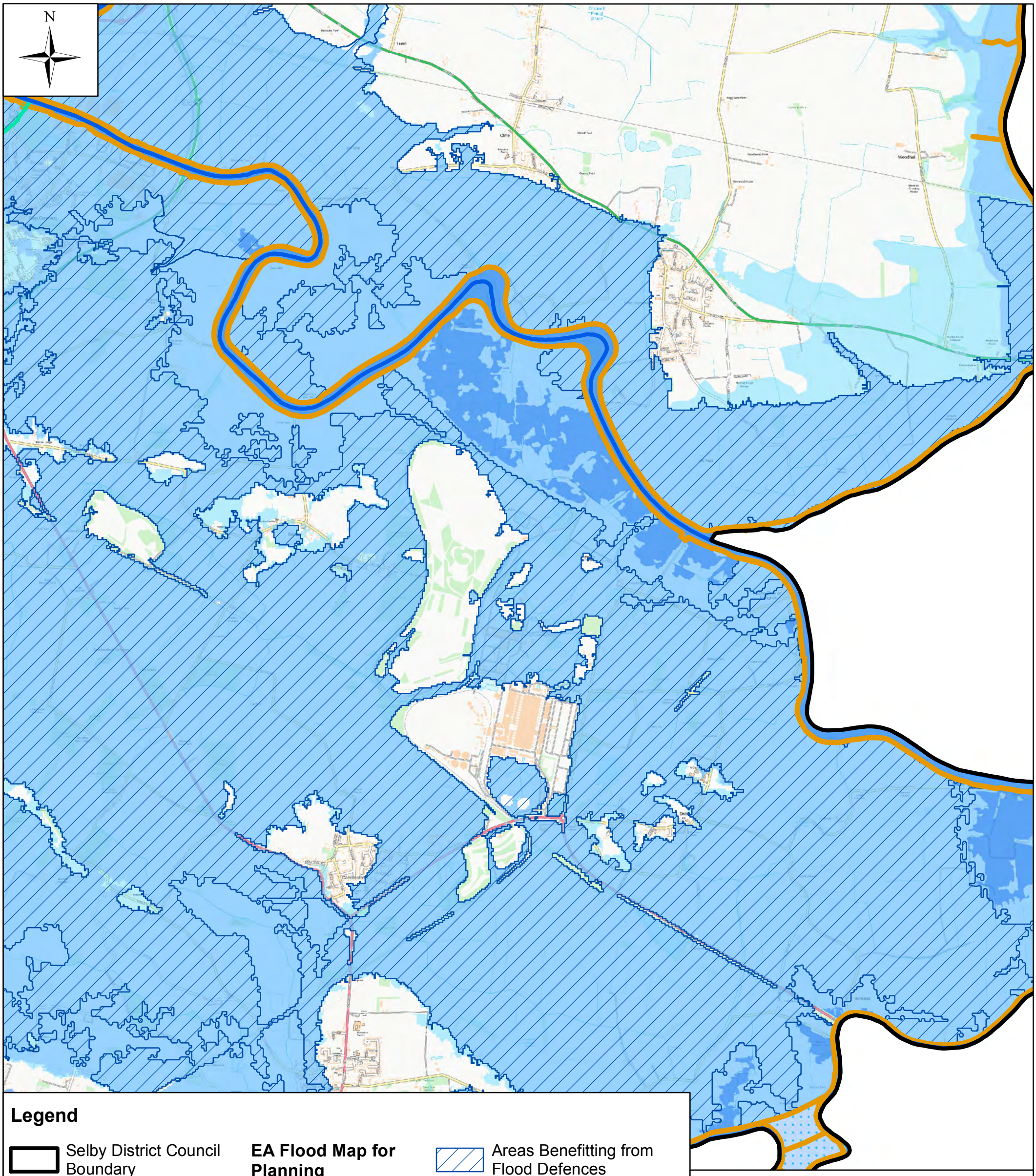

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET F

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/08/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A8 - F		A3

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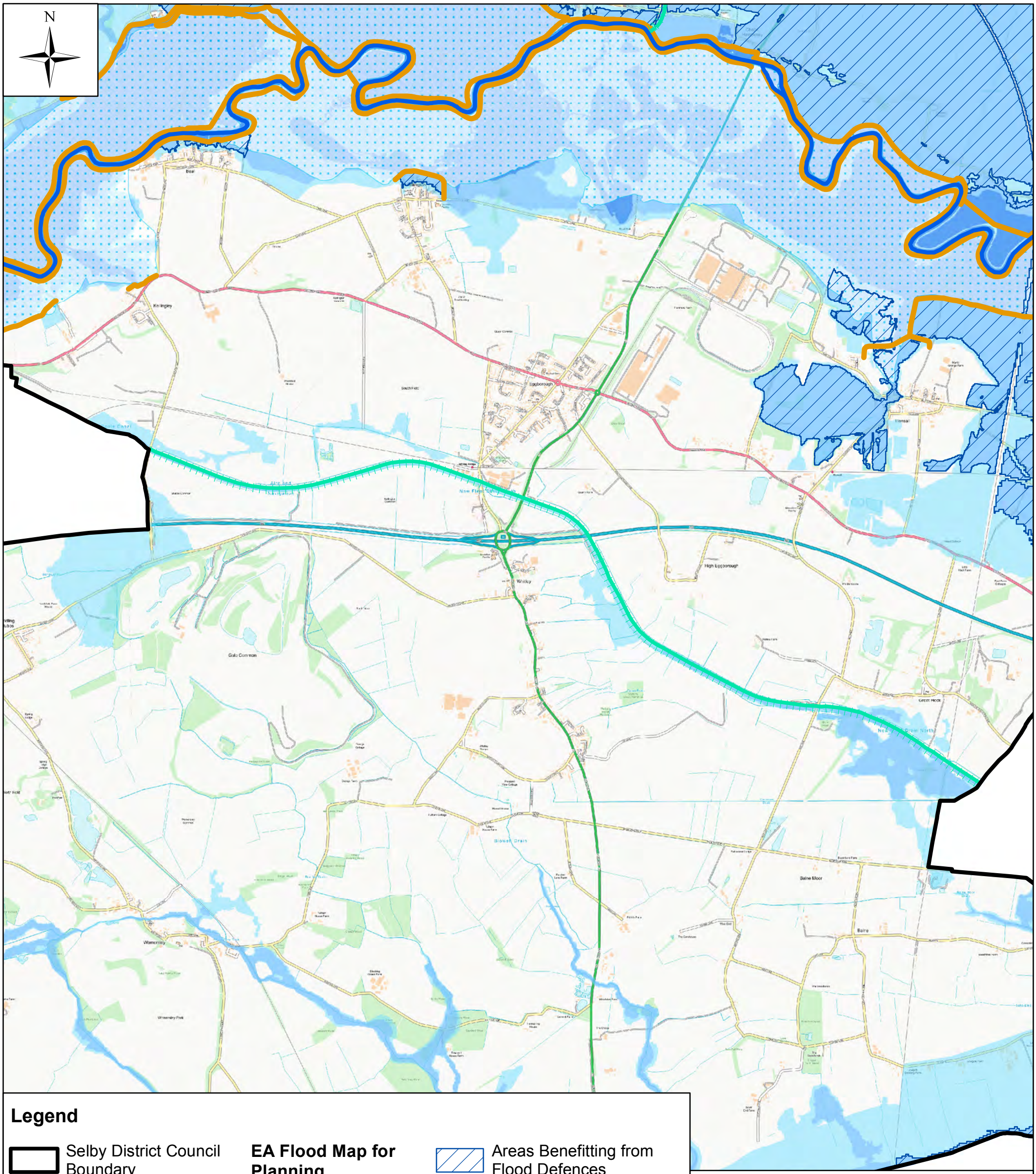

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET G

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/08/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A8 - G		A3

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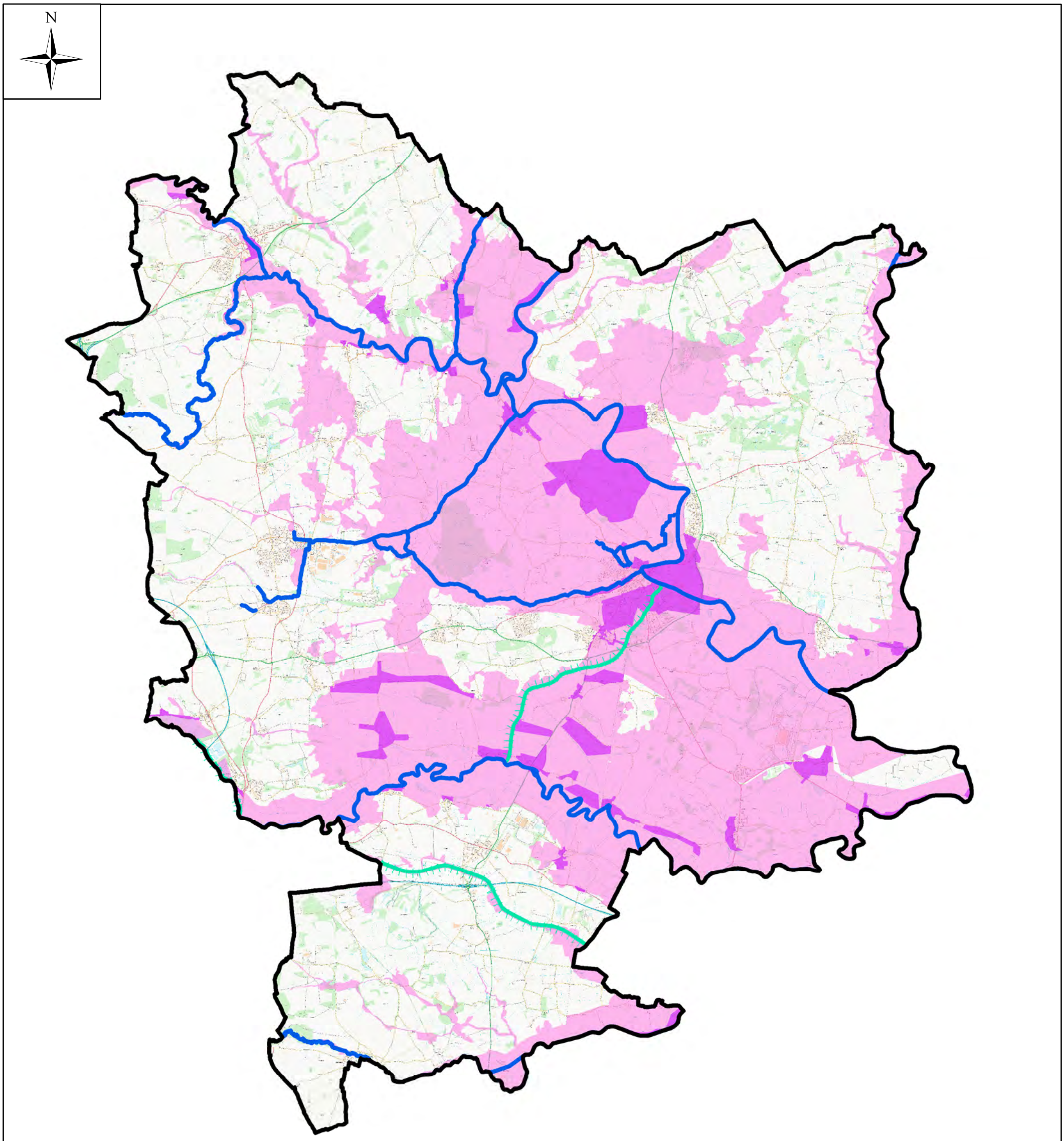

Legend

- Selby District Council Boundary
- Main Rivers
- Canals
- Environment Agency Flood Warning Areas
- Environment Agency Flood Alert Areas

0 2.5 5 10 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY FLOOD ALERT AND FLOOD WARNING AREAS

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	25/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A9		A3

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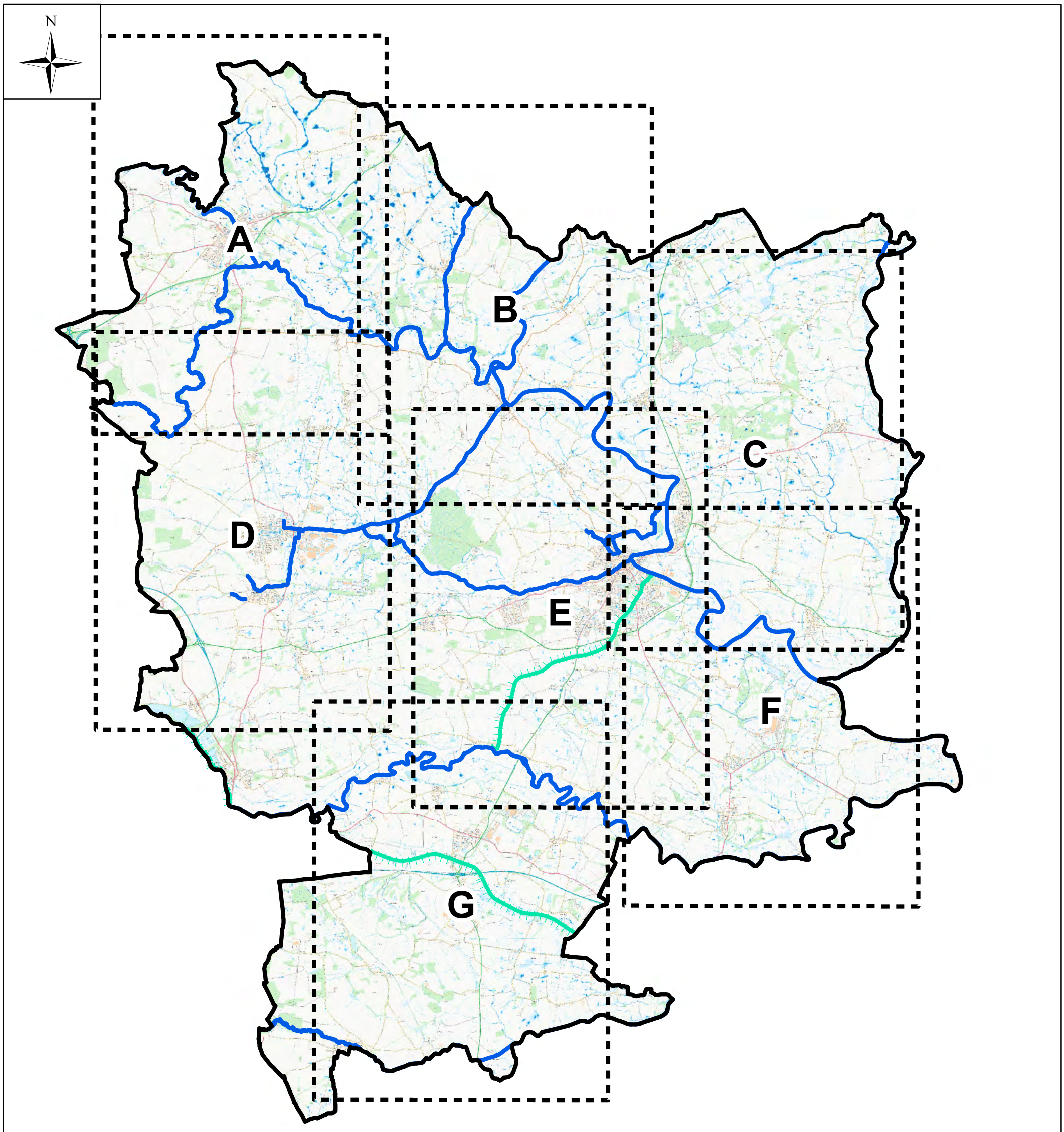

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Risk of Flooding from Surface Water

- 1 in 30 Year Extent
- 1 in 100 Year Extent
- 1 in 1000 Year Extent

0 2.5 5 10 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	25/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A10		A3

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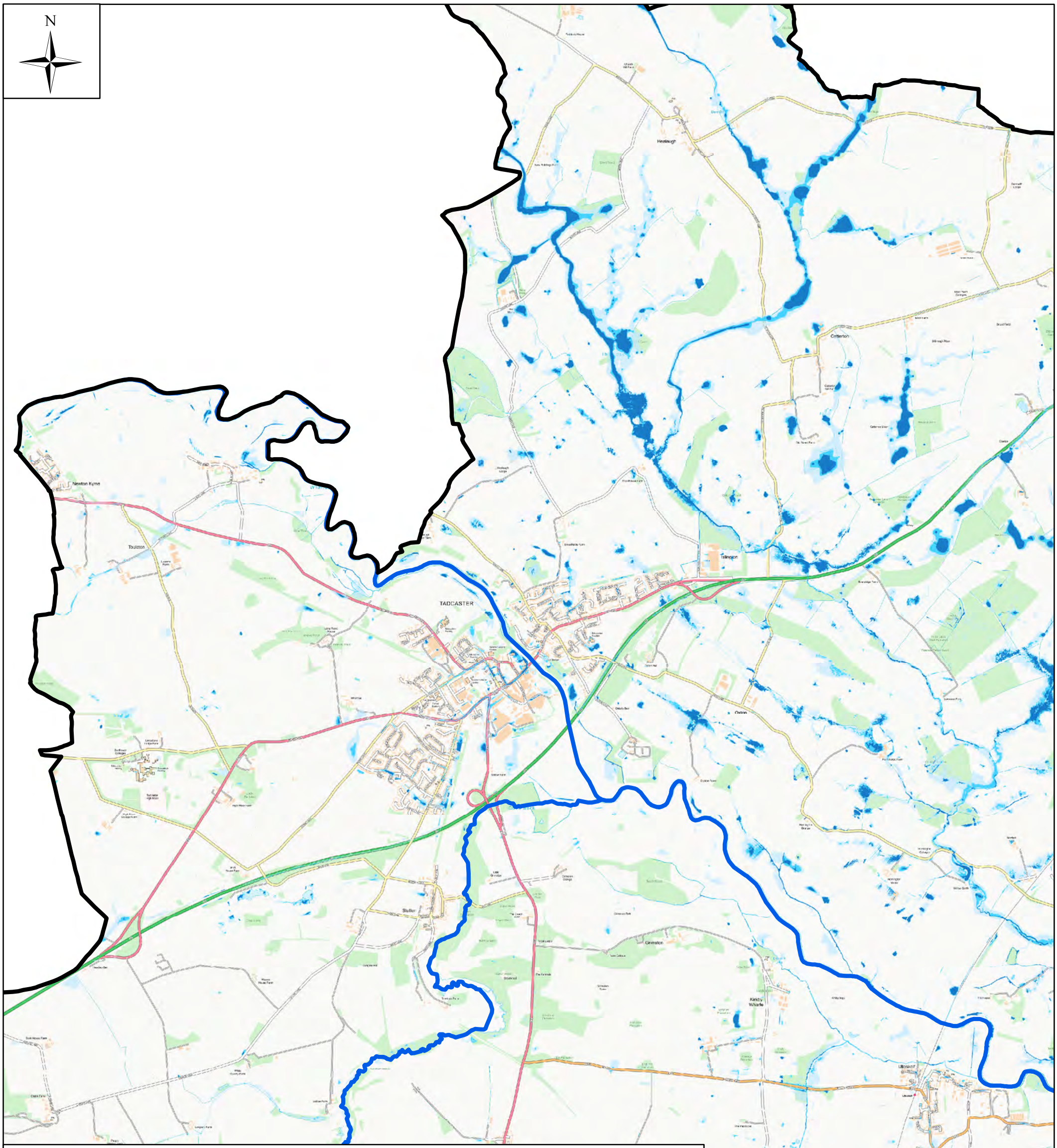

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Risk of Flooding from Surface Water

- 1 in 30 Year Extent
- 1 in 100 Year Extent
- 1 in 1000 Year Extent

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER - INSET A

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/06/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A10 - A		A3

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Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Risk of Flooding from Surface Water

- 1 in 30 Year Extent
- 1 in 100 Year Extent
- 1 in 1000 Year Extent

0 0.5 1 2 km

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Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER - INSET B

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/06/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A10 - B		A3

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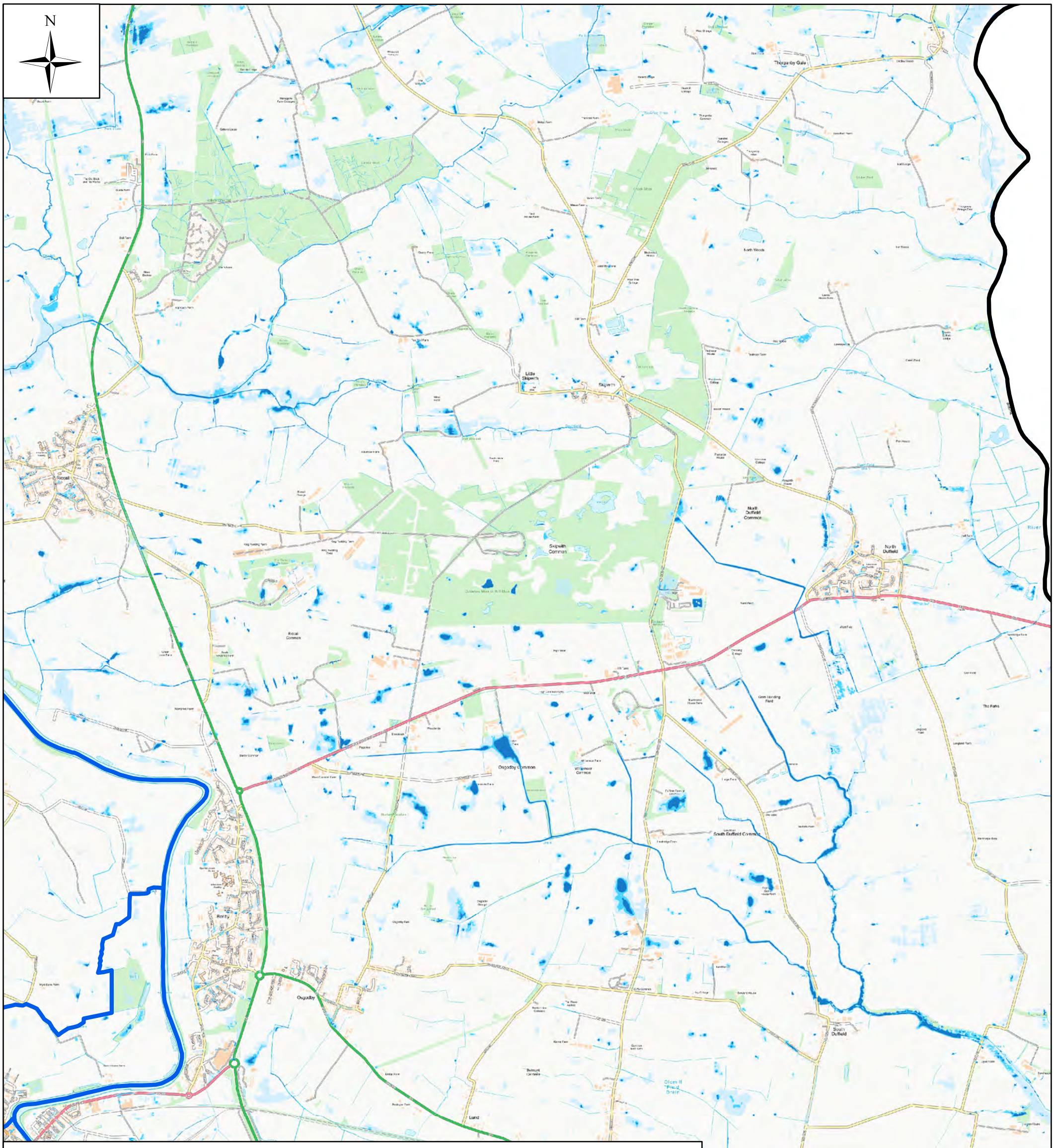

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Risk of Flooding from Surface Water

- 1 in 30 Year Extent
- 1 in 100 Year Extent
- 1 in 1000 Year Extent

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER - INSET C

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/06/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A10 - C		A3

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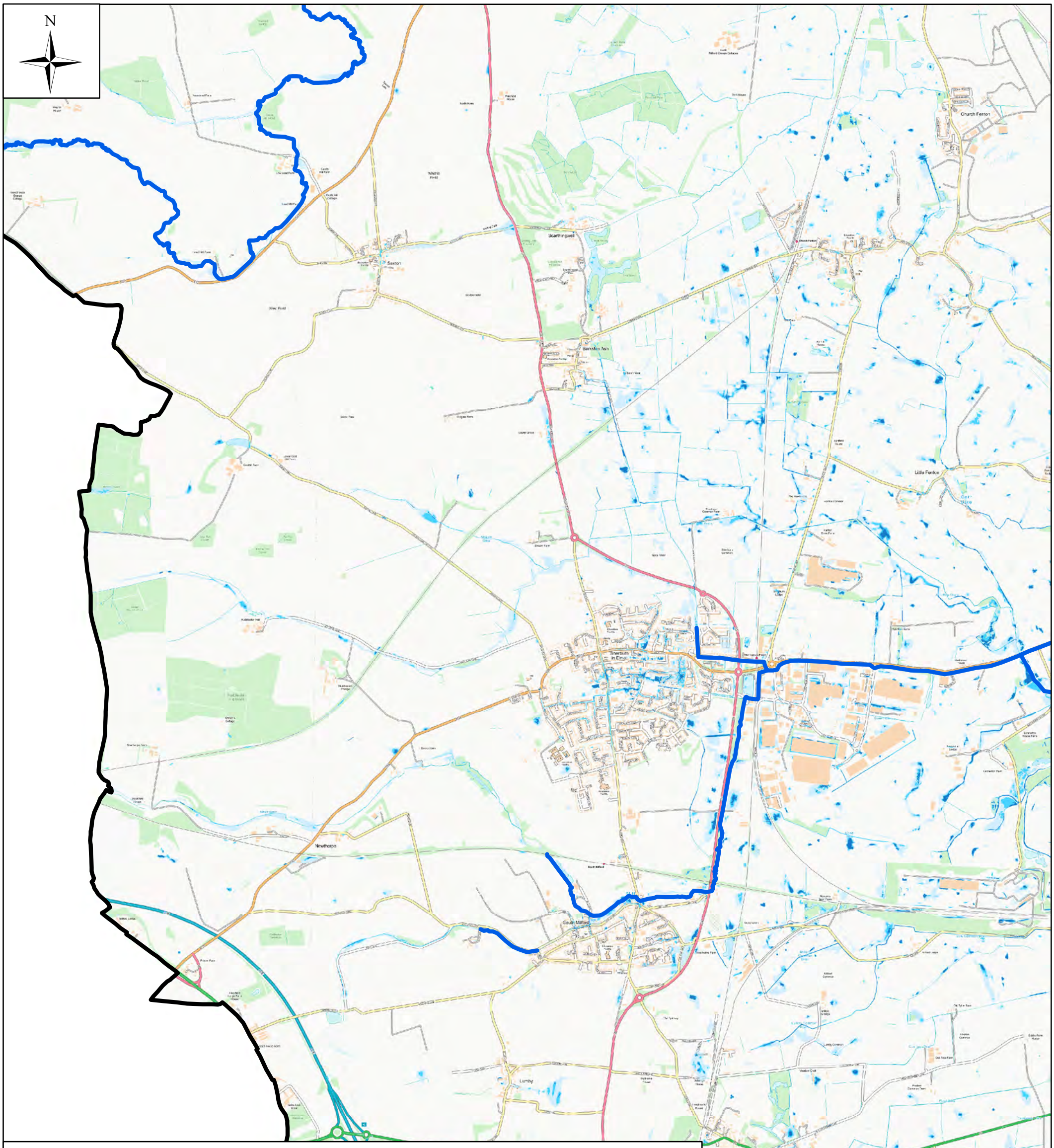

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Risk of Flooding from Surface Water

- 1 in 30 Year Extent
- 1 in 100 Year Extent
- 1 in 1000 Year Extent

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER - INSET D

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/06/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A10 - D		A3

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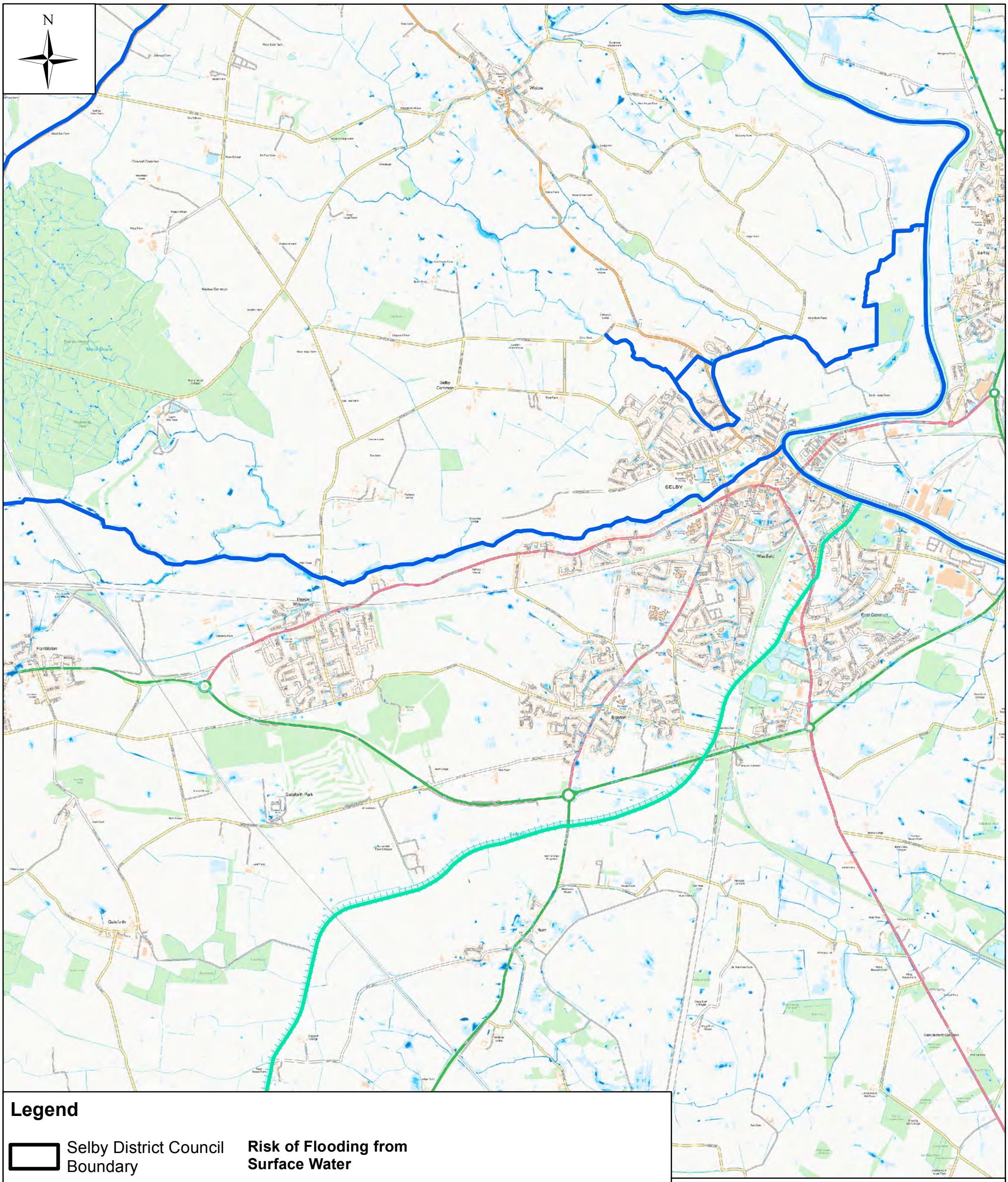

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Risk of Flooding from Surface Water

- 1 in 30 Year Extent
- 1 in 100 Year Extent
- 1 in 1000 Year Extent

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER - INSET E

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/06/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A10 - E		A3

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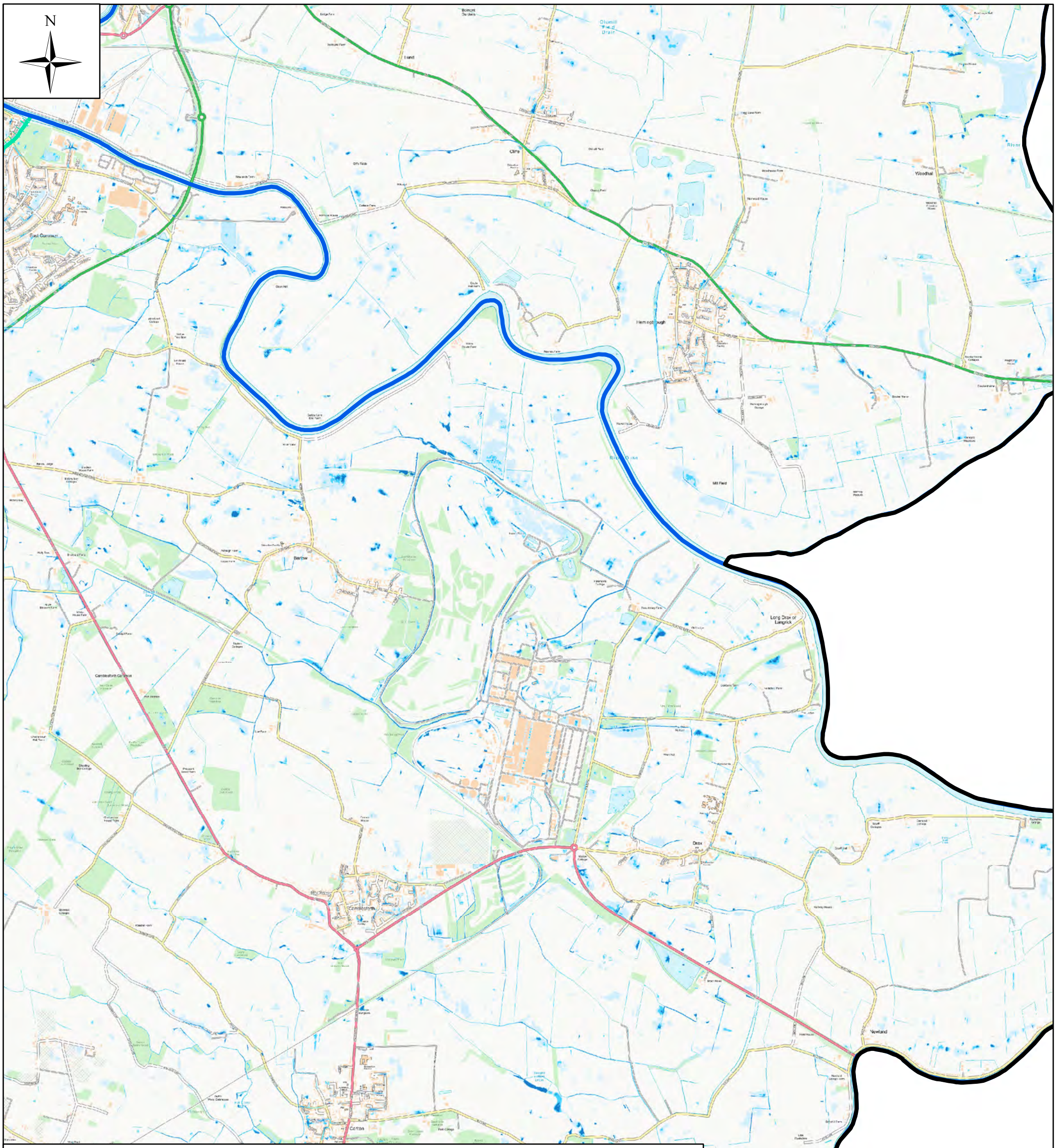

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Risk of Flooding from Surface Water

- 1 in 30 Year Extent
- 1 in 100 Year Extent
- 1 in 1000 Year Extent

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER - INSET F

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/06/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A10 - F		A3

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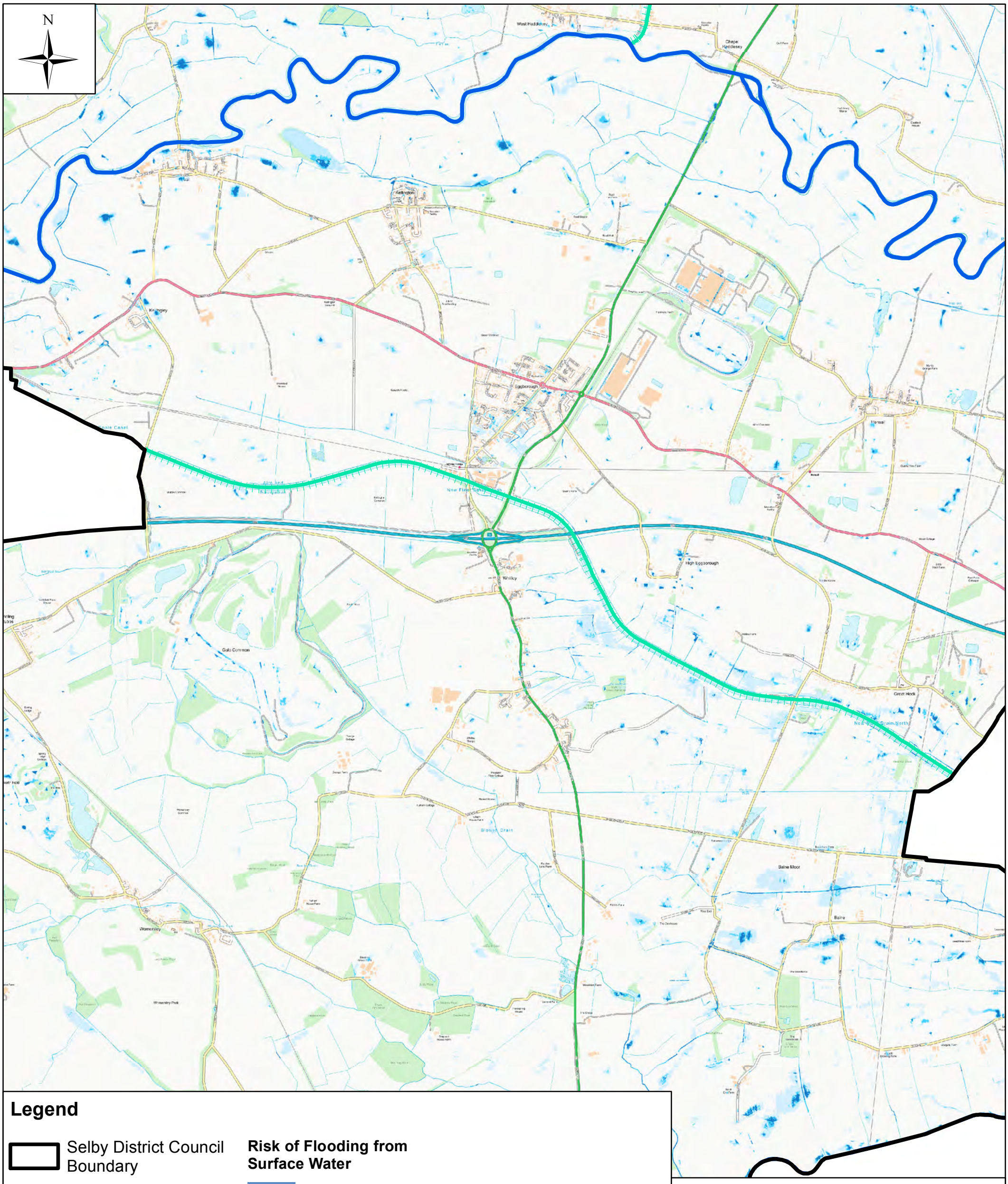

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER - INSET G

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	01/06/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A10 - G		A3

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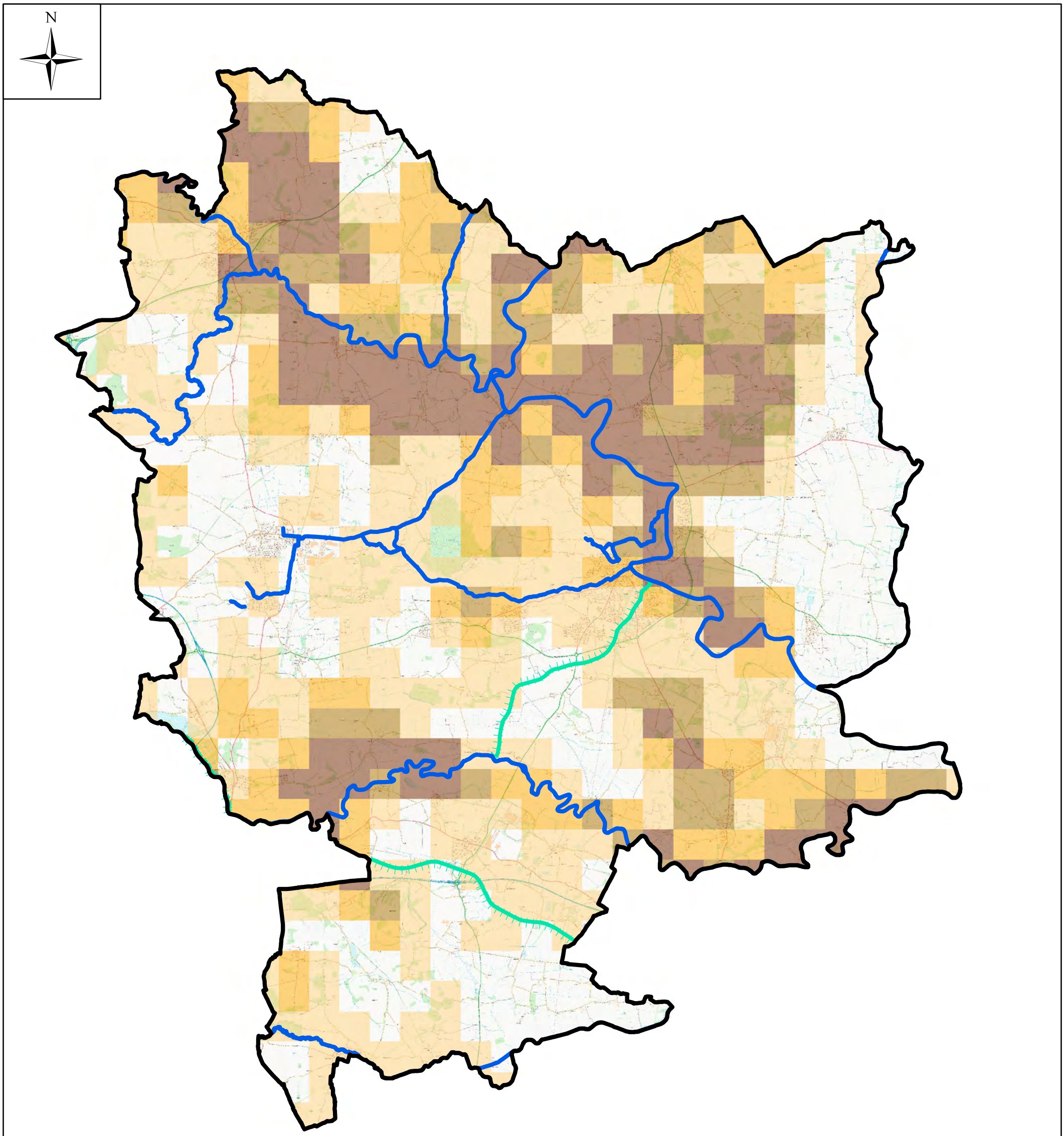

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Areas Susceptible to Groundwater Flooding

- < 25%
- >= 25% <50%
- >= 50% <75%
- >= 75%

0 2.5 5 10 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: AREAS SUSCEPTIBLE TO GROUNDWATER FLOODING

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	25/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A11		A3

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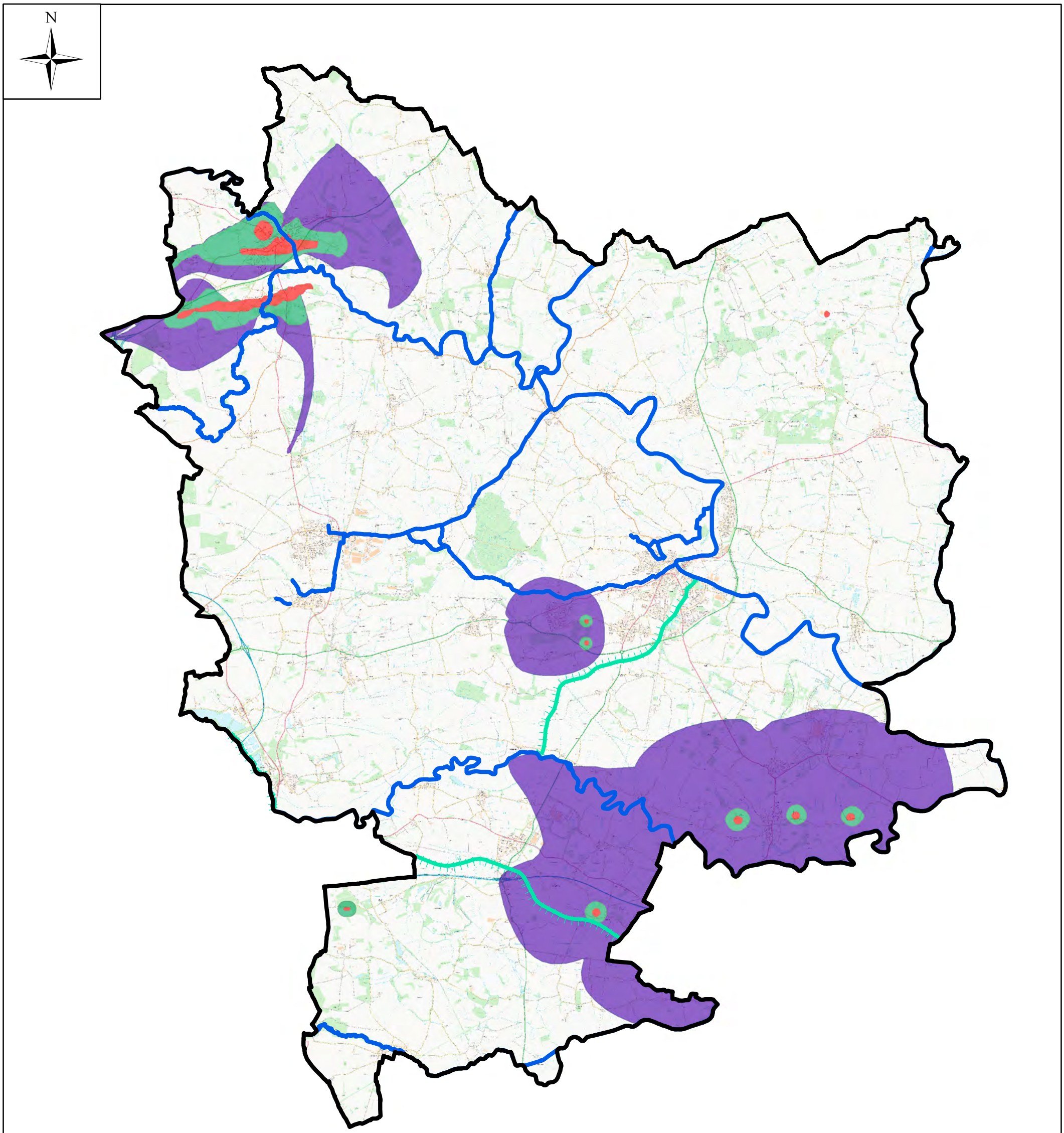

Legend

- Selby District Council Boundary
- Main River
- Canal

Source Protection Zone

- Inner Zone (Zone 1)
- Outer Zone (Zone 2)
- Total Catchment (Zone 3)

0 2.5 5 10 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: GROUNDWATER SOURCE PROTECTION ZONES

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	24/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A12		A3

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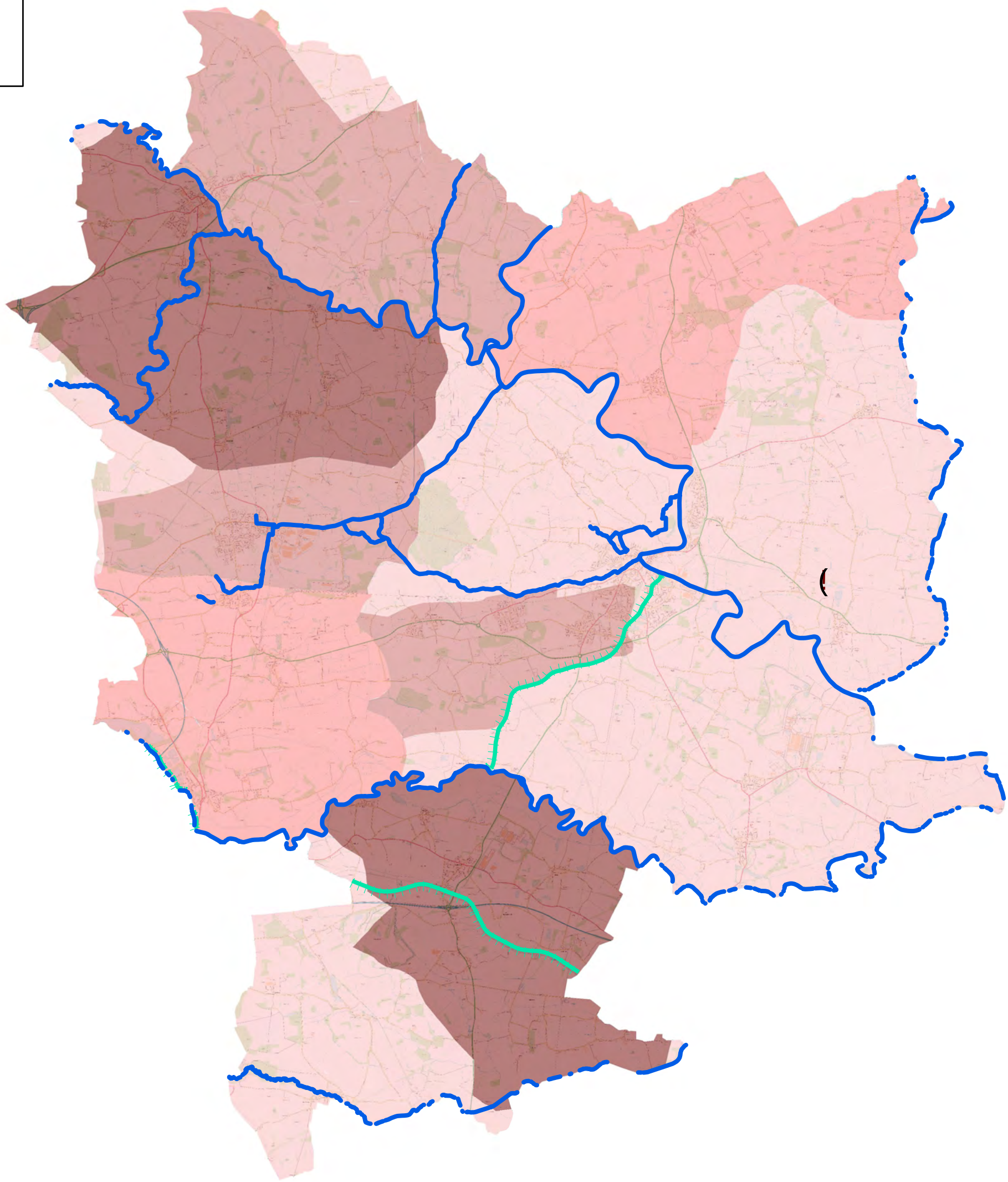

Legend

- Main Rivers
- Canals
- YW Internal Sewer Flooding Records

YW External Sewer Flooding Records

- 9 to 11
- 6 to 8
- 3 to 5
- 0 to 2

0 2.5 5 10 km

5th Floor,
2 City Walk,
Leeds, LS11 9AR

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Client: SELBY DISTRICT COUNCIL	Title: YORKSHIRE WATER (YW) HISTORICAL SEWER FLOODING REGISTER
Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update	

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	05/08/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A13		A3

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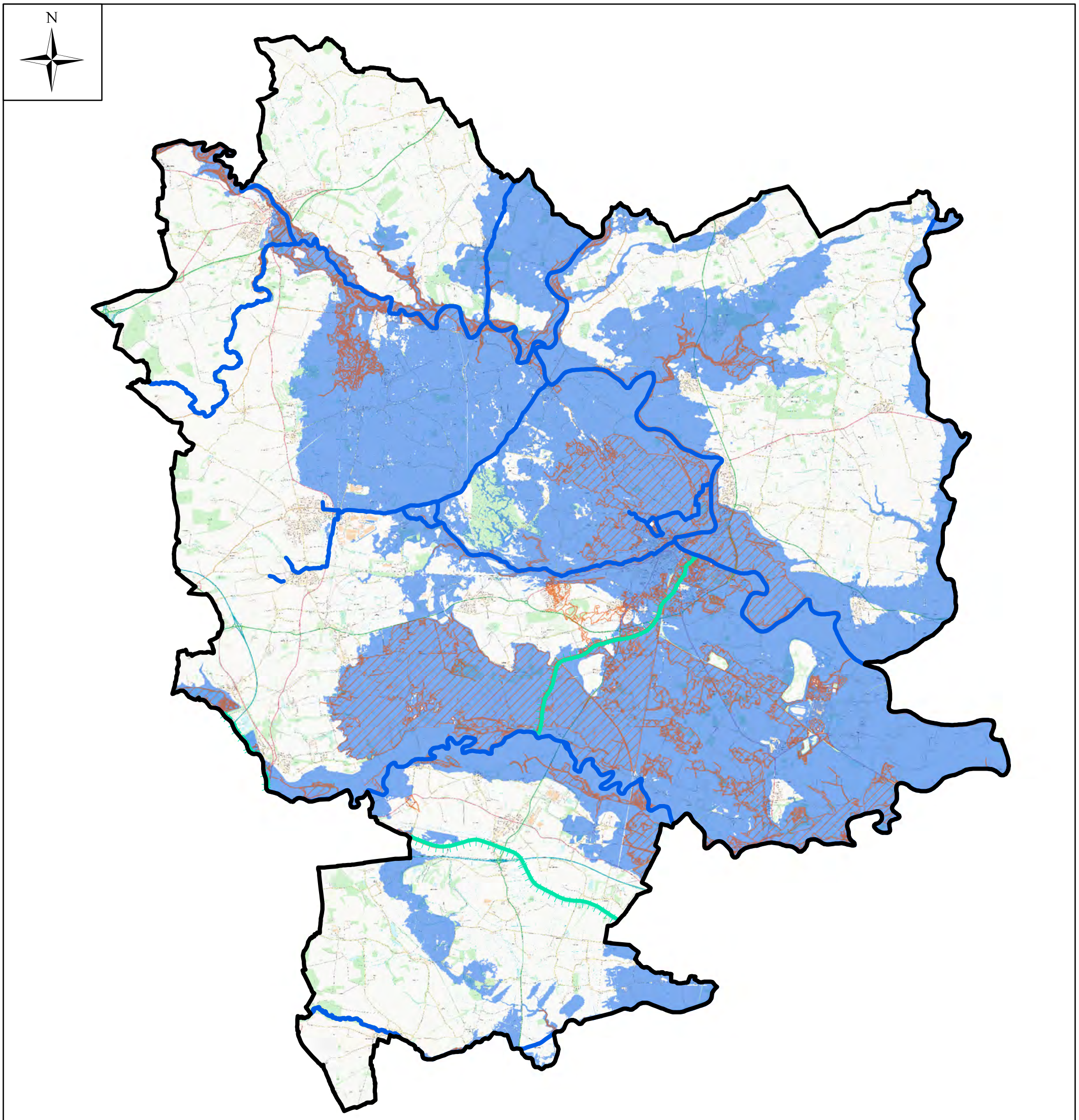

Legend

- Selby District Council Boundary
- Main Rivers
- Canals
- Dry Day Reservoir Flood Risk
- Wet Day Reservoir Flood Risk

0 2.5 5 10 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: RESERVOIR FLOOD RISK

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	25/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A14		A3

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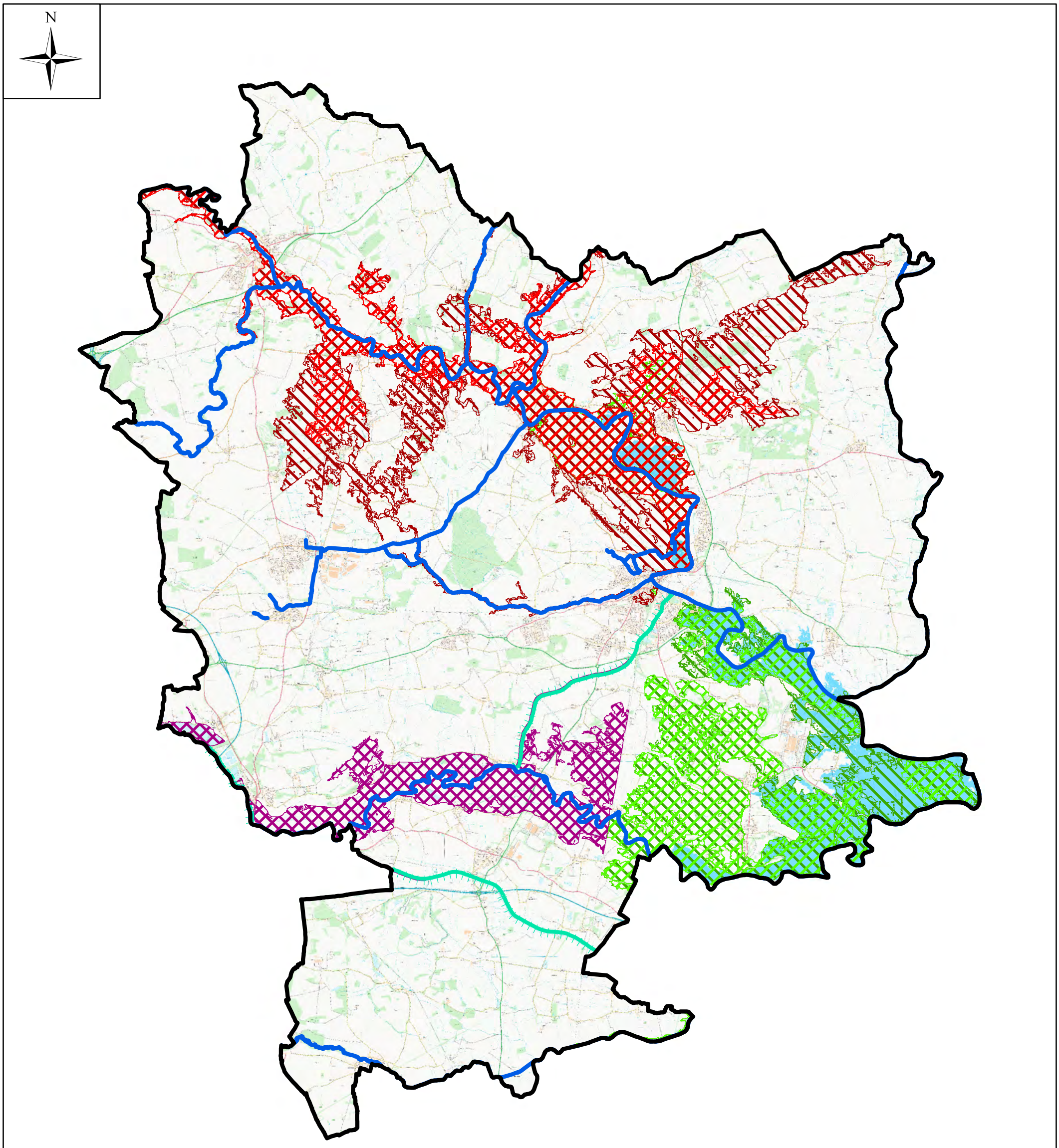

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Lower Ouse and Wharfe Washlands Fluvial Flood Extents

- 1% AEP plus 23% CC Higher Central SLR
- 1% AEP plus 23% CC Upper End SLR

Upper Humber Fluvial Flood Extents

- 1% AEP plus 24% CC Higher Central SLR
- 1% AEP plus 24% CC Upper End SLR

Lower Aire Fluvial Flood Extents

- 1% AEP plus 23% CC

Tidal Flood Extents

- 0.5% AEP (+1.38m SLR)

0 2.5 5 10 km

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Leeds, LS11 9AR
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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: FLUVIAL AND TIDAL FLOOD 1% AEP MAXIMUM FLOOD EXTENTS INCLUDING CLIMATE CHANGE AND SEA LEVEL RISE ALLOWANCES

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	15/07/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A15		A3

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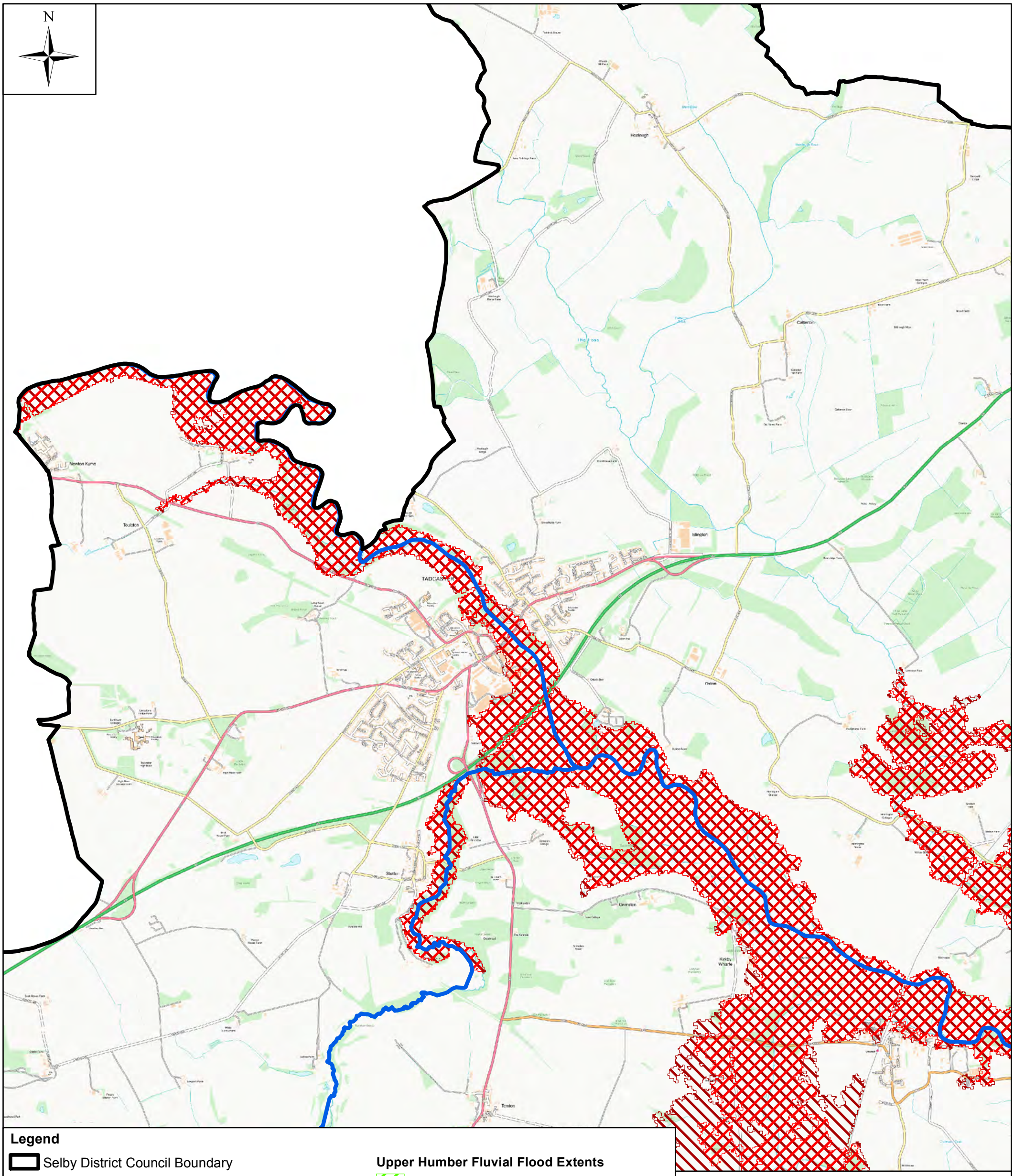

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Lower Ouse and Wharfe Washlands Fluvial Flood Extents

- 1% AEP plus 23% CC Higher Central SLR
- 1% AEP plus 23% CC Upper End SLR

Upper Humber Fluvial Flood Extents

- 1% AEP plus 24% CC Higher Central SLR
- 1% AEP plus 24% CC Upper End SLR

Lower Aire Fluvial Flood Extents

- 1% AEP plus 23% CC

Tidal Flood Extents

- 0.5% AEP (+1.38m SLR)

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: FLUVIAL AND TIDAL FLOOD 1% AEP MAXIMUM FLOOD EXTENTS INCLUDING CLIMATE CHANGE AND SEA LEVEL RISE ALLOWANCES - INSET A

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	15/07/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A15 - A		A3

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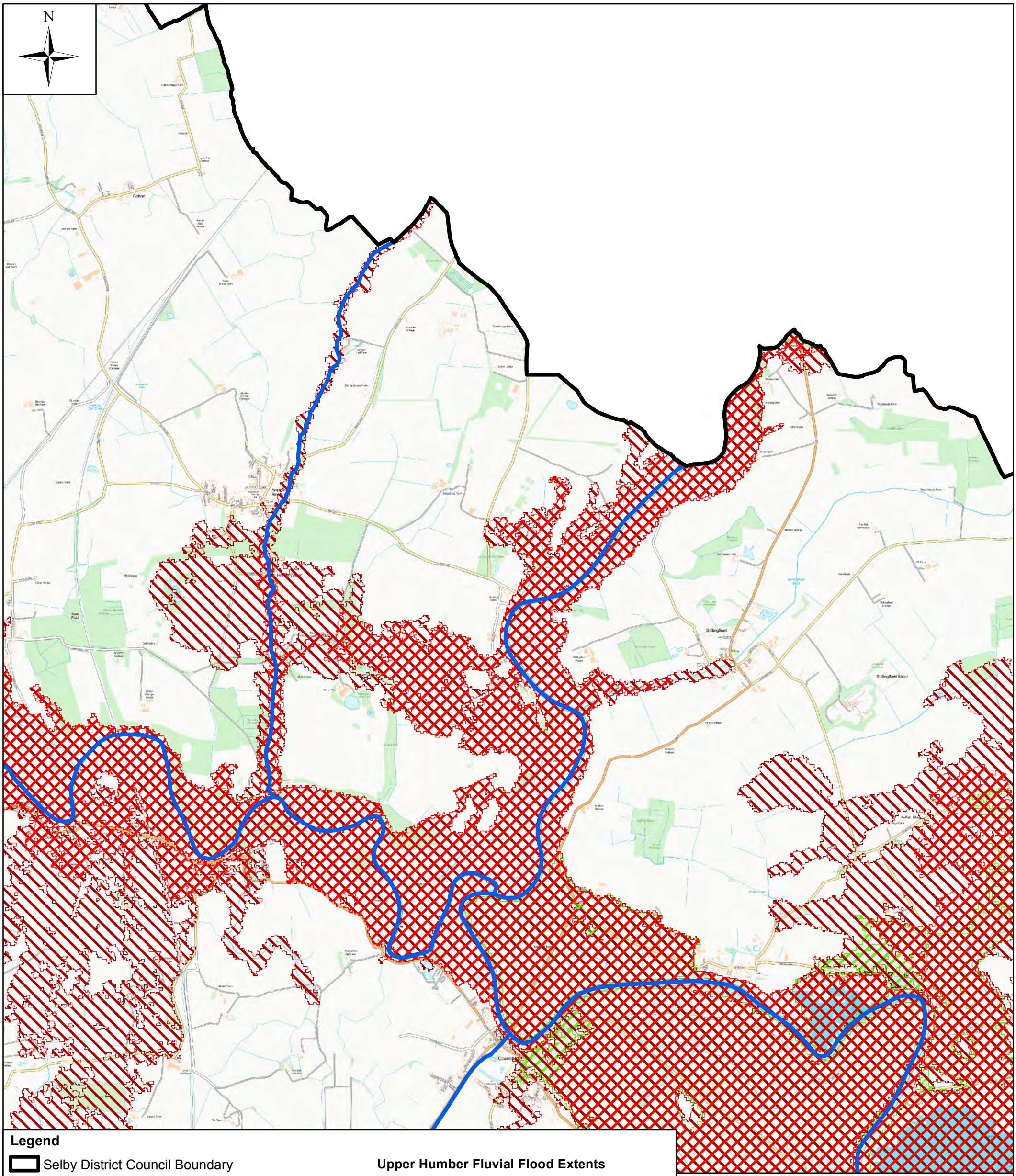

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Lower Ouse and Wharfe Washlands Fluvial Flood Extents

- 1% AEP plus 23% CC Higher Central SLR
- 1% AEP plus 23% CC Upper End SLR

Upper Humber Fluvial Flood Extents

- 1% AEP plus 24% CC Higher Central SLR
- 1% AEP plus 24% CC Upper End SLR

Lower Aire Fluvial Flood Extents

- 1% AEP plus 23% CC

Tidal Flood Extents

- 0.5% AEP (+1.38m SLR)

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: FLUVIAL AND TIDAL FLOOD 1% AEP MAXIMUM FLOOD EXTENTS INCLUDING CLIMATE CHANGE AND SEA LEVEL RISE ALLOWANCES - INSET B

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	15/07/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A15 - B		A3

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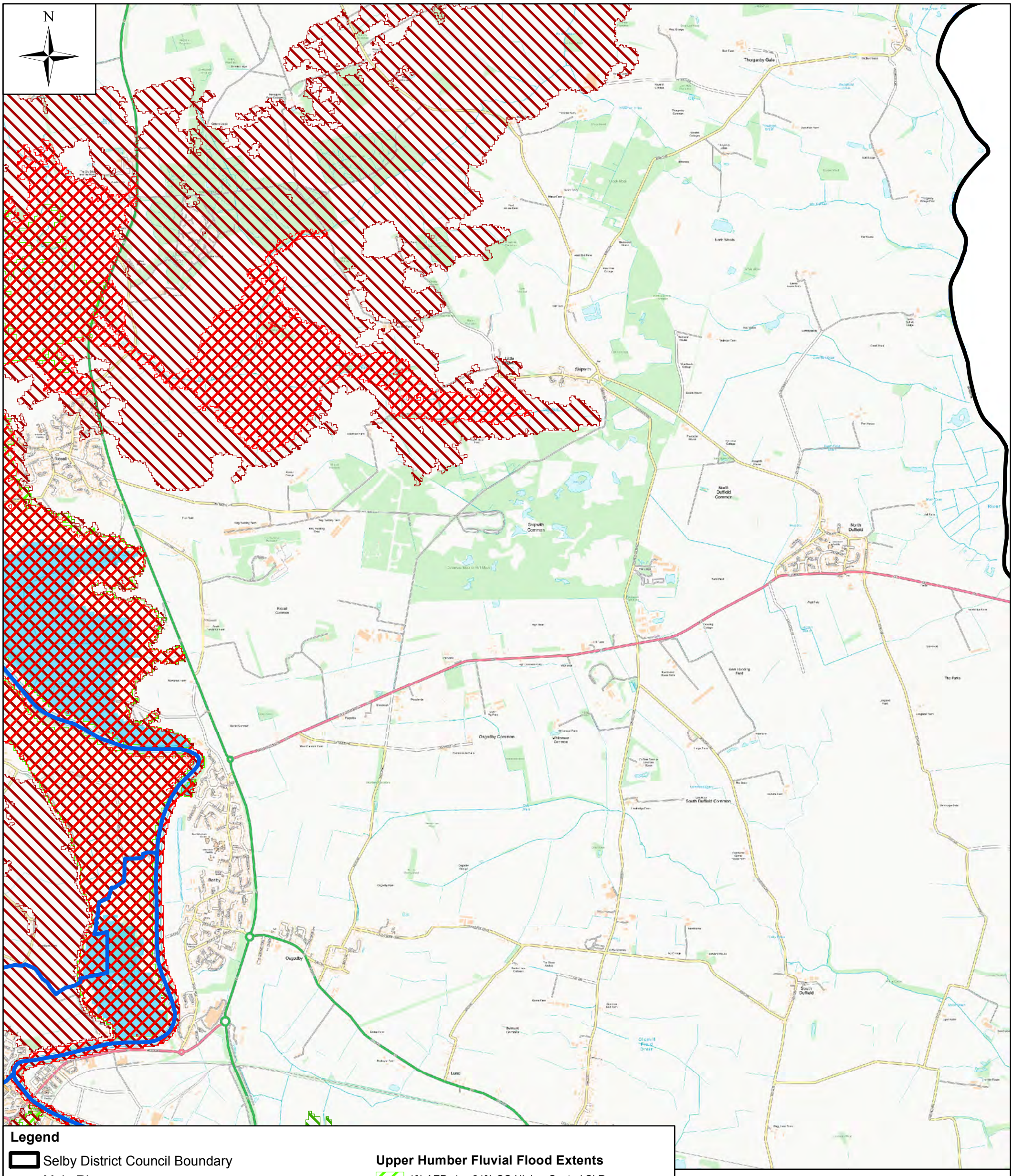

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Lower Ouse and Wharfe Washlands Fluvial Flood Extents

- 1% AEP plus 23% CC Higher Central SLR
- 1% AEP plus 23% CC Upper End SLR

Upper Humber Fluvial Flood Extents

- 1% AEP plus 24% CC Higher Central SLR
- 1% AEP plus 24% CC Upper End SLR

Lower Aire Fluvial Flood Extents

- 1% AEP plus 23% CC

Tidal Flood Extents

- 0.5% AEP (+1.38m SLR)

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: FLUVIAL AND TIDAL FLOOD 1% AEP MAXIMUM FLOOD EXTENTS INCLUDING CLIMATE CHANGE AND SEA LEVEL RISE ALLOWANCES - INSET C

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	15/07/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A15 - C		A3

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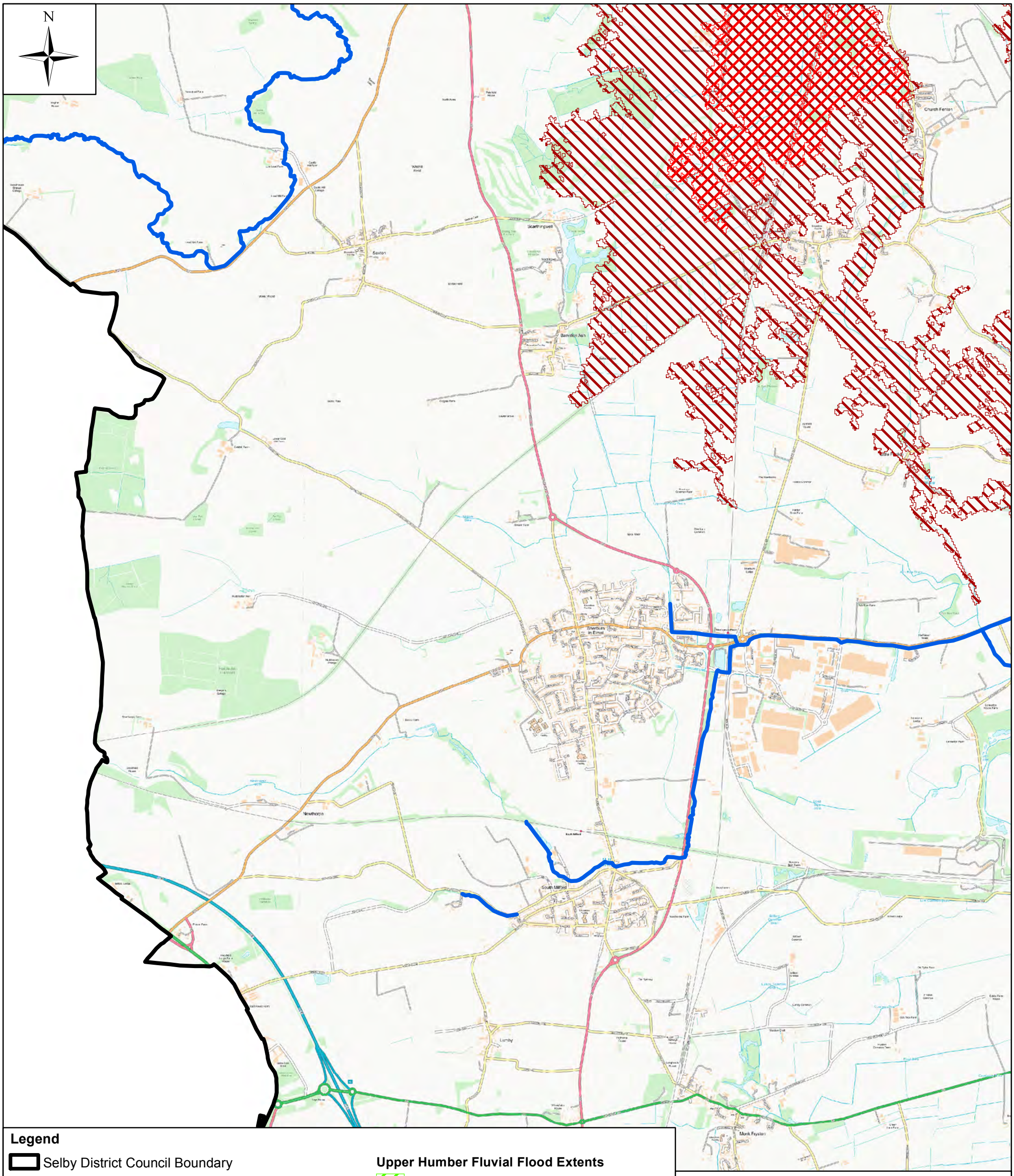

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Lower Ouse and Wharfe Washlands Fluvial Flood Extents

- 1% AEP plus 23% CC Higher Central SLR
- 1% AEP plus 23% CC Upper End SLR

Upper Humber Fluvial Flood Extents

- 1% AEP plus 24% CC Higher Central SLR
- 1% AEP plus 24% CC Upper End SLR

Lower Aire Fluvial Flood Extents

- 1% AEP plus 23% CC

Tidal Flood Extents

- 0.5% AEP (+1.38m SLR)

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: FLUVIAL AND TIDAL FLOOD 1% AEP MAXIMUM FLOOD EXTENTS INCLUDING CLIMATE CHANGE AND SEA LEVEL RISE ALLOWANCES - INSET D

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	15/07/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A15 - D		A3

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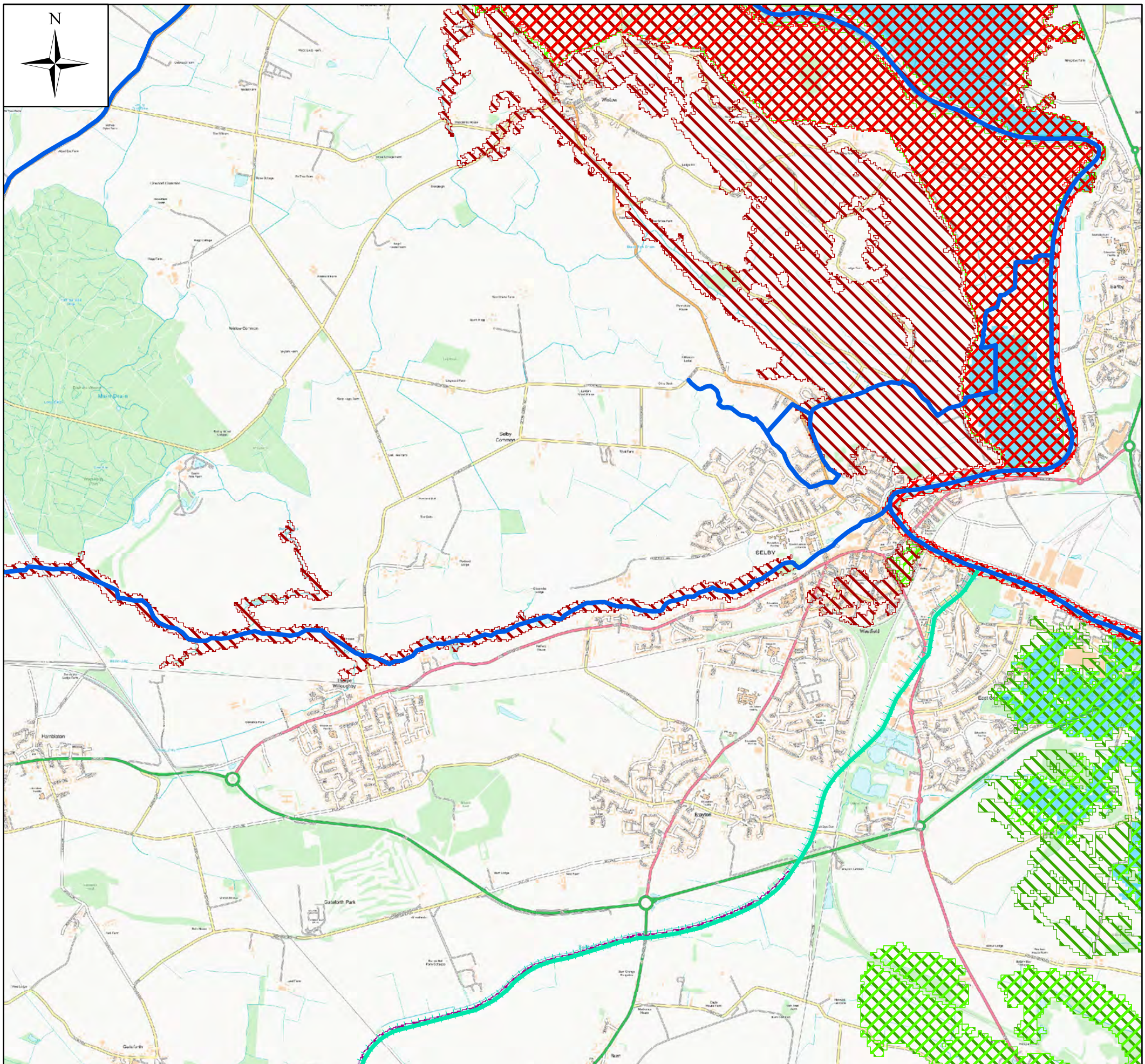

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Lower Ouse and Wharfe Washlands Fluvial Flood Extents

- 1% AEP plus 23% CC Higher Central SLR
- 1% AEP plus 23% CC Upper End SLR

Upper Humber Fluvial Flood Extents

- 1% AEP plus 24% CC Higher Central SLR
- 1% AEP plus 24% CC Upper End SLR

Lower Aire Fluvial Flood Extents

- 1% AEP plus 23% CC

Tidal Flood Extents

- 0.5% AEP (+1.38m SLR)

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: FLUVIAL AND TIDAL FLOOD 1% AEP MAXIMUM FLOOD EXTENTS INCLUDING CLIMATE CHANGE AND SEA LEVEL RISE ALLOWANCES - INSET E

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	15/07/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A15 - E		A3

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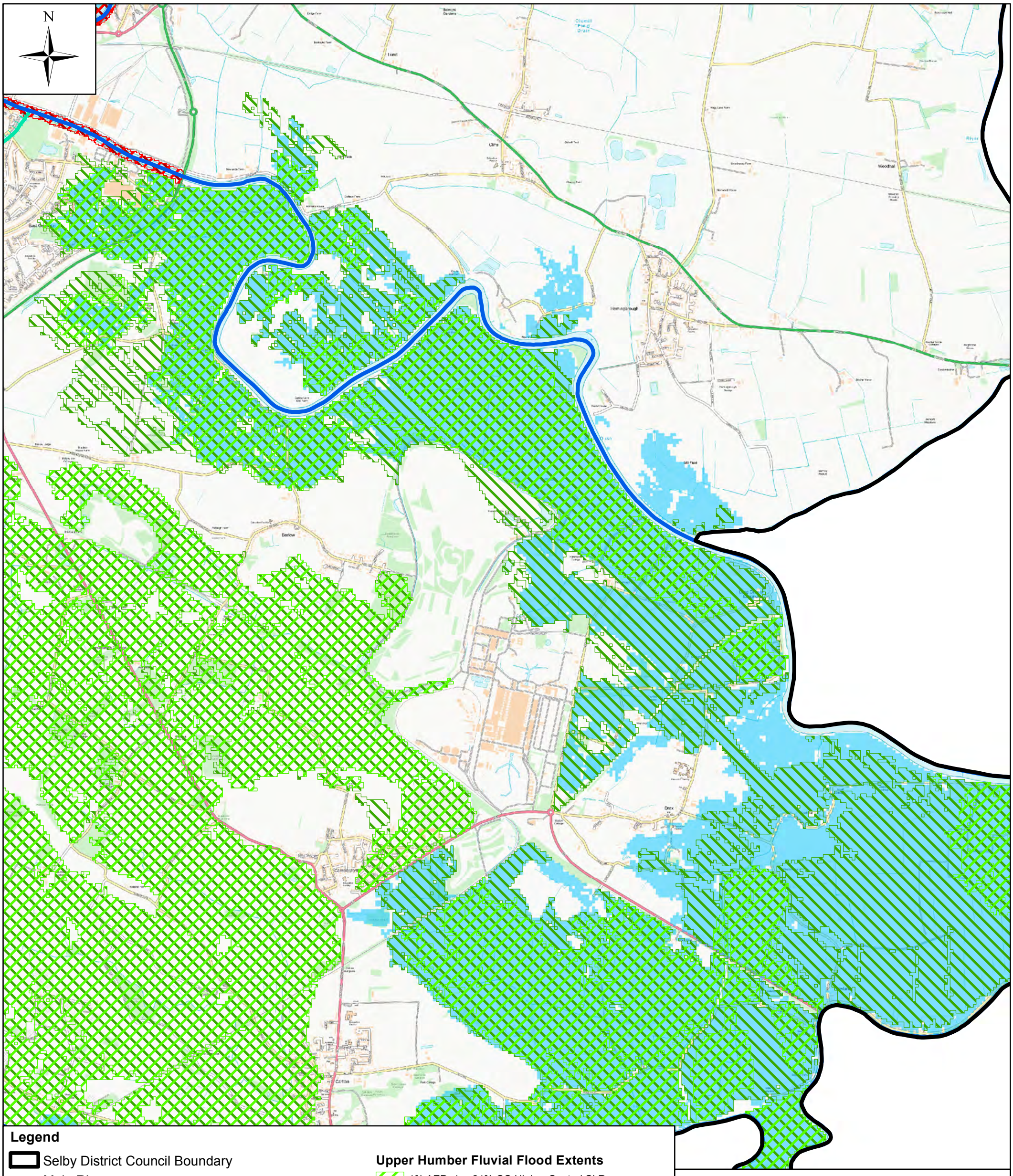

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Lower Ouse and Wharfe Washlands Fluvial Flood Extents

- 1% AEP plus 23% CC Higher Central SLR
- 1% AEP plus 23% CC Upper End SLR

Upper Humber Fluvial Flood Extents

- 1% AEP plus 24% CC Higher Central SLR
- 1% AEP plus 24% CC Upper End SLR

Lower Aire Fluvial Flood Extents

- 1% AEP plus 23% CC

Tidal Flood Extents

- 0.5% AEP (+1.38m SLR)

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: FLUVIAL AND TIDAL FLOOD 1% AEP MAXIMUM FLOOD EXTENTS INCLUDING CLIMATE CHANGE AND SEA LEVEL RISE ALLOWANCES - INSET F

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	15/07/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A15 - F		A3

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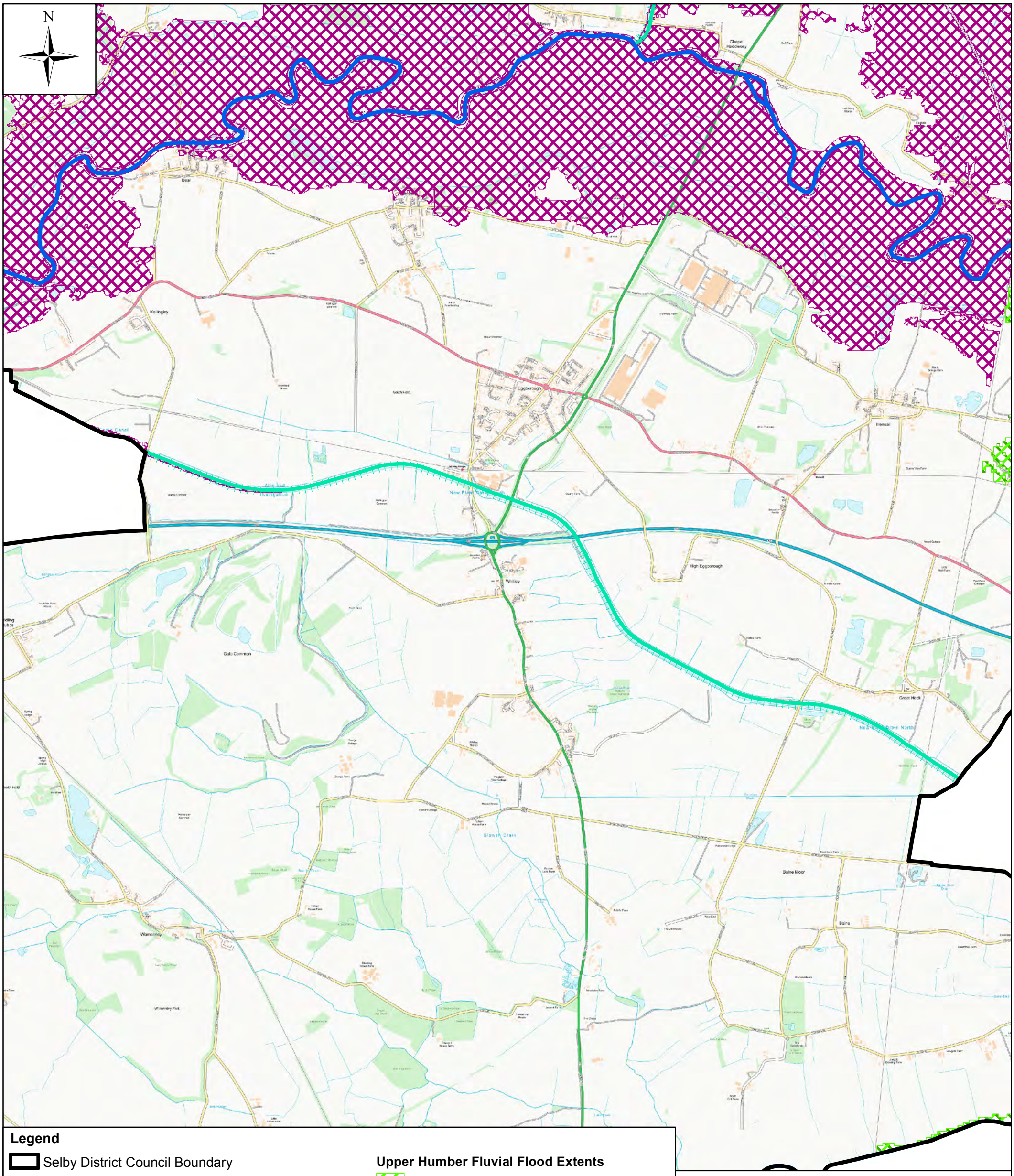

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Lower Ouse and Wharfe Washlands Fluvial Flood Extents

- 1% AEP plus 23% CC Higher Central SLR
- 1% AEP plus 23% CC Upper End SLR

Upper Humber Fluvial Flood Extents

- 1% AEP plus 24% CC Higher Central SLR
- 1% AEP plus 24% CC Upper End SLR

Lower Aire Fluvial Flood Extents

- 1% AEP plus 23% CC

Tidal Flood Extents

- 0.5% AEP (+1.38m SLR)

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: FLUVIAL AND TIDAL FLOOD 1% AEP MAXIMUM FLOOD EXTENTS INCLUDING CLIMATE CHANGE AND SEA LEVEL RISE ALLOWANCES - INSET G

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	15/07/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A15 - G		A3

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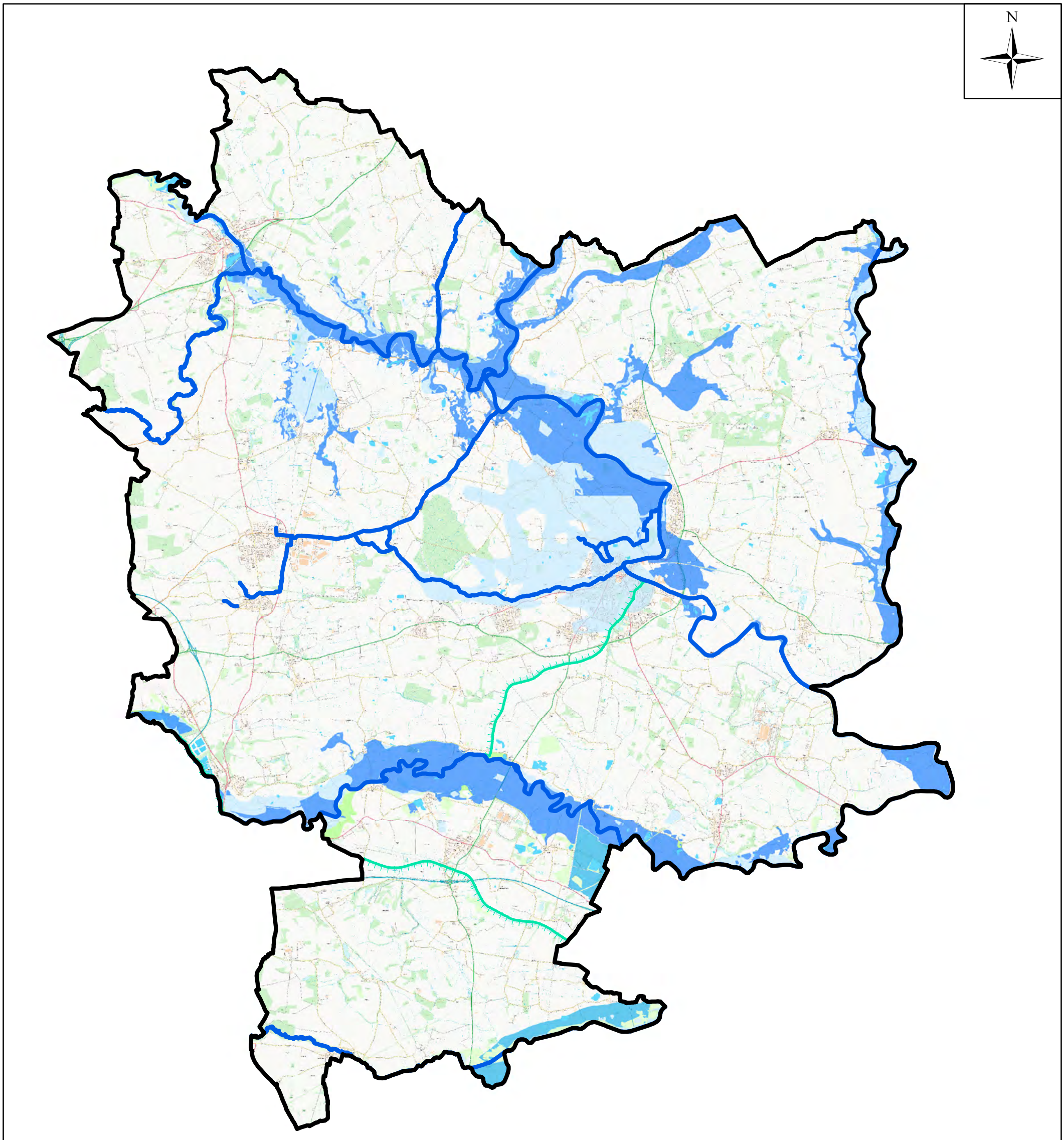

Legend

- Selby District Council Boundary
- Main Rivers
- Canals

Cause of Flooding

- Channel Capacity Exceeded
- Groundwater
- Local Drainage/Surface Water
- Operational Failure/Breach of Defence
- Overtopping of Defences
- Other
- Unknown

0 2.5 5 10 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: HISTORICAL FLOODING INCIDENTS (REPORTED)

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	25/05/2022	Scale at A3:	1:125,000
Drawing Number:	FIGURE A16		A3

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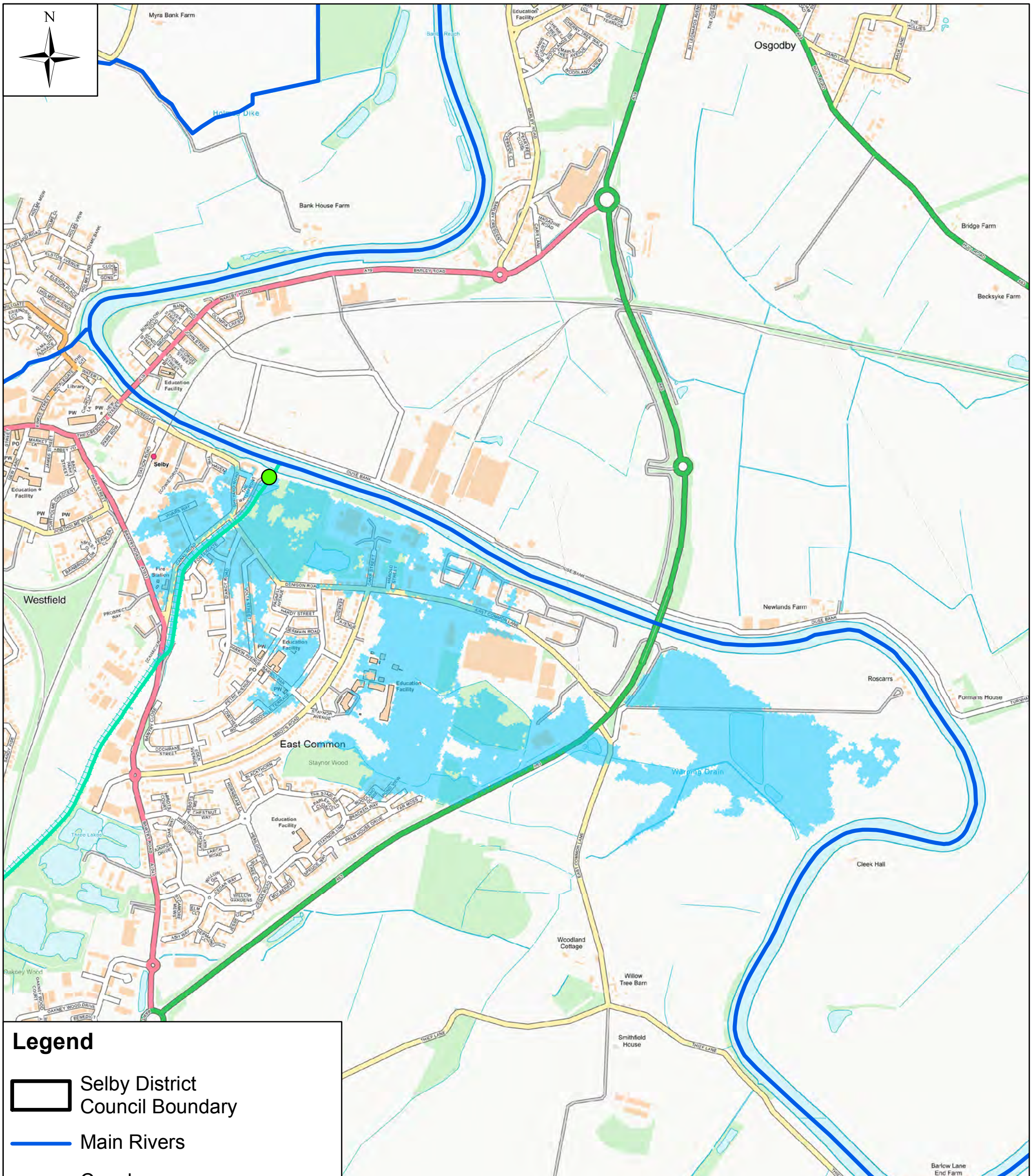

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Fax: 0113 391 6899
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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: BREACH 1 FLUVIAL FLOOD EXTENTS 1% AEP PLUS FLUVIAL & TIDAL CLIMATE CHANGE ALLOWANCES

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	24/05/2022	Scale at A3:	1:12,500
Drawing Number:	FIGURE A17		A3

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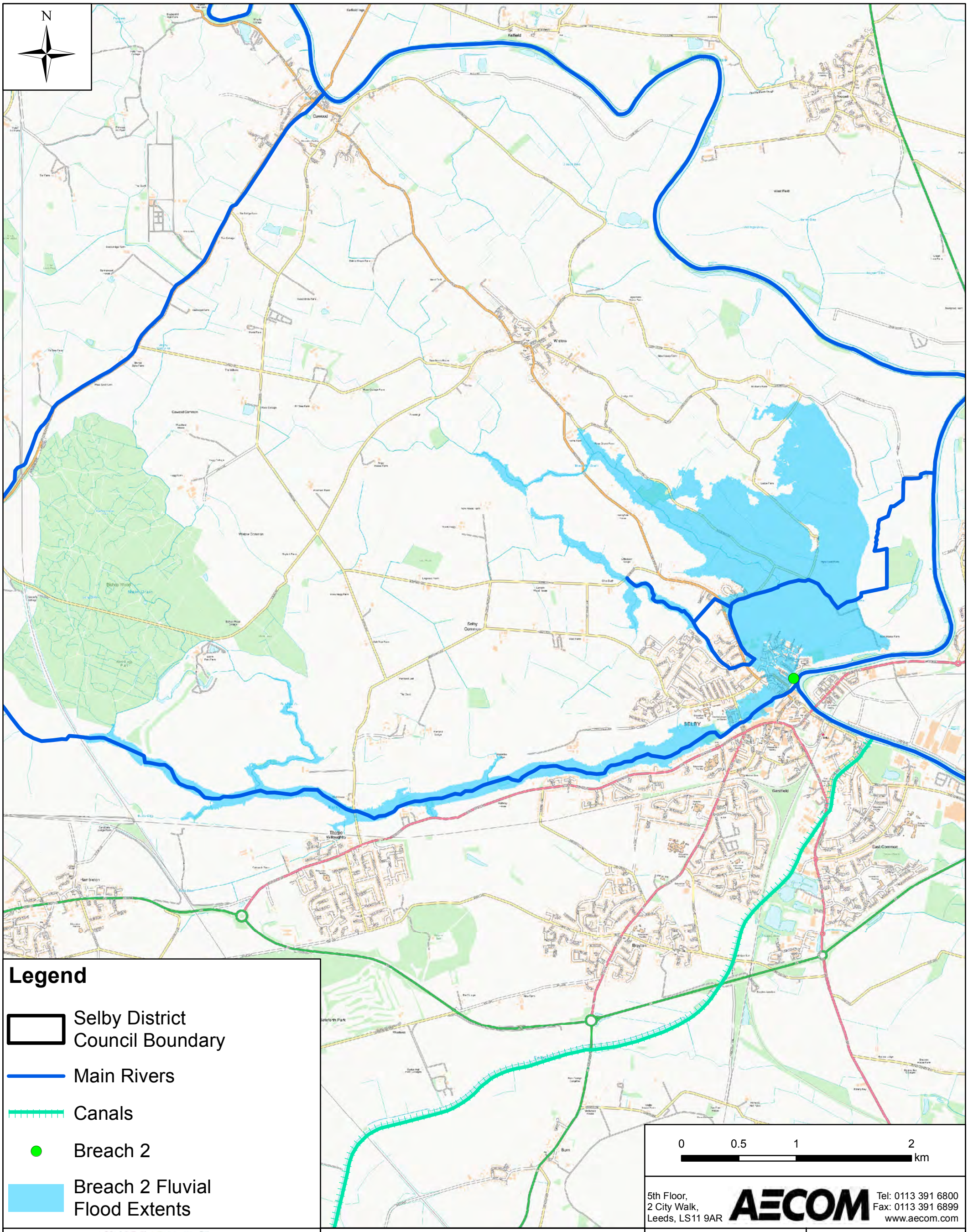

Legend

- Selby District Council Boundary
- Main Rivers
- Canals
- Breach 2
- Breach 2 Fluvial Flood Extents

0 0.5 1 2 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title:

BREACH 2 FLUVIAL FLOOD EXTENTS 1% AEP PLUS FLUVIAL & TIDAL CLIMATE CHANGE ALLOWANCES

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	25/05/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A18		A3

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N

Legend

- Selby District Council Boundary
- Main Rivers
- Canals
- Breach 3
- Breach 3 Fluvial FLood Extents

0 1 2 4 km

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: BREACH 3 FLUVIAL FLOOD EXTENTS 1% AEP PLUS FLUVIAL & TIDAL CLIMATE CHANGE ALLOWANCES

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	30/05/2022	Scale at A3:	1:50,000
Drawing Number:	FIGURE A19		A3

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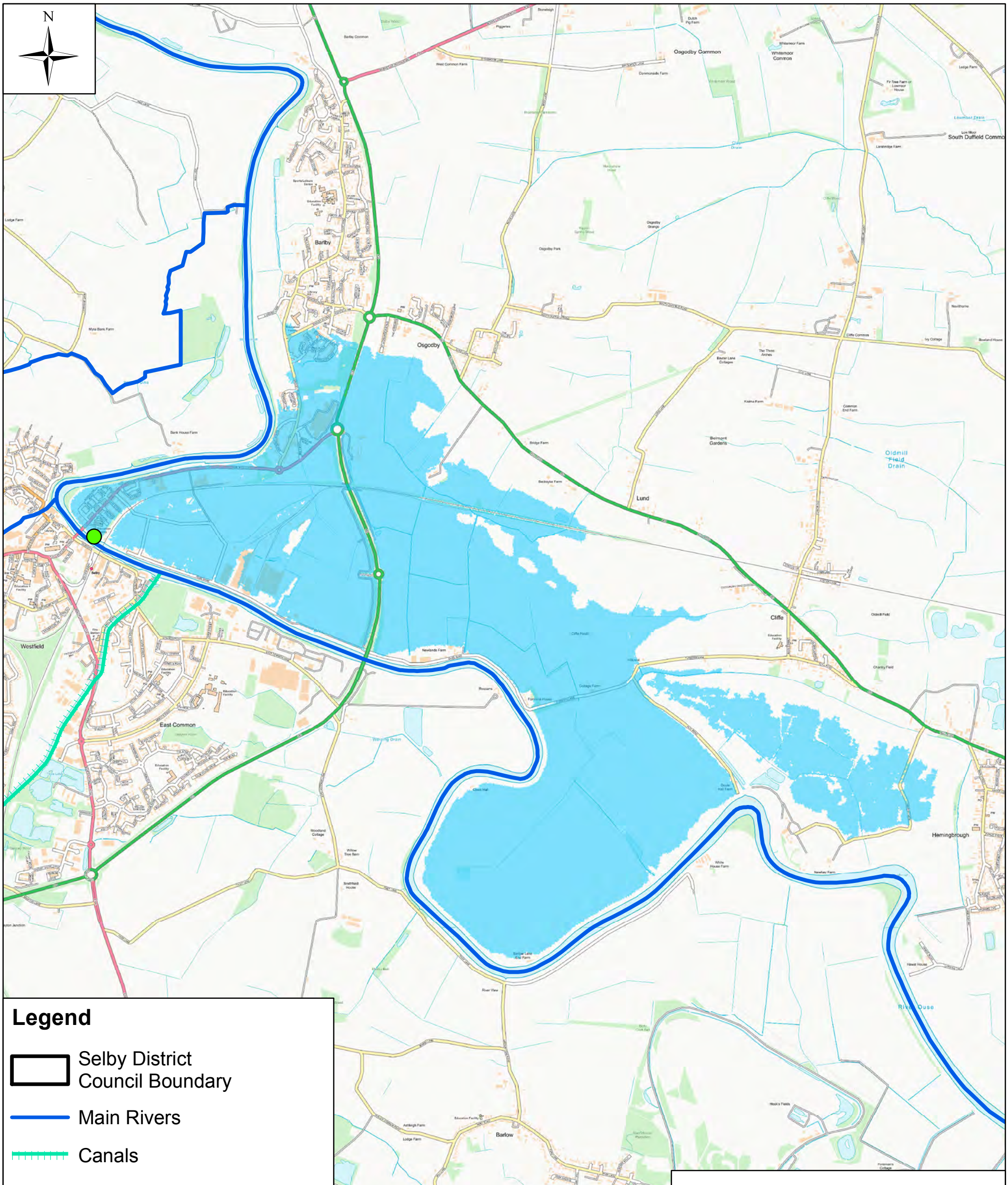

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Fax: 0113 391 6899
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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: BREACH 4 FLUVIAL FLOOD EXTENTS 1% AEP PLUS FLUVIAL & TIDAL CLIMATE CHANGE ALLOWANCES

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	30/05/2022	Scale at A3:	1:22,500
Drawing Number:	FIGURE A20		A3

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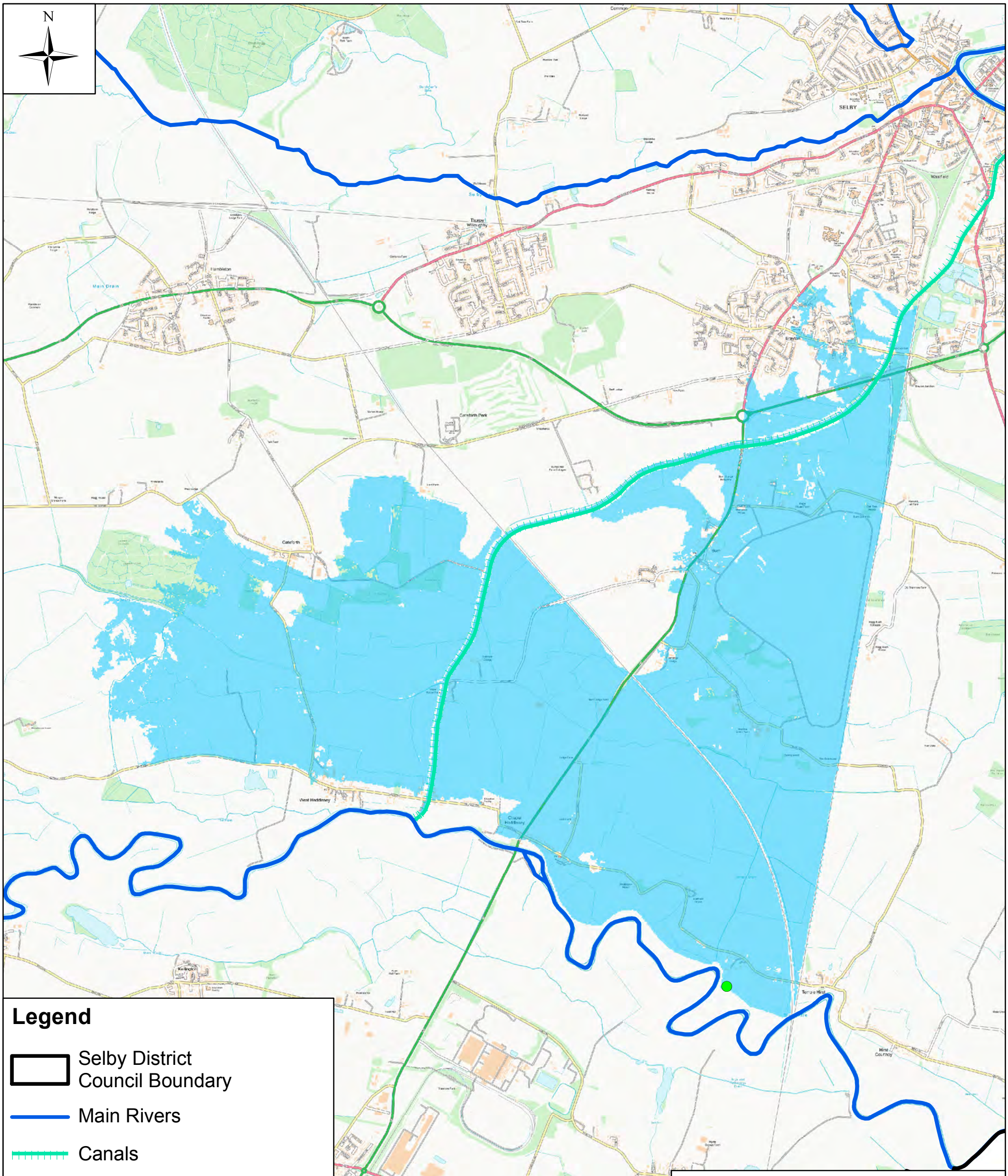

Legend

- Selby District Council Boundary
- Main Rivers
- Canals
- Breach 5
- Breach 5 Fluvial Flood Extents

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Client: SELBY DISTRICT COUNCIL

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update

Title: BREACH 5 FLUVIAL FLOOD EXTENTS 1% AEP PLUS FLUVIAL & TIDAL CLIMATE CHANGE ALLOWANCES

Drawn:	TC	Checked:	HC
Verified:	CS	Approved:	IB
Date:	24/05/2022	Scale at A3:	1:30,000
Drawing Number:	FIGURE A21		A3

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Appendix B Data Register

	Dataset	Source	Format	Description
Fluvial	Flood Map for Planning (Rivers and Sea) Flood Zones 2 and 3	Defra Data services Platform	GIS Layer	A quick and easy reference that can be used as an indication of the probability of flooding from Main Rivers. The original Flood Map was broad scale national mapping typically using JFLOW modelling software that is generally thought to have inaccuracies. This is regularly updated with the result of new modelling studies. For those rivers where there is no updated modelling, the Flood Zones from JFLOW modelling may not provide an accurate representation of probability of flooding. Typically watercourses with a catchment area less than 3km^2 are omitted from Environment Agency mapping unless there is a history of flooding affecting a population. Consequently there will be some locations adjacent to watercourses that on first inspection, suggest there is no flood risk.
	OS Open Rivers	Defra Data services Platform	GIS Layer	Identification of the river network including Main Rivers and Ordinary Watercourses for which the Environment Agency and North Yorkshire County Council have discretionary and regulatory powers.
	Statutory Main Rivers	Defra Data services Platform	GIS Layer	Identification of the river network including Main Rivers for which the Environment Agency have discretionary and regulatory powers.
	Historic Flood Map	Defra Data services Platform	GIS Layer	A single GIS layer showing the extent of fluvial historic flood events created using best available information at time of publication. However, some of the data is based on circumstantial and subjective evidence. There is not always available metadata, e.g. date of flood event.
	Modelled flood outlines for designated Main Rivers	Environment Agency	GIS Layer	Detailed and calibrated hydraulic model outlines. The Environment Agency applies the outcomes from such detailed modelling studies to update the Flood Map for Planning (Rivers and Sea) on a quarterly basis. Some watercourses have not been modelled (e.g. smaller tributaries). The flood risk from these is based on broad scale JFLOW modelling and therefore the flood risk from these cannot be as accurately assessed.
	AIMS Asset Bundle	Defra Data services Platform	GIS Layer	Shows where there are existing defences, structures, heights, type and design standard.
Surface Water	'Updated Flood Map for Surface Water' dataset	Defra Data services Platform	GIS Layer	Provides an indication of the broad areas likely to be at risk of surface water flooding, i.e. areas where surface water would be expected to flow or pond. This dataset does not show the susceptibility of individual properties to surface water flooding.
	Surface Water Flood Records	Environment Agency	MS Excel Database	Historic records of surface water flooding in the District held by the Environment Agency.

	Dataset	Source	Format	Description
	Surface Water Flood Records	North Yorkshire County Council	MS Excel Database / GIS Layer	Historic records of surface water flooding in the District held by North Yorkshire County Councils Flood and Water Management and Highways teams.
Groundwater	GIS layers of the geology across the District	SDC	GIS Layer	Illustrates bedrock and superficial geology across the District.
	GIS layer of Source Protection Zones	Defra Data services Platform	GIS Layer	Shows the areas where the groundwater is protected by the Environment Agency. The designation may not consider fractures in the strata at a greater radius where pollutants could reach the source protection zone.
	Aquifer Designation Maps for Bedrock and Superficial	Defra Data services Platform	Website	Shows aquifer designations for bedrock aquifers. The designations identify the potential of the geological strata to provide water that can be abstracted and have been defined through the assessment of the underlying geology.
	GIS layer 'Areas Susceptible to Groundwater Flooding'	Defra Data services Platform	GIS Layer	Strategic-scale mapping indicating areas where groundwater emergence may occur.
Sewer	DG5 Register of sewer flooding incidents, by post code area.	Yorkshire Water Services	Excel Spreadsheet	Indicates post code areas that may be prone to flooding as have experienced flooding in the last 10 years due to hydraulic incapacity. However, given that YW target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding. Covering period 2006-2016
Artificial	GIS layer of canals and reservoirs	Defra Data services Platform	GIS Layer	GIS layer showing the centre line of the Selby Canal and Aire and Calder Navigation.
Other	LiDAR data (DTM, ASCII)	Defra Data services Platform	GIS ASCII	Provides a useful basis for understanding local topography and the surface water flood risk in the area. Spatial resolution of 2m, resampled to 5m.
Emergency Planning	Flood Warning Areas	Defra Data services Platform	GIS Layer	Indicates which areas are covered by the flood warning system.
Planning	OS Mapping of SDC administrative area (1:10K)	Ordnance Survey website	GIS format	Provides background mapping to other GIS layers. Designed for use at 1:10K scales.
	GIS layer of administrative boundary	Ordnance Survey website	GIS format	Defines the administrative area of the District for mapping purposes.

Appendix C Hydraulic Modelling for the SDC area

This section describes some of the known updates to hydraulic modelling which may affect developments within the Selby District LLFA area. Figure C1 covers a wider area than the Selby District LLFA area and wider surrounding areas, but it shows which hydraulic modelling dataset should be used to define water levels on a number of the major rivers in the area. The key locations where modelling approach changes in the Selby LLFA area are as follows:

- A63 road Bridge in Selby- Upstream of the A63 road bridge in Selby, the Lower Ouse and Wharfe Washlands (2018) model should be used to define the water level profile and downstream of there the Humber Extreme Water Levels (2020) model should be used.
- Temple Hirst rail bridge: Upstream of the Temple Hirst rail bridge the Lower Aire (2017) model should be used to define water level profile. However, downstream of the Temple Hirst rail bridge, the Humber Extreme Water Levels (2020) model should be used to define water level profile.

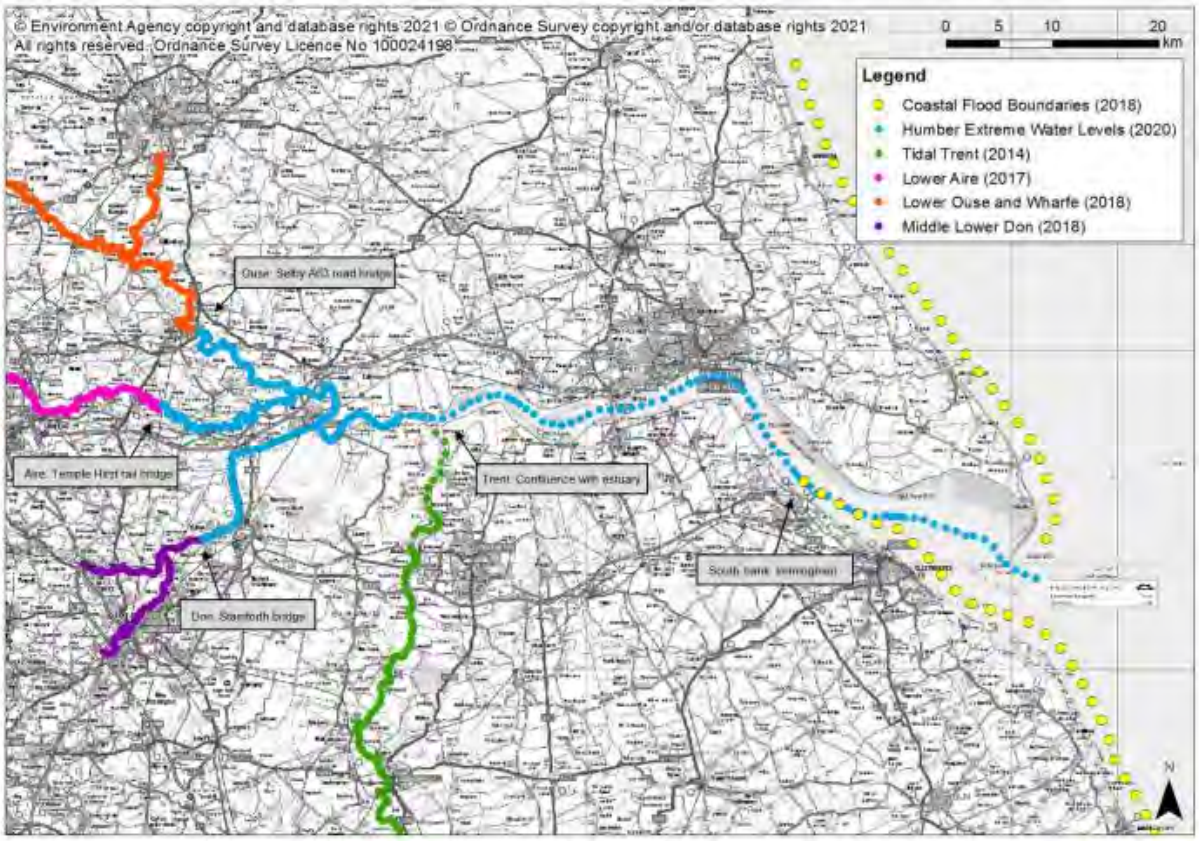

Figure C1: Datasets used to define the water level profile on the Humber estuary and its tidal tributaries

The sections below describe notable hydraulic models which cover parts of the Selby LLFA which have not been discussed in the SFRA above. It is advised that the Environment Agency are contacted before starting any Flood Risk Assessment within the area to ensure that the correct datasets are used.

Humber Extreme Water Levels (2020)

Extreme peak water levels have been produced for the Humber region as part of the Humber 2100+ project. This information is available to inform wider flood risk management work around the Humber estuary and on its tidal boundaries. The water levels are referred to as the Humber Extreme Water Levels (HEWL), which cover the Humber estuary and lower reaches of the rivers Ouse, Aire, Don and Trent, refer to Figure 12-1 (which shows the full extent of the HEWL model).

The modelling approach used is joint probability, which considers the interaction between tidal and fluvial conditions. Tidal and fluvial dependency analysis was carried out to generate joint probability scenarios for a range of AEPs. The scenarios are then run through a hydraulic model and maximum water levels are extracted at each location. The data is also available in time series format to for each model node and it is possible to identify which scenario created the ‘worst case’ level at a specific location.

The HEWL model is 1D only so no maximum flood extents are available from modelling outputs. It is understood that the Lower Aire (2016) model is used upstream of Temple Hirst rail bridge and the Lower Ouse and Wharfe Washlands (2018) model is used upstream of the Selby A63 road bridge to define flood extents. Downstream of Temple Hirst rail bridge and the Selby A63 road bridge the Upper Humber (2016) should be used in the Selby LLFA at present to define flood extents. It is advised that the Environment Agency are contacted to ensure that the correct modelling data are used before any Flood Risk Assessment is completed in the area.

Lower Aire 2019/2020 Winter floods

It is understood that the Lower Aire (2017) model was simulated after the Winter 2019/ 2020 floods. This exercise was completed to better calibrate the model to the extreme flooding. The results of this study can be requested from the Environment Agency.

Lower Ouse and Wharfe Washlands

It is understood that the Lower Ouse and Wharfe Washlands (2018) model may be re-simulated with a downstream boundary taken from the HEWL (2020). This would supersede the Lower Ouse and Wharfe Washlands (2018) modelling and would be used in preference to it as well. It is advised that the Environment Agency are contacted to ensure that the correct modelling data is used before any Flood Risk Assessment is completed in the area.

Upper Humber

It is understood that the Upper Humber (2016) model may be re-simulated with an upstream boundary taken from the HEWL (2020). This would supersede the Upper Humber (2016) modelling and would be used in preference to it as well. It is advised that the Environment Agency are contacted to ensure that the correct modelling data is used before any Flood Risk Assessment is completed in the area.

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