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Local Plan for Slough
Slough Borough Council

STRATEGIC FLOOD RISK ASSESSMENT
LEVEL 1

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DRAFT Revision 4

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Contents

Tables

Figures

Glossary

Abbreviations

Term	Definition
AP	Annual probability
BGS	British Geological Survey
CDA	Critical drainage area
CFMP	Catchment flood management plan
Defra	Department for Environment, Food and Rural Affairs
DRN	Detailed river network
DTM	Digital terrain model
FCERM	Flood and coastal erosion risk management
FEH	Flood Estimation Handbook
FRA	Flood risk assessment
FRMP	Flood risk management plan
GIS	Graphical information systems
IDB	Internal Drainage Board
LDF	Local Development Framework
LiDAR	Light detection and ranging
LLFA	Lead Local Flood Authority
LFRMS	Local flood risk management strategy
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
PPG	Planning practice guidance
NRD	National receptor database
OS	Ordnance Survey
RMA	Risk Management Authority
RoFSW	Risk of flooding from surface water
SBC	Slough Borough Council
SFRA	Strategic flood risk assessment
SPZ	Source protection zone
SuDS	Sustainable drainage systems
SWMP	Surface water management plan
uFMfSW	Updated flood map for surface water

Term	Definition
UKCP18	UK Climate Projections 2018

Definitions

Term	Definition
Aquifer	An area of permeable rock underground which absorbs and holds groundwater.
Areas with critical drainage problems	Environment Agency defined areas that have critical drainage problems.
Brownfield site	A previously developed parcel of land.
Bedrock	Main mass of rocks forming the Earth. These might be exposed at the surface or concealed by either water or superficial deposits.
Canal flooding	Flooding from canals following bank overtopping or breaching.
Climate change	Climate change is widely regarded as the most serious environmental challenge facing us in the 21st century. Increasing amounts of greenhouse gases being released into the atmosphere are helping to trap more heat in, making the planet warmer than it should be. This is likely to result in increased risk of flooding.
Critical drainage area	An area within Environment Agency defined Flood Zone 1, which has critical drainage problems.
Exception Test	Demonstrates how flood risk will be managed on a proposed development site. For the Exception Test to be passed, the sustainability benefits need to outweigh the flood risk.
Flood Zone	Environment Agency classified Flood Zone that refers to the probability of flooding from rivers or the sea, ignoring the presence of defences. Flood Zones do not take account of climate change.
Flood Zone 1	“Low probability”. Land having a less than 1 in 1,000 AP of river flooding.
Flood Zone 2	“Medium probability”. Land having between a 1 in 100 and 1 in 1,000 AP of river flooding.
Flood Zone 3a	“High probability”. Land having a 1 in 100 or greater AP of river flooding.
Flood Zone 3b	“High probability”. This zone comprises land where water flows or is stored in times of flood.
Fluvial flooding	Exceedance of the flow capacity of river channels, leading to overtopping of the riverbanks and inundation of the surrounding land. Climate change is expected to increase the risk of fluvial flooding in the future.
Functional floodplain	Land where water flows or is stored in times of flood.

Term	Definition
Green Belt	Defined areas of open land surrounding a city. Building is restricted in this area.
Greenfield site	A previously undeveloped parcel of land.
Groundwater flooding	Emergence of groundwater at the surface (and subsequent overland flows) or into subsurface voids as a result of abnormally high groundwater flows, the introduction of an obstruction to groundwater flow and / or the rebound of previously depressed groundwater levels.
Lead Local Flood Authority (LLFA)	As defined by the Flood and Water Management Act (2010), Slough Borough Council as LLFA are responsible for developing, maintaining and applying a strategy for local flood risk management. A LLFA must maintain a register of their flood risk assets and has a duty in investigate flood incidents to the extent that it considers it necessary or appropriate. The LLFA are responsible for flooding from surface water, groundwater and Ordinary Watercourses.
Local Planning Authority (LPA)	The public authority responsible for controlling planning and development through the planning system.
Main River	Main Rivers are usually larger rivers and streams. The Environment Agency carries out maintenance, improvement or construction work on Main Rivers to manage flood risk.

Major development	A major development involving any one or more of the following:
	• The provision of residential property where:
	  ○ the number of residential properties to be provided is 10 or more; or
	  ○ the development is to be carried out on a site having an area of 0.5 hectares or more and the number of residential properties is unknown.
	• The provision of non-residential property where the floor space created by the development is equal to or greater than 1,000 square metres;
	• Non-residential development on a site with an area equal to or greater than 1 hectare;
	• The winning and working of minerals or the use of land for mineral-working deposits; or
	• Waste development.

Minor development	A minor development involves: • Provision of residential property where: ○ the number of residential properties to be provided is between 1 and 9 inclusive; or

Term	Definition
	○ the development is to be carried out on a site having an area less than 0.5 hectares where the number of residential properties is unknown. • The provision of non-residential property where the floor space created by the development is less than 1,000 square metres: or • Non-residential development on a site with an area less than 1 hectare.
Ordinary Watercourse	Ordinary Watercourses are watercourses that are not classified as an Environment Agency Main Rivers. The Lead Local Flood Authority carries out maintenance, improvement or construction work on Main Rivers to manage flood risk.
Penstock	A sluice or a gate that controls water flow.
Principal aquifer	*"These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer."* (Environment Agency, 2017).
Reservoir flooding	Flooding from reservoirs following embankment overtopping or breaching.
Riparian owner	Someone who owns a property where there is a watercourse within or adjacent to the boundaries of their property and a watercourse.
Secondary A aquifer	*"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"* (Environment Agency, 2017).
Sequential Test	The Sequential Test aims to steer vulnerable development to the areas of lowest flood risk.
Sewer flooding	Flooding from sewers is caused by exceedance of sewer capacity and / or blockages in the sewer network.
Siphon	A "U" shaped pipe which allows water to flow uphill without being pumped. A siphon can be used to allow one river to cross and flow under another.
Source protection zone (SPZ)	Source protection zones are defined for groundwater sources such as boreholes, wells or springs used for drinking water supply. They show the risk of contamination from any activities that might cause pollution in the area.
Surface water flooding	Intense rainfall exceeds the available infiltration capacity and / or the drainage capacity leading to overland flows and surface water flooding. Climate change is expected to increase the risk of surface water flooding in the future.
Superficial deposits	Younger rocks which sit on bedrock.

Term	Definition
Sustainable Drainage Systems (SuDS)	Drainage systems that manage water in a sustainable way and have multiple environmental benefits.

Executive summary

As the Local Planning Authority (LPA), Slough Borough Council (SBC) has the responsibility, in accordance with the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019) to ensure that flood risk is understood and managed effectively through the planning process.

In 2008 SBC published a strategic flood risk assessment (SFRA) to address flood risk within the Borough, this was then updated in 2009 and then 2012. Since this time national flood management policy and flood risk mapping has been updated and hence a SFRA update is required. The aim of this updated Strategic Flood Risk Assessment (SFRA) is to:

- Inform the sustainability appraisal of the Local Plan so that flood risk is taken into account when assessing allocation options and in the preparation of plan policies, including policies for flood risk management to ensure that flood risk is not increased;
- Ensure that the allocation of land within the Local Plan is made based on an appropriately detailed assessment of flood risk. This should include the Sequential Test, and where necessary the Exception Test from the NPPF (Ministry of Housing, Communities and Local Government, 2019);
- Ensure the formulation of appropriate development control policies for managing flood risk (from all sources) in the Slough Borough;
- Identify the level of detail required for site specific flood risk assessments (FRAs) and for surface water drainage schemes;
- Determine the acceptability of flood risk in relation to emergency planning capability; and
- Inform the Sequential Test for windfall housing sites.

This revised SFRA provides an overview of the risk of flooding from all sources across the Slough Borough including flooding from rivers, surface water, groundwater, sewers and other sources. This SFRA will provide part of the evidence base for the new Local Plan and allocation of development sites.

Flood risk information is continuously being updated; this SFRA has been developed using the best available data at the time of preparation. The SFRA should be updated when appropriate; for example, when new information on flood risk, flood warnings, planning guidance or legislation is made available.

1. Introduction

The Slough Borough is at risk of multiple sources of flooding. In recent years, it has experienced flooding from rivers (fluvial), surface water, groundwater and sewers. This needs to be taken into account when considering future development within the Slough Borough.

This level 1 strategic flood risk assessment (SFRA) provides a detailed assessment of flood risk within the administrative area of Slough Borough Council (SBC). All sources of flooding are considered and information on historic flooding is provided where available and applicable.

This SFRA has been prepared in accordance with the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019) and associated planning practice guidance (PPG) (Ministry of Housing, Communities & Local Government, 2016) on flood risk. The SFRA is also in accordance with the latest Environment Agency guidance on climate change (Environment Agency, 2020 a).

Since the previous SFRA was published in 2012, a number of changes in planning policy have occurred. Furthermore, updated datasets have been made available, including improvements to flood mapping. This SFRA incorporates all these changes and updates. The Environment Agency and Thames Water are currently being consulted; this document will be updated following the consultation.

Regarding the purpose of the SFRA in relation to the Local Plan the Council is currently preparing a new Local Plan for Slough. This SFRA will provide part of the evidence base for the Local Plan and allocation of development sites.

1.1. Purpose of the SFRA

The purpose of the level 1 SFRA is to collate, analyse and present the most up to date flood risk information for the Slough Borough to:

- Inform the sustainability appraisal of the Local Plan so that flood risk is taken into account when assessing allocation options and in the preparation of plan policies, including policies for flood risk management to ensure that flood risk is not increased;
- Ensure that the allocation of land within the Local Plan is made based on an appropriately detailed assessment of flood risk. This should include the Sequential Test, and where necessary the Exception Test from the NPPF (Ministry of Housing, Communities and Local Government, 2019);
- Ensure the formulation of appropriate development control policies for managing flood risk (from all sources) in the Slough Borough;
- Identify the level of detail required for site specific flood risk assessments (FRAs) and for surface water drainage schemes;
- Determine whether any level 2 SFRAs are required, or whether any surface water management plans (SWMPs) would be recommended;
- Determine the acceptability of flood risk in relation to emergency planning capability; and
- Inform the Sequential Test for windfall housing sites.

1.2. Approach to strategic flood risk management

The NPPF (Ministry of Housing, Communities and Local Government, 2019) and associated PPG (Ministry of Housing, Communities & Local Government, 2016) on flood risk highlight the active role the Local Planning Authority (LPA) should take with regards to flood risk. The overall approach for the consideration of flood risk has three key elements:

1. Assess flood risk;
    a. Undertake a SFRA to fully understand local flood risk and to inform the preparation of the Local Plan; and
    b. In areas at risk of flooding or for sites of 1 hectare or more, developers undertake a site-specific flood risk assessment to accompany applications for planning permission.
2. Avoid flood risk; and
    a. SBC should apply the sequential approach to development site selection. As far as reasonably possible, development should be located where the risk of flooding (from all sources) is lowest, taking account of climate change and the vulnerability of future uses to flood risk;
    b. A sequential approach, and where necessary the Exception Test, should be applied to the Local Plan; and
    c. A Sequential Test for individual development proposals, and where necessary the Exception Test, should be applied to specific development proposals.
3. Manage and mitigate flood risk.
    a. When development needs to be in areas at flood risk, the development should be flood resilient and resistant and safe for its users for the development's lifetime, including a changing climate;
    b. Development should not increase flood risk overall or to third party land; and
    c. Flood risk management opportunities should be sought as well as ways to reduce the causes and impacts of flooding (e.g. using sustainable drainage systems (SuDS)).

This SFRA does not reproduce all the guidance from the NPPF (Ministry of Housing, Communities and Local Government, 2019) and thus, the NPPF, together with the PPG (Ministry of Housing, Communities & Local Government, 2016) should be read in conjunction with this SFRA.

SBC has worked closely with the Environment Agency (the principal flood risk management operating authority in England empowered under the Water Resources Act 1991 to manage flood risk arising from designated "main" rivers and the sea) on strategic fluvial flooding in the Slough Borough. SBC work with neighbouring authorities to ensure that proposals and developments in those districts do not have an adverse impact on the Slough Borough, and vice versa. SBC work with Thames Water, the local water company, to ensure proposals and developments do not have an adverse impact on the capacity of the sewer network in the Slough Borough.

This assessment has now been updated to reflect changes which have occurred since 2012. All figures within the SFRA have been appended in high resolution in Appendix A.

This SFRA will be subject to further amendments when appropriate to reflect future changes in planning policy or available data, including:

- Flood map up-dates/new detailed modelling of the Salt Hill Stream by Atkins Limited;

- Flood events which provide new information/data/flood outlines; and
- Relevant changes in national policy and legislation.

2. Study area

2.1. Local Planning Authority area

Slough Borough (Figure 1) is situated to the west of London in the Thames Valley, with the administrative boundaries of Buckinghamshire Council to the north and west, London Borough of Hillingdon to the east and Surrey County Council and the Royal Borough of Windsor and Maidenhead to the south. Slough is a small Borough of just 32.5 km^2. It is densely built up, with an area of Green Belt located south of the M4.

The A4 runs through the length of the Slough Borough with the M4 motorway running parallel along the south of the Slough Borough. The M25 runs north-south along the eastern boundary. Heathrow airport also lies just to the east of the Slough Borough boundary.

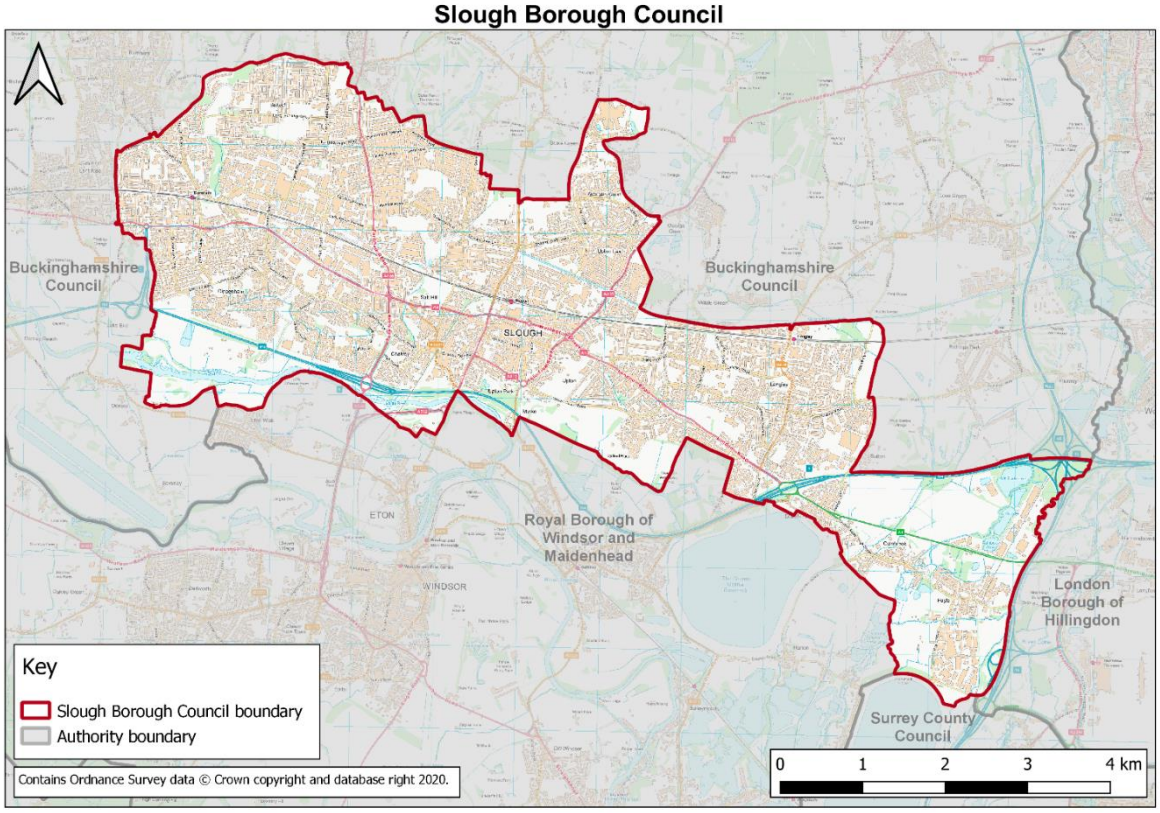

Figure 1 - Location map of the Slough Borough Council boundary

See Appendix A for high resolution version of Figure 1.

2.2. Topography

As shown on Figure 2, the Slough Borough is situated on two terraces, the upper terrace and the river terrace. The land slopes from north to south, and west to east. The Thames Valley runs west/east along the southern boundary and the Lower Colne valley north/south through the Colnbrook and Poyle area. In addition, the Slough Borough is cut north/south by a number of watercourse valleys, more information on these watercourses is provided in Section 2.5. Due to the topography of Slough, parts of the Borough are at significant risk of surface water flooding, as water flows south where it then sits on the relatively flat upper terrace.

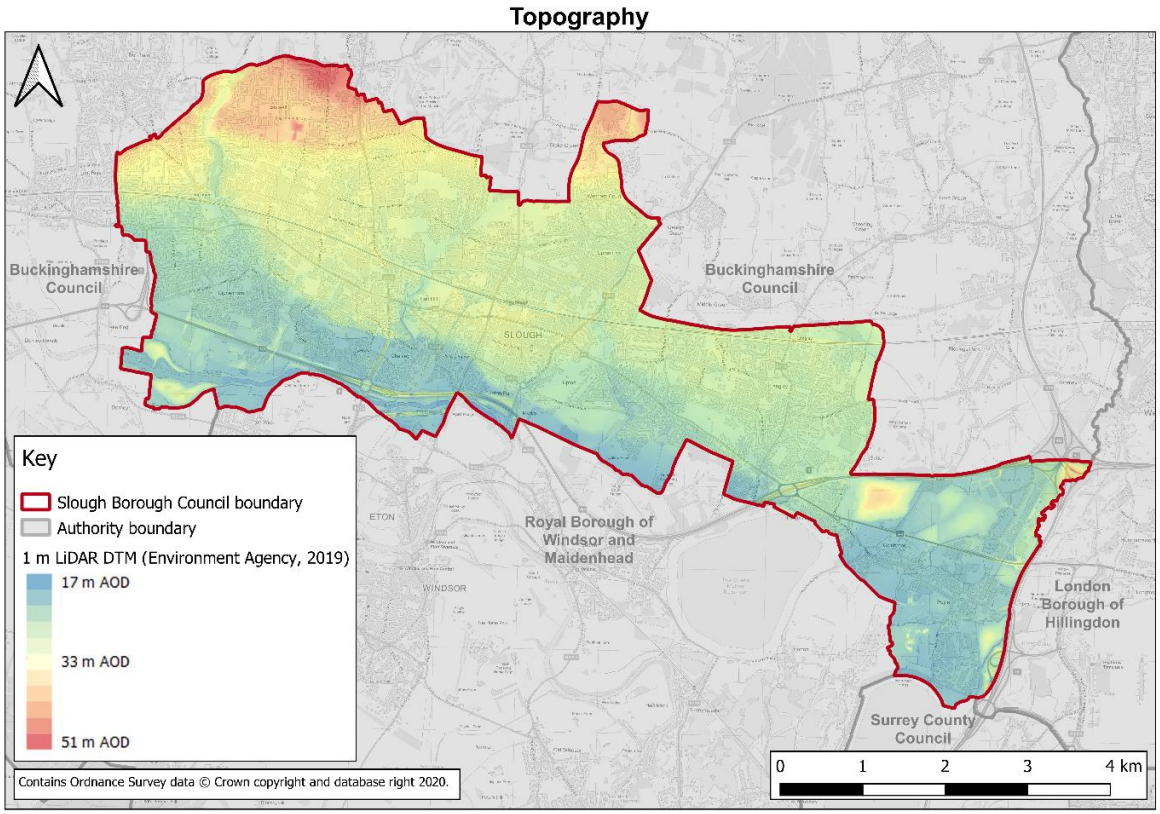

Figure 2 – Topography map of Slough

See Appendix A for high resolution version of Figure 2.

2.3. Geology

Although the Slough Borough is a small, compact area extending seven miles east to west and three miles north to south, the underlying geology is complex and varied. The bedrock and superficial deposit types are outlined below, using British Geological Survey (BGS) data (British Geological Survey, 2019). The boundaries between the various areas of bedrock and superficial deposits as shown on the BGS maps are by no means precise; the BGS maps are updated as new information becomes available and hence the geology discussed here is liable to change.

2.3.1. Bedrock

The bedrock (as shown in Figure 3) is mainly comprised of Clay Silt and Sand from the London Clay formation and the Lambeth Group. There is a small area comprised of Seaford Chalk Formation and Newhaven Chalk formation to the North West of the Borough.

2.3.2. Superficial deposits

The superficial deposits (as shown on Figure 4) also vary across the Slough Borough. There is a large band of Langley Silt (Clay and Silt) across the northern part of the borough, changing to Taplow Gravel (sand and Gravel) and then Alluvium (Clay, Silt, Sand and Gravel) as distance from the River Thames decreases. There are also small areas around the Borough of Shepperton Gravel (Sand and Gravel). There are only very small areas containing no superficial deposits.

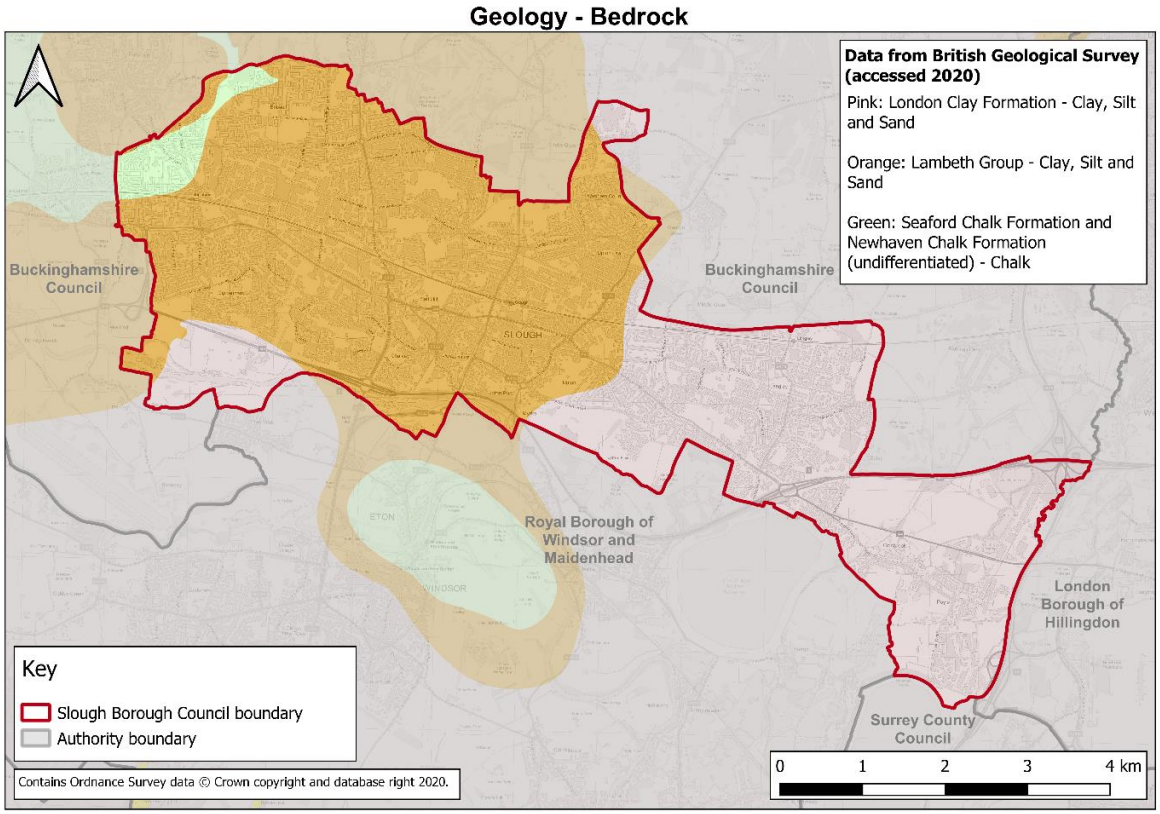

Figure 3 - Bedrock geology (British Geological Survey, 2019)

See Appendix A for high resolution version of Figure 3.

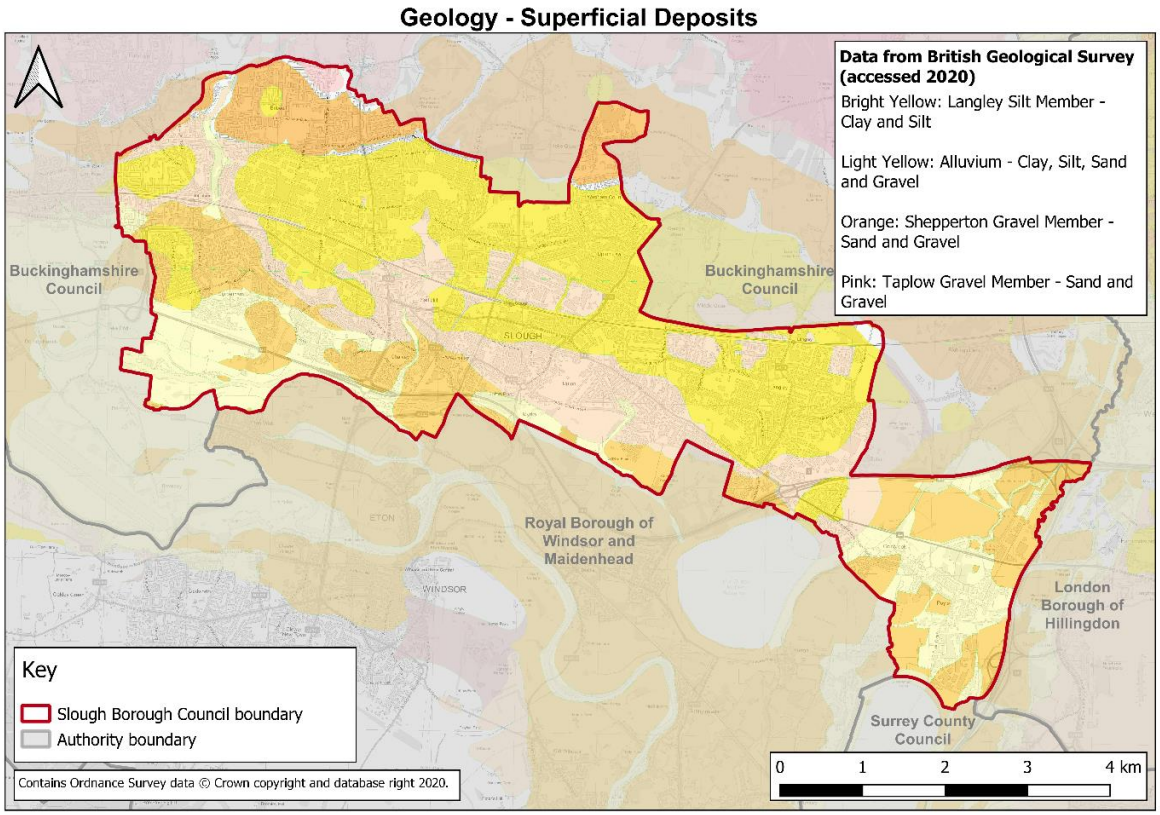

Figure 4 - Superficial deposits (British Geological Survey, 2019)

See Appendix A for high resolution version of Figure 4.

2.4. Hydrogeology

Aquifers are defined as an underground layer of permeable rock, rock fractures or unconsolidated material (sand, gravel, silt etc.) which can store and transport large quantities of water. Understanding the location and behaviour of aquifers is important as they can indicate the potential for groundwater flooding.

The aquifers within the Slough Borough are as follows:

- The Seaford Chalk formation and the Newhaven Chalk formation bedrock that underlies part of the Burnham area in the Slough Borough (Figure 3) is described by the Environment Agency as a Principal Aquifer;
- The Shepperton Gravel (sand and gravel) superficial deposits shown in Figure 4 is described by the Environment Agency as a Principal Aquifer;
- The Lambeth Group (clay, silt and sand) bedrock that underlies the western half of the Slough Borough (Figure 3) is described by the Environment Agency as a Secondary A aquifer; and
- The Alluvium (clay, silt, sand and gravel) superficial deposits are described by the Environment Agency as a Secondary A aquifer.

The Environment agency provides the following definitions:

- **Principal Aquifer:** *"These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer."* (Environment Agency, 2017).
- **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"* (Environment Agency, 2017).

See Section 8 for further information relating to groundwater and infiltration issues, and groundwater source protection zones (SPZs).

2.5. Watercourses

There are a number of watercourses in the Slough Borough (as shown on Figure 5). Many of these are classified as Main River, which the Environment Agency have permissive powers to maintain and improve. Others, or parts of some rivers, are classified as Ordinary Watercourses, for which the Lead Local Flood Authority (LLFA) (SBC) are the operating authority. Some of the watercourses are not apparent on the ground as substantial sections have been culverted. The catchment areas are shown in Figure 6. These are indicative boundaries based upon those delineated in the Flood Estimation Handbook (FEH) online service. Certain culverted sections are mapped as Thames Water surface water sewers, but Thames Water dispute their ownership as they are not responsible for watercourse management. Thames Water are the water and sewerage board for the Slough Borough.

The River Thames itself flows to the south of the Borough, within the Royal Borough of Windsor and Maidenhead.

An overview of the watercourses within the Slough Borough is given in Table 1.

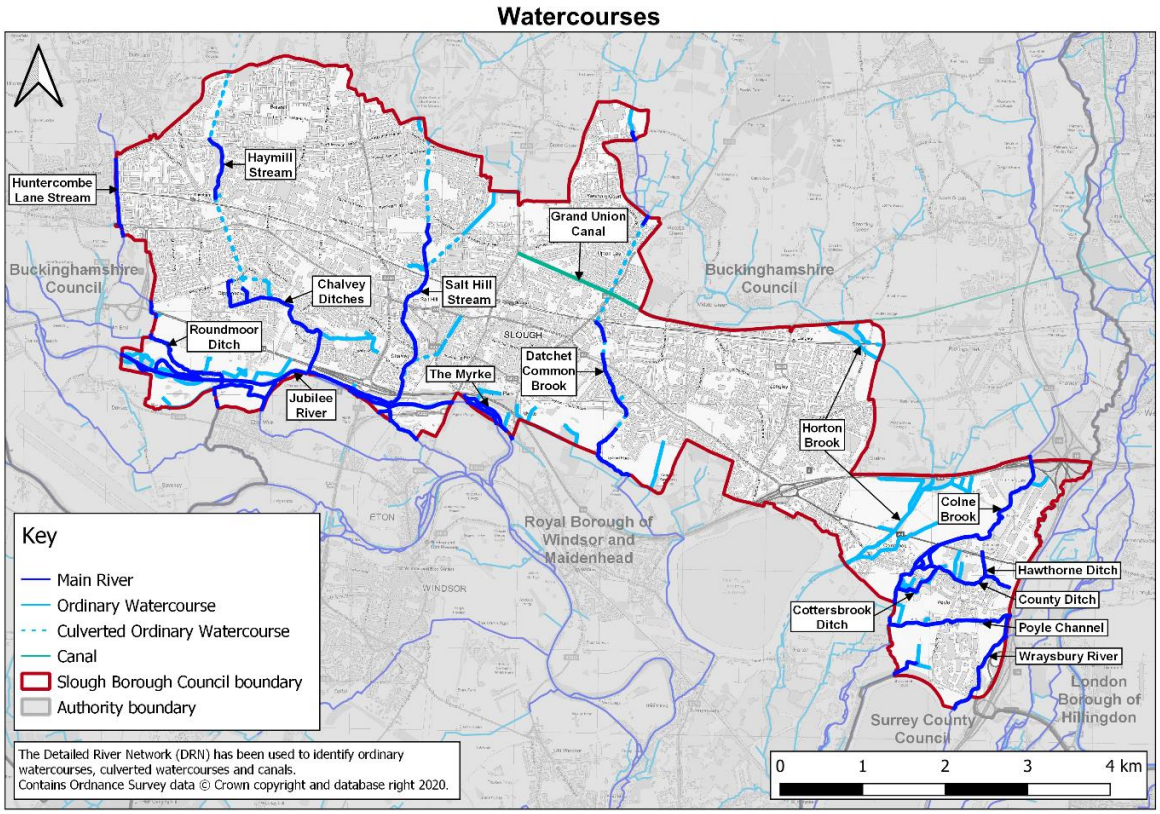

Figure 5 - Watercourses in the Slough Borough

See Appendix A for high resolution version of Figure 5.

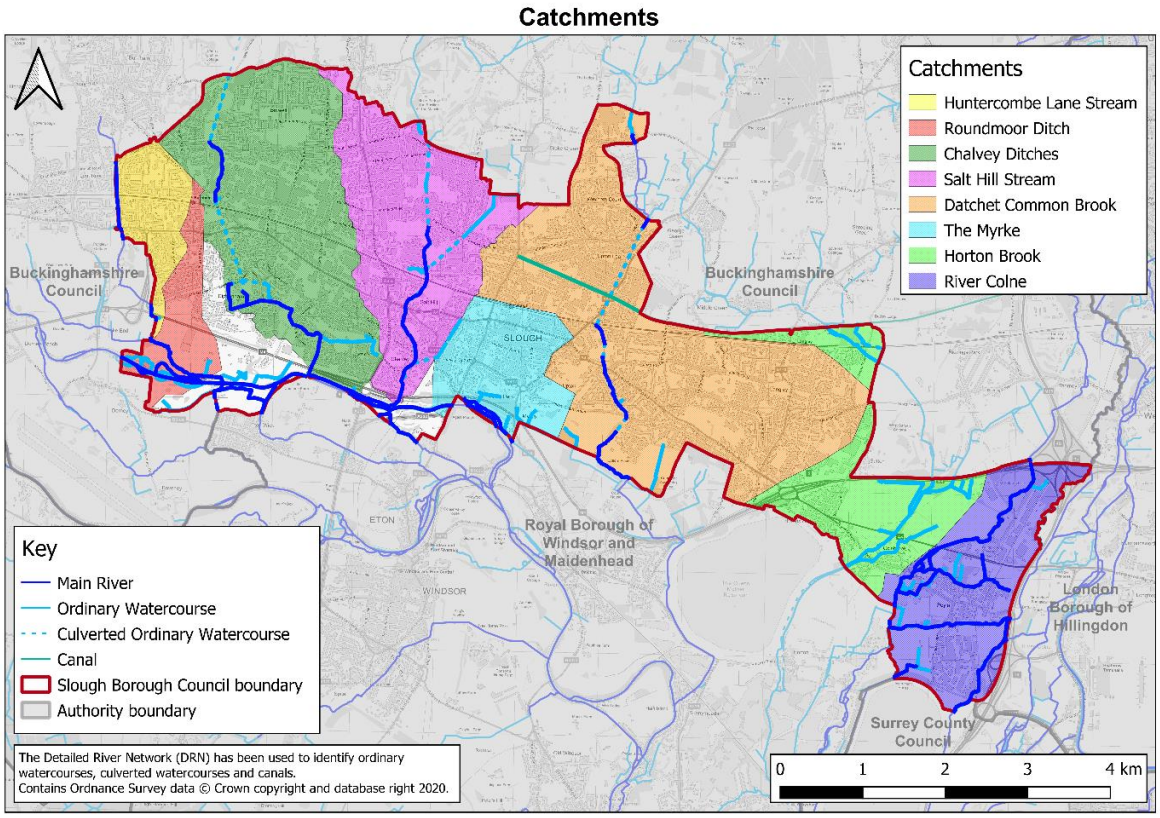

Figure 6 - Catchments in the Slough Borough

See Appendix A for high resolution version of Figure 6.

Table 1 - Watercourses within the Slough Borough

** 'Catchment size' is defined as the size of the catchment until there is a confluence or the watercourse leaves the Slough Borough. 'N/A' has been used where the river is manmade or where the catchment area is a sub-catchment of another and is included elsewhere.*

Name	Type	Location	Tributary of	Approximate catchment size*	Description
Huntercombe Lane Stream and Roundmoor Ditch					
Huntercombe Lane Stream	Main River	Burnham (West Slough)	Roundmoor Ditch	2.3 km^2	The Huntercombe Lane Stream enters the Slough Borough from Buckinghamshire Council at the junction of Stomp Road and Huntercombe Lane North. It is culverted for most of its length within the Slough Borough. The Huntercombe Lane Stream leaves the Slough Borough following Huntercombe Lane South, it then re-enters the Slough Borough at the junction of West Point and Mercian Way. It flows in an open watercourse through the West Point allotments and south of the M4 motorway. Just south of the M4 motorway the Huntercombe Stream joins the Roundmoor Ditch.
Roundmoor Ditch	Main River	South-West Slough (rural)	Jubilee River	11.6 km^2 *including Huntercombe*	The Roundmoor Ditch flows into the Slough Borough, from Buckinghamshire Council, west of the Thames Water Slough sewage works at its confluence with the Huntercombe Lane Stream. It then flows south east, around the sewage works, and is culverted underneath the weir on the Jubilee River before leaving the Slough Borough and flowing into the Royal Borough of Windsor and Maidenhead.
Jubilee River					

Name	Type	Location	Tributary of	Approximate catchment size*	Description
Jubilee River	Main River	South-West Slough (rural)	River Thames	N/A	The Jubilee River is a manmade channel built to reduce the risk of flooding by diverting water from the Thames upstream of Maidenhead. The Jubilee re-joins the River Thames downstream of Windsor in the Royal Borough of Windsor and Maidenhead.
Chalvey Ditches					
Haymill Stream	Main River and Ordinary Watercourse	Burnham (West Slough)	Chalvey Ditches	N/A	The upper reaches of the Chalvey Ditches are referred to as the Haymill Stream or Two-Mile Stream.
Chalvey Ditches	Main River	Burnham and Cippenham (West Slough)	River Thames	22.9 km^2	The Chalvey Ditches enters the Slough Borough from Buckinghamshire Council. It is culverted through the Lynch Hill Valley and then flows in open channel from south of Whittaker Road through the Haymill Valley to Burnham Lane. In high flows the water ponds behind a structure and dam (Haymill Dam) at the junction of Buckingham Avenue and Burnham Lane. The Chalvey Ditches is then culverted south towards Cippenham. At Cippenham Green, the Chalvey Ditches branch into three: • Mill Stream, the original course, branches off in a culvert to the west and flows in open channel along part of Lower Cippenham Lane and south along Mill Stream Lane. • Most of the flow is passed south through a culvert into an open watercourse at the south of College Road, through

Name	Type	Location	Tributary of	Approximate catchment size*	Description
					Deerwood Park. This joins Mill Stream just south of Earls Lane. • The third culvert flows to the east, towards Lower Cippenham Lane, it then flows in an open channel south to re-join the Mill Stream. The Chalvey Ditches is then culverted under the M4 to the east of Asda supermarket and then flows east alongside the south side of the M4, under the A355. It is then siphoned under the Jubilee River and discharges into the River Thames in the Royal Borough of Windsor and Maidenhead.
Salt Hill Stream					
Salt Hill Stream	Main River and Ordinary Watercourse	Manor Park, Salt Hill and Chalvey	River Thames	16.9 km^2	The Salt Hill Stream enters the Slough Borough from Buckinghamshire Council at the Stoke Poges golf course. It originates in two tributaries in wooded or rural parts of Farnham Common and Stoke Poges. The two tributaries meet just south of the Stoke Poges golf course where they are culverted south. The Salt Hill Stream flows in open channel through Granville Park and is then culverted again until it reaches Godolphin Recreation Ground and Baylis Memorial Gardens. The river is then culverted under the railway and then flows in open channel through Salt Hill Park. Culverted under Bath Road, the Salt Hill Stream them flows in open channel until it reaches Church Street, it then flows in both culverts and open channel to the M4, where it is culvert underneath.

Name	Type	Location	Tributary of	Approximate catchment size*	Description
					It is then siphoned under the Jubilee River and discharges into the River Thames in the Royal Borough of Windsor and Maidenhead.
Datchet Common Brook					
Datchet common brook	Main River and Ordinary Watercourse	Wexham and Upton	River Thames	14.0 km^2	The Datchet Common Brook initially enters the Slough Borough to the east of Wexham Hospital from Buckinghamshire Council as an open channel Ordinary Watercourse. It flows through a ponded area to the north of Wexham Park Lane, approximately 100 m upstream of Wexham Park Lane, the river changes from an Ordinary Watercourse to a Main River. South of Wexham Park Lane, the watercourse flows out of SBC, back into Buckinghamshire Council. The Datchet Common Brook re-enters the Slough Borough near the junction of Church Lane and the Uxbridge Road. The watercourse remains an open channel through the allotments to the south of Church Lane and then is culverted most of the way south to Upton Court Park. The watercourse splits at the London Road with the original route running as an open watercourse parallel and north of Quaves Road; it enters a culverted section at Upton Court Road and runs southwards into Upton Court Park. The main flow is culverted and mapped as a surface water sewer under Quaves Road. The two culverts join at a point in Upton Court Park.

Name	Type	Location	Tributary of	Approximate catchment size*	Description
					The Datchet Common Brook then flows out of the Slough Borough and discharges into the River Thames in the Royal Borough of Windsor and Maidenhead.
The Myrke					
The Myrke	Main River	Central Slough	Jubilee River	2.0 km^2	The Myrke catchment covers Slough town centre and south of the town centre down to the Jubilee River. The catchment drains Herschel Park and part of Upton Court Park. One ordinary watercourse from Herschel Park and two from Upton Court Park flow into the Myrke which discharges into the Jubilee River.
Horton Stream					
Horton Brook	Ordinary Watercourse	Langley and Colnebrook	Colne Brook	17.9 km^2	The Horton Brook enters the Slough Borough through a culvert under the Grand Union Canal from Buckinghamshire Council, north-east of Langley Station, and flows in an open channel south eastward. It is culverted under Market Lane and re-enters Buckinghamshire Council. The Horton Brook re-enters the Slough Borough through a culvert under the M4 motorway, south of Richings Park Golf Club, and flows in an open channel south, culverted under Colnbrook bypass to Colnbrook High Street where it is culverted again. The Horton Brook emerges along the side of Crown Meadow and flows through the meadow and alongside the Horton Road into the Royal Borough of Windsor and Maidenhead.
River Colne catchment					

Name	Type	Location	Tributary of	Approximate catchment size*	Description
Colne Brook	Main River	Colnbrook and Poyle	River Colne	88.3 km^2	The Colne Brook is a part of the River Colne catchment and runs from Uxbridge Moor to the River Thames at the downstream boundary entering the Thames just below Bell Weir Lock in Hythe End, Wraysbury. The Colne Brook leaves the River Colne in the Colne Valley Regional Park and then flows south to West Drayton and passes under the M25 and M4 where it enters the Slough Borough. The open channel flows alongside a series of lakes north of the Colnbrook Bypass. After passing under the Colnbrook Bypass the channel splits and flows around the east and west side of the Tanhouse Farm industrial area. On the eastern arm the Colne Brook channel is joined by the County ditch. The inflow into the Colne Brook from the County Ditch is controlled by a weir. The controls and embankments around this area form part of a flood alleviation scheme installed by the Environment Agency in the1990s. The County Ditch runs from the north side of the Colne/Galleymead trading estates and is joined by the Hawthorn Ditch from the north around Hawthorn Avenue. The Hawthorn Ditch is fed by Colnebrook Water – the discharge from Colnebrook Water is controlled by a penstock which is operated by the Environment Agency. The County Ditch can flow into an overflow channel via a lowered embankment at the Albany Park overflow which was constructed as part of the more recent flood alleviation scheme in 2004/2005. This overflow channel then connects to the
County Ditch	Main River	Colnbrook and Poyle	Colne Brook		
Hawthorne Ditch	Main River	Colnbrook and Poyle	Colne Brook		
Cottersbrook ditch	Main River	Colnbrook and Poyle	Colne Brook		
Poyle Channel	Main River	Poyle	Colne Brook		
Wraysbury River	Main River	Poyle	River Thames	2.4 km^2	

Name	Type	Location	Tributary of	Approximate catchment size*	Description
					Cottersbrooke Ditch which flows south and west and joins the Colne Brook south of Colnbrook village centre. The Colne Brook east and west arms join just north of Bridge Street and flows through the village of Colnbrook. South of Colnbrook village the Poyle Channel joins the Colne Brook having flowed through the Poyle industrial area. The Poyle Channel is an offtake from the Wraysbury River via a weir just inside the SBC boundary on the west side of the M25. The Wraysbury River itself branches off the River Colne at West Drayton. It flows along the west side of the M25 within the Slough Borough boundary before leaving the Borough by the Wraysbury reservoir.
Other					
Grand Union Canal	Canal	Central Slough	N/A	N/A	The Grand Union Canal is a 137 mile canal from the Tideway (Thames) at Brentford in London to Birmingham. There is an arm, that comes off this main line, into the Slough Borough. The Slough arm is 4.9 miles long and ends at Stoke Road (B416).

3. Policy and flood risk responsibility

The overall aim of development and flood risk planning policy is to make sure that the risk of flooding is considered at all stages of the planning process. This section of the SFRA provides a brief overview of national, regional and local planning policy relevant to flood risk and the preparation of this SFRA. This section also highlights flood risk responsibilities.

3.1. National legislation

3.1.1. Flood and Water Management Act (2010)

The Flood and Water Management Act was enacted in 2010. The key areas within this Act are the roles and responsibilities for flood and coastal erosion risk management and improving reservoir safety.

3.1.2. Flood Risk Regulations (2009)

The Flood Risk Regulations aim to provide a consistent approach to manage flood risk. It outlines that the Environment Agency are responsible for managing flood risk from Main Rivers, the sea and reservoirs. LLFAs are responsible for local sources of flood risk from surface water, groundwater and ordinary watercourses.

3.1.3. The Environmental Permitting (England and Wales) Regulations (2016)

The Environmental Permitting regulations provide a consolidated system of environmental permitting in England and Wales. Formally known as flood defence consents, flood risk activities: environmental permits[1] are required if work is going to be undertaken on or near a main river, on or near a flood defence structure, in a flood plain or on or near a sea defence.

3.2. National policy

3.2.1. National flood and coastal erosion risk management (FCERM) strategy for England

The National flood and coastal erosion risk management (FCERM) strategy for England (Environment Agency, 2020 i) outlines what needs to be undertaken by all Risk Management Authorities (RMAs) that are involved in flood and coastal erosion risk management. The Environment Agency has strategic leadership for all sources of flooding and coastal change and this National Strategy seeks to better manage both the risks and consequences from flooding from many sources; rivers, the sea, groundwater, surface water, sewers, reservoirs, ordinary watercourses and coastal erosion.

The vision of the strategy is *"A nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100."*. This vision is mirrored in each of the objectives and measures outlined in the strategy.

3.2.2. National Planning Policy Framework (NPPF)

The NPPF (Ministry of Housing, Communities and Local Government, 2019) is the overarching document in relationship to development and flood risk. It sets out the Government's planning policies for England and how these should be applied.

The aim of the NPPF is to ensure that development is not at an unacceptable risk of flooding. Where development is unavoidable in areas at risk from flooding, the NPPF

[1] https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

ensures that the development is safe for its lifetime without increasing flood risk elsewhere, and where possible reducing flood risk overall.

It outlines that SFRAs should inform strategic policies and should consider *"cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards".*

These 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. They should do this, and manage any residual risk, by:*

applying the Sequential Test and then, if necessary, the Exception Test as set out below;

safeguarding land from development that is required, or likely to be required, for current or future flood management;

using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and

where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations"

More information on the Sequential Test and further steps in identifying areas suitable for development is provided in Section 0.

The NPPF outlines that applications for development should be supported by a site-specific flood risk assessment (FRA) where appropriate. More information is provided in Section 7.

It also states that new development should be planned to avoid the increased vulnerability to impacts from climate change.

3.2.3. Planning practice Guidance (PPG)

The PPG (Ministry of Housing, Communities & Local Government, 2016) outlines the guidance in relation to the policies within the NPPF. This provides specific guidance on how to take account of, and address risks associated with flooding in the planning process. It sets out that Local Authorities should look to:

- Assess flood risk: by undertaking a SFRA in order to understand the flood risk in the area, and set out requirements for site-specific FRAs to accompany planning permissions if appropriate;
- Avoid flood risk: by applying a sequential approach, Sequential Test and if needed, the Exception Test; and
- Manage and mitigate flood risk: by making sure development is flood resilient and resistant, safe for its lifetime and does not increase risk elsewhere. Flood risk management opportunities and sustainable drainage systems should also be encouraged.

3.2.4. Climate change allowances

The Environment Agency have published advice for including climate change allowances in both SFRAs and FRAs (Environment Agency, 2020 a). The current guidance as of December 2020 is aligned with UKCP09, it is acknowledged that an update is expected imminently. This should be followed when appraising the future risk of an area or

development over its lifetime. Incorporating this guidance should help to reduce the vulnerability of sites to flooding and provide resilience.

For the Slough Borough there are two main areas of guidance that should be followed:

- Peak river flow; and
- Peak rainfall intensity.

For more information on SBC's climate change strategy please refer to the '*Climate Change Strategy for Slough 2011-2014.'* and Section 3.4.7.

3.2.4.1. Peak River Flow

This shows the anticipated changes to peak flow by river basin district. The Slough Borough is situated within the Thames River Basin District and therefore should follow the guidance for this river basin district.

The type of allowance needed within a study depends on the flood zone and type of development proposed. The information pertaining as to which allowance category should be assessed is detailed in The Environment Agency's Flood risk assessments: climate change allowances guidance (Environment Agency, 2020 a).

Peak river flow allowances for the Thames River Basin District are shown in Table 2. This is taken from Table 1 in the Environment Agency Climate Change Guidance (Environment Agency, 2020 a).

Table 2 - Peak river flow allowances by river basin district (based on a 1961 to 1990 baseline) (Environment Agency, 2020 a)

River basin district	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Thames	H++	25%	40%	80%
	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

Further information on the allowance categories and floodplain storage compensation is provided in the Environment Agency guidance.

3.2.4.2. Peak rainfall intensity allowance

This shows the anticipated changes in peak rainfall intensity for urbanised drainage catchments or small catchments of less than 5 km^2. The guidance states that both the upper end and central allowances should be used within FRAs and for SFRAs.

Peak rainfall intensity allowances are shown in

Table 3. This is taken from Table 2 in the Environment Agency Climate Change Guidance (Environment Agency, 2020 a).

Table 3 - Peak rainfall intensity allowance in small catchments (less than 5 km^2) or urban drainage catchments (based on a 1961 to 1990 baseline) (Environment Agency, 2020 a).

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

3.3. Regional policy

3.3.1. Thames River basin district Flood Risk Management Plan (FRMP) 2015 to 2021

The Flood Risk Management Plan (FRMP) for the Thames river basin district (Environment Agency, 2016) outlines the risk of flooding from all sources to the area and sets out how the RMAs should work with communities in order to manage that risk within 2015 to 2021. SBC is the RMA for the Slough Borough. The main aims of the FRMP are to prevent risk, prepare for risk and protect from risk. The Slough Borough is within both the Colne and Maidenhead to Sunbury relevant management catchments.

As well as the FRMP, each river basin district must have a river basin management plan which focusses on water quality and sustainable use of water.

3.3.2. Thames: Catchment flood management plan (CFMP)

The Thames: Catchment flood management plan (CFMP) (Environment Agency, 2009) provides an overview of the flood risk within the River Thames catchment and sets out a plan for sustainable flood risk management for the next 50 to 100 years. The CFMP assesses all types of inland flooding. The role of the CFMP is to 'establish flood risk management policies which will deliver sustainable flood risk management for the long term.'

Within the CFMP the Slough Borough is outlined to have between 2,000 to 5,000 properties at risk of a 1% annual probability (AP) fluvial flood.

3.4. Local policy

3.4.1. Slough Local Development Framework (LDF), Core Strategy 2006-2026

This is the current adopted core strategy for the Slough Borough (Slough Borough Council, 2008). This sets out both the policies and guidance for planning within the Slough Borough from 2006 to 2026. It forms part of the Local Development Framework (LDF).

Core policy 8 outlines that:

- Development within the borough should 'be sustainable, of a high-quality design, improve the quality of the environment and address the impact of climate change.'
- Development will only be permitted if it is demonstrated that it is safe from flooding and it will not 'impede the flow of floodwaters, increase the risk of flooding elsewhere or reduce the capacity of a floodplain'.
- Development will need to manage surface water sustainably, which will reduce flood risk and increase the water quality.

3.4.2. The Emerging Local Plan for Slough 2016-2036

The council is currently developing a new Local Plan. Once accepted this will replace the current Core Strategy 2006-2026 and will set out the spatial strategy for accommodating growth, managing development and allocating development sites in the period up to 2036 in the most sustainable solution, in terms of amenity, traffic and the environment. A draft preferred Spatial Strategy has been prepared indicating broad areas for growth or change. It does not allocate specific sites but takes account of flood risk.

The emerging Local Plan aims to address some of the key challenges facing the Slough Borough. In particular:

- Meeting the need for new homes;
- Continuing to provide for locally and nationally important businesses;
- Enhance the quality of the built and natural environment; and
- How to tackle congestion on Slough's roads.

The key spatial elements of the Plan are as follows:

- Delivering major comprehensive redevelopment within the "Centre of Slough";
- Selecting other key locations for appropriate sustainable development;
- Enhancing our distinct suburbs, vibrant neighbourhood centres and environmental assets;
- Protecting the "Strategic Gap" between Slough and Greater London;
- Promoting the cross border expansion of Slough to meet unmet housing needs.

3.4.3. Slough Housing Strategy 2016 to 2021

The SBC Housing Strategy (Slough Borough Council, 2017) sets out the councils plans for development in the town from 2016-2021. This covers new housing, private sector housing, council homes, homelessness and housing need and special housing needs and vulnerable groups. It covers a five-year period but also considers the longer term, so that in 20 years' time there is a range of housing and support services that match the ambition and needs of our residents. The Housing Strategy states that the borough's population is expected to grow rapidly over the next 20 years, by at least 15% to 169,111 in 2036. To accommodate this grown as well as existing demand for homes, ~20,000 new homes need to be built by 2036. This equates to 1,000 new homes per year.

This document does not reference flood risk but should be consulted in relation to new developments, specifically when allocating land for such development.

3.4.4. Local flood risk management strategy (LFRMS) for Slough

As part of the responsibilities designated to a LLFA, SBC are required to have a local flood risk management strategy (LFRMS) for its area. The main aim of the strategy (Slough Borough Council, 2013) is to identify where flooding can be reduced or managed in a sustainable manger and to alleviate where possible the misery, economic damage and social disruption that flooding causes.

3.4.5. Surface water management plan (SWMP) for Slough

The Slough Surface Water Management Plan (SWMP) (WSP, 2012) outlines the preferred surface water management strategy for the Borough and examines the causes and effects of

surface water flooding. It identifies the most cost effective means of managing long term surface water flood risk.

3.4.6. Section 19 reports

Under the Flood and Water Management Act 2010, LLFAs must undertake an investigation after a flood incident within its area, where necessary or appropriate. A Section 19 report is required when there has been internal flooding, flooding of transport infrastructure causing a closure or diversion or flooding of a plant where loss of service to customers results. SBC have produced two Section 19 reports (Colnbrook flooding 2014 and Edinburgh Avenue 2015). For more information on these Section 19 reports see Section 5.2.1, for information on other flood incidents that have not required a Section 19 report, see Table 10 in Section 5.2.

3.4.7. Slough Climate Change Strategy 2011-2014

The Slough Climate Change Strategy (Slough Borough Council, 2011) outlines the changes in climate that will possibly affect the Slough Borough under a changing climate in the future. It identified what the UK government is doing to prevent climate change and the strategies in the Slough Borough, for example outlining that actions are being taken in different areas:

- Community Leadership;
- Domestic, industrial and commercial buildings and the natural environment;
- Transport;
- Waste and Recycling; and
- Procurement.

The strategy outlines that measures should be taken to reduce the risk to development. For example, taking a strategic approach to locating development in areas that minimise the exposure to flood risk and that the infrastructure is designed or renovated to be resilient to both storms and floods as well as other impacts of a changing climate. It also outlines that effective emergency planning should be used to anticipate extreme weather events more effectively and thereby creating plans that reduce the impact on SBC.

On 23/07/2019 SBC passed a motion on climate change. One of the five objectives was: "Supporting council services, residents and businesses to adapt to the impacts of climate change". The impact of climate change on flood risk in the Slough Borough is discussed further in Section 5.5. SBC are currently working on a new climate change strategy and action plan to tackle this issue, and this SFRA will be updated when these are issued.

3.4.8. Neighbouring authorities

As outlined in Section 2.5 the watercourses in the Slough Borough also flow through neighbouring authorities. The SFRAs of these authorities should be consulted when development could impact flood risk, in order to make sure their guidance is being followed, and flood risk is not made worse in any neighbouring area. The neighbouring authorities include:

- London Borough of Hillingdon;
- Royal Borough of Windsor and Maidenhead;
- Buckinghamshire Council (South Bucks Area SFRA); and
- Spelthorne Borough Council.

3.5. Risk Management Authorities

There is no single body responsible for managing flood risk in the UK, the responsibility is joint among a number of bodies; RMAs. The Flood and Water Management Act 2010 requires RMAs to co-operate with each other, act in a manner that is consistent with the National FCERM strategy for England and the LFRMS developed by LLFAs, and exchange information with each other.

The RMAs in the Slough Borough are listed below, and their responsibilities, alongside the responsibilities of riparian owners are outlined in Table 4.

- Environment Agency
- Slough Borough Council (LLFA)
- Thames Water
- Highways Authority

There are no Internal Drainage Boards (IDBs) in the Slough Borough.

Table 4 – Responsibilities of RMAs in the Slough Borough

Responsibilities	RMA				Riparian owner
	Environment Agency	Slough Borough Council (LLFA)	Thames Water	Highways Authority	
Fluvial flooding from Main Rivers	✓				✓
Fluvial flooding from Ordinary Watercourses		✓			✓
Surface water flooding		✓			
Groundwater flooding		✓			
Surface water and foul sewer flooding			✓		
Reservoir flooding	✓				✓
Highways flooding		✓		✓	✓

3.6. Consultation

The Environment Agency and Thames Water are currently being consulted on the update of this SFRA. The SFRA, will be updated following consultation.

4. SFRA approach

As stated in the NPPF (Ministry of Housing, Communities and Local Government, 2019) the role of the SFRA is *"to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact that land use changes and development in the area will have on flood risk."*

As outlined in Section 3.2, the NPPF states that a sequential approach should be followed for development. This means that development should be located in areas of no or low flood risk over areas of higher risk. The following sections outline how this approach should be followed, including the Sequential and Exception Tests and when they should be applied.

4.1. Sequential Test

The primary purpose of the Sequential Test is to direct new development to the lowest flood risk zone. Thus, if development is not possible within Flood Zone 1, then Zone 2 could be considered, and if development is not possible within Zone 1 and Zone 2, then Zone 3 could be considered.

However, the Sequential Test is constrained by the vulnerability of the proposed land use, with the more vulnerable land uses restricted to zones with lower risk of flooding Wherever possible, development must be directed to a site in the lowest flood risk zone, and, where there are no suitable sites in the lower flood risk zones, the Exception Test is might then be required depending on Flood Zone and development type.

If development is planned in a higher risk zone, flood management and mitigation measures may be required to reduce risks to an acceptable level for proposed land use. Such measures could include traditional flood defences and flood alleviation schemes or flood resistant and resilient design, together with evacuation plans.

The Sequential Test requires a demonstration that the residual risk, taking into account flood management and mitigation measures, is acceptable. The potential for climate change over the life of the development must also be considered.

All developments must also take into account other sources of flooding including groundwater, surface and foul sewer flooding, and apply a sequential approach to these risks if present. The impact the development has for flood risk elsewhere due to drainage and runoff from the site must also be considered.

More information on the application of the Sequential Test in site-specific flood risk assessments can be found in Section 7.5

4.2. Flood Zones

The NPPF outlines four Flood Zone classifications of which three have been used by the Environment Agency in the creation of their fluvial flood mapping. They represent both fluvial and tidal flooding without flood defences in place. The Environment Agency Flood Zone maps for planning should be used to identify when the Sequential Test and Exception Test are required.

The Flood Zone definitions are outlined in Table 5 below, taken from Table 1 of the PPG (Ministry of Housing, Communities & Local Government, 2016).

Table 5 - Flood Zones (Ministry of Housing, Communities & Local Government, 2016)

Flood Zone		Definition
Zone 1	Low Probability	Land having a less than 1 in 1,000 AP of river or sea flooding.
Zone 2	Medium Probability	Land having between a 1 in 100 and 1 in 1,000 AP of river flooding; or land having between a 1 in 200 and 1 in 1,000 AP of sea flooding.
Zone 3a	High Probability	Land having a 1 in 100 or greater AP of river flooding; or Land having a 1 in 200 or greater AP of sea flooding
Zone 3b	The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. This is often represented by the 5% (1 in 20) AP flood event, where modelling is available. Otherwise it can be approximated to Zone 3a.

4.3. Land use vulnerability

The NPPF classifies land use based on vulnerability to flood risk. Vulnerability is set out in the following categories (as shown in Table 6); the full list of land use types is provided in Table 2 of the PPG (Ministry of Housing, Communities & Local Government, 2016):

Table 6 – Flood risk vulnerability classification (Ministry of Housing, Communities & Local Government, 2016)

Category	Example land use type
Essential infrastructure	Essential transport infrastructure; essential utility infrastructure; and wind turbines.
Highly Vulnerable	Emergency services stations; basement dwellings; and caravan and mobile homes.
More Vulnerable	Hospitals; residential institutions; and dwellings.
Less Vulnerable	Buildings used for shops; land and building used for agriculture and forestry; and water and sewage treatment works.
Water compatible	Flood control infrastructure; docks, marinas and wharves; and lifeguard and coastguard stations.

To identify the suitability of development within each Flood Zone, the following table (Table 7) should be consulted. This is taken from Table 3 of the PPG.

Table 7 - Flood risk vulnerability and Flood Zone 'compatibility' (Ministry of Housing, Communities & Local Government, 2016)

Flood Zone	Flood Risk Vulnerability Classification				
	Essential infrastructure	**Highly vulnerable**	**More vulnerable**	**Less vulnerable**	**Water compatible**
Zone 1	Yes	Yes	Yes	Yes	Yes
Zone 2	Yes	Exception Test required	Yes	Yes	Yes
Zone 3a	Exception Test required	No	Exception Test required	Yes	Yes
Zone 3b	Exception Test required	No	No	No	Yes

4.4. Exception Test

An Exception Test must be passed for specific types of development in certain Flood Zones as shown in Table 7 above. The NPPF (Ministry of Housing, Communities and Local Government, 2019) states that *"For the Exception Test to be passed it should be demonstrated that:*

1. *the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
2. *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."*

Evidence demonstrating a passed Exception Test should be included in site-specific FRAs where applicable. This information is also required for any developments allocated as part of the Emerging Local Plan.

More information on the application of the Exception Test in site-specific flood risk assessments can be found in Section 7.5

5. Flood risk in Slough

In recent years, the Slough Borough has experienced flooding from rivers (fluvial), surface water, groundwater and sewers, these are defined below in Table 8. The historical flooding that the Slough Borough has experienced is outlined in Section 0, and the current and future flood risk within the Slough Borough is outlined in Section 0. Section 5.5 provides more detailed information on the impact of Climate Change on the sources described in Table 8

Table 8 – Flood sources in SBC

Source	Definition
Fluvial	Exceedance of the flow capacity of river channels, leading to overtopping of the riverbanks and inundation of the surrounding land.
Surface water	Intense rainfall exceeds the available infiltration capacity and / or the drainage capacity leading to overland flows and surface water flooding.
Groundwater	Emergence of groundwater at the surface (and subsequent overland flows) or into subsurface voids as a result of abnormally high groundwater flows, the introduction of an obstruction to groundwater flow and / or the rebound of previously depressed groundwater levels.
Sewer	Exceedance of sewer capacity and / or blockages in the sewer network.
Other	Flooding from canals, reservoirs (breach or overtopping).

Climate change is expected to increase the risk of flooding across all sources in the future and is further discussed in Section 5.5.

5.1. Data collection

Data to inform this SFRA has been collected from multiple sources, shown in Table 9. This SFRA is a 'live' document; the documents and maps are to be updated when new data becomes available as appropriate. Data that is available to inform a site-specific FRA section is listed in Section 7.4.

Table 9 - Data sources

Data	Description	Format	Source
Main Rivers	Identification of the Main River network for which the Environment Agency are responsible for.	Geographic information systems (GIS) layer	Environment Agency
Detailed river network (DRN)	Identification of the river network including Main Rivers and Ordinary Watercourses for which the Environment Agency and SBC have regulatory powers.	GIS layer	
Flood Map for Planning (Rivers and Sea) Flood Zones 2 and 3	The Environment Agency's best estimate of the areas of land at risk of flooding from rivers or the sea, when the presence of flood defences is ignored.	GIS layer	

Data	Description	Format	Source
Risk of flooding from surface water (RoFSW)	The Environment Agency's RoFSW mapping output which shows the extent of flooding from surface water that could result from a flood with various probabilities. This dataset was previously known as the updated flood map for surface water (uFMfSW).	GIS layer	
Risk of flooding from reservoirs	A merged outline that shows the maximum flood extent for all reservoir flooding scenarios together.	WMS layer	
Light detection and ranging (LiDAR) digital terrain model (DTM)	Local topography information. Spatial resolution of 1 m, accuracy of ± 0.25 m.	Raster image	
Flood alert areas	Indicates which areas are covered by Environment Agency flood alerts.	GIS layer	
Flood warning areas	Indicates which areas are covered by Environment Agency flood warnings.	GIS layer	
Source Protection Zones (SPZs)	Zones which show the level of risk to the source from contamination.	GIS layer	
Historic flood extents	Historic flood extents as recorded by the Environment Agency	GIS layer	
Geology data	Bedrock and superficial geology.	WMS layer	BGS
Susceptibility to groundwater flooding	The potential for groundwater flooding to occur in an area.	GIS layer	
Fluvial catchment boundaries	Identifies the fluvial catchment boundaries.	GIS layer	FEH online
Historic flood risk information	SBC's record of properties and roads that have flooded historically.	Database	SBC
Flood asset location	SBC's record of flood risk assets.	GIS layer	
SBC administrative boundary	Defines the administrative area of SBC for mapping purposes.	GIS layer	
Ordnance Survey (OS) mapping	Provides background mapping to other GIS layers.	Raster image	OS

5.2. Historic flood risk

Historic flood risk information has been collated for the Slough Borough and shown in Figure 7 and Table 10.

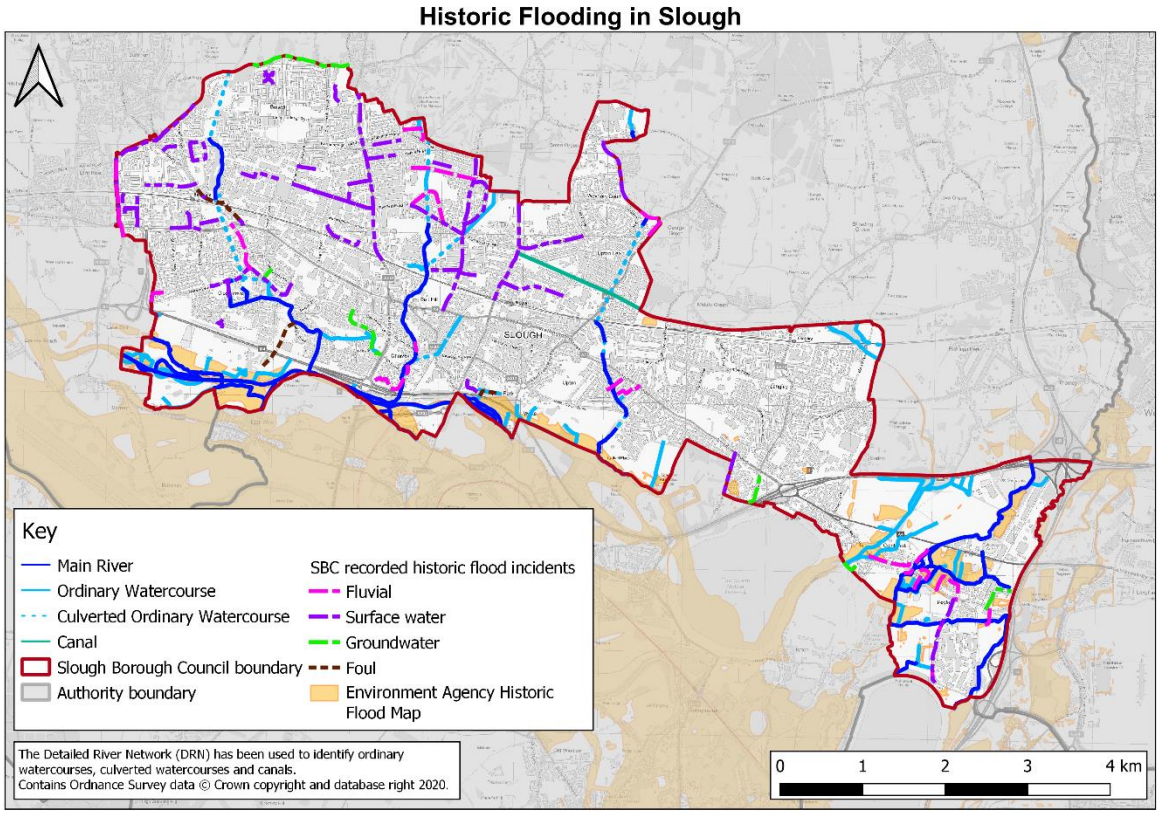

Figure 7 – Recorded Historic Flooding in the Slough Borough

See Appendix A for high resolution version of Figure 7.

Table 10 – Historic flood incidents in the Slough Borough

Year	Month	Flood type	Catchment	Area	Description of flood event taken from SBC records
2000 2001 2003	-	Fluvial	River Colne	Colnbrook and Poyle	Fluvial flooding in Colnbrook and Poyle.
2007	July	Surface Water	Chalvey Ditches Datchet Common Brook	Burnham, Stoke Road	Surface water flooding occurred in the Stoke Road and Burnham Lane (Five Points) area was a result of large volumes of surface flow from areas to the north in Buckinghamshire Council.
2008	August / September	Surface Water and Fluvial	Salt Hill Stream Huntercombe Lane Stream Chalvey Ditches Datchet Common Brook	Burnham, Manor Park, Slough Trading Estate, Cippenham	Heavy rainfall resulted in surface water and fluvial flooding. Roads flooded included Burnham Lane, Huntercombe lane, Westlands Ave Estate, Penn and Waterbeach Road, Ploughlees Lane and Essex and Warwick Avenues. Other areas flooded are shown in Figure 7
2009	May	Fluvial	River Colne	Poyle Channel	Developer lowered a flood bank along the Poyle Channel which enabled fluvial water to flood Poyle Road, Golden Cross public house and the gardens along Poyle New Cottages road.
2011	July	Fluvial	Huntercombe Lane Stream	Cippenham	Root ingress in the culvert, which reduced hydraulic capacity, and sewer surcharge resulted in surface flooding underneath a rail bridge on Huntercombe Lane South and properties south of the A4.
2012	January	Fluvial	Salt Hill Stream	Manor Park	High water levels in the Stoke Poges Reservoir resulted in the spillway activating and flooding on Penn Road.

Year	Month	Flood type	Catchment	Area	Description of flood event taken from SBC records
	December	Foul	The Myrke	Winvale / Herschel Park	Foul flooding backing up in ditch to south of Herschel Park.
	December	Foul	Chalvey Ditches	Burnham	Foul flooding from Wood Lane to the Burnham area.
	December	Surface Water	Huntercombe Lane Stream	Cippenham	Surface water flooding in gardens at Moundsfield Way
	December	Fluvial	Salt Hill Stream	Manor Park	Fluvial flooding as a result of heavy rainfall and partially blocked trash screens. Flooding at Penn Road, Granville Avenue and Waterbeach Road.
2014	January	Foul	The Myrke	Winvale / Herschel Park	Foul flooding backing up in ditches and nearby watercourse.
	February	Fluvial	River Colne Horton Brook	Colnbrook	Heavy rainfall in Colnbrook flooded residential areas including Coleridge Crescent, Albany Park, Mill Street, Rudsworth Close, Cottesbrooke Close, Colnbrook High Street and the A4. See Section 5.2.1 below for more information on this flood incident.
	July	Surface Water	Datchet Common Brook	Slough Centre	Blocked surface water sewers resulted in sewer water flooding along the Shaggy Calf Lane.
2015	July	Fluvial	Salt Hill Stream	Chalvey	Fluvial flooding in the Newbery Way area as a result of heavy rainfall and partially blocked trash screens.
	August	Surface Water	Chalvey Ditches Salt Hill Stream	Slough Trading Estate / Manor Park	A failed Thames Water surface water pump station and collapsed storm overflow pipe caused by recent utility works in combination with a high volume of surface water runoff resulted in surface water flooding at Edinburgh Avenue and Farnburn Avenue Road.

Year	Month	Flood type	Catchment	Area	Description of flood event taken from SBC records
					See Section 5.2.1 below for more information on this flood incident.
2016	May	Surface Water	Chalvey Ditches	Slough Trading Estate / Manor Park	Heavy rainfall resulted in a flooding along Berwick Avenue.
		Surface Water	Chalvey Ditches Salt Hill Stream	Slough Trading Estate / Manor Park	Heavily silted surface sewers resulted in the flooding of Winvale Road and Edinburgh Avenue affecting several properties.
		Surface Water	Huntercombe Lane Stream	Burnham Park / Lent	Severe ponding under the railway bridge on Huntercombe Lane North.
		Surface water	River Colne	Poyle	Drainage overload of the highway drainage system flooded Galleymead Road, car parks and surrounding pathways.
		Surface Water	River Colne	Poyle	Blocked outfalls due to an unmaintained slip road resulting in flooding on Poyle Road.
		Surface Water	Chalvey Ditches	Cippenham	Surface flooding along Millstream Lane
	June	Foul	The Myrke	Herschel Park Winvale	Foul flooding as a result of a failed Thames Water pumping station, heavy rainfall and resulting flash floods.
		Surface Water	Datchet Common Brook	Ditton Park	Blocked ditch resulted in property flooding along Ditton Park Road
2018	-	Fluvial	Datchet Common Brook	Upton	Blockage of watercourse resulted in property flooding along Hurworth Avenue and St. Bernards Road.

5.2.1. Section 19 reports

As outlined in Section 3.4.5. two section 19 reports have been published by SBC reporting on flood events that occurred in Colnbrook in 2014 and Edinburgh Avenue in 2015.

Colnbrook flooding - February 2014 (Slough Borough Council, 2015)

The Colnbrook flooding incident occurred in January and February 2014. Internal flooding was officially reported at 14 properties, and it is estimated up to 67 properties could have suffered from internal flooding. There were four main areas of flooding:

- Internal flooding of properties in Coleridge Crescent and the adjoining Closes. The flooding was predominantly caused by groundwater;
- Fluvial flooding from the Cottersbrook Ditch (fed by County Ditch) of The Albany Park area;
- Internal flooding of properties in Cottersbrook Close was predominantly caused by groundwater; and
- Fluvial flooding from the Colne Brook along Mill Street. However, one incident of ground water flooding was reported in the area.

The flood event was caused by prolonged rainfall in January and February 2014 which saturated the catchment and raised already high groundwater levels and river levels.

Edinburgh Avenue - 26th August 2015 flood event (Slough Borough Council, 2016)

The Edinburgh Avenue flooding incident occurred on 26th August 2015 causing the closure of Edinburgh Avenue and inundation of Farnburn Avenue from surface water flooding. Flooding in this area was exacerbated by:

- A failed Thames Water surface water only pumping station;
- A collapsed storm overflow pipe caused by recent utility works;
- Blocked highway drains / gullies; and
- A high volume of surface water runoff from nearby buildings and carparks.

More information on both flood events can be found in the Section 19 reports.

5.2.2. Additional historic information

The following sections outline additional historic information for the Slough Borough. These have not been included in the table above due to limited knowledge on the flood events, but are included in Figure 7.

5.2.2.1. Fluvial flooding

Fluvial flooding in the Slough Borough has been recorded since 1947, in which Chalvey, the Myrke and Langley areas flooded. In addition to this and the historic fluvial water flood incidents recorded in Table 10, the following areas are known to SBC as where fluvial water flooding is known to have occurred:

- The area of Wexham Court near the junction of Church Lane and the Uxbridge Road has experienced flooding in the late 1980's/early 1990's; it is thought that this was due to the flow in the Horton Brook flowing across catchment boundaries, possibly as a result of blockages under the A412 Uxbridge Road;
- Spackmans Way area as a result of the backing up of Salt Hill Stream; and
- West Point as a result of Huntercombe Lane Stream backing up.

5.2.2.2. Surface water

In addition to the historic surface water flood incidents recorded in Table 10, the following areas are known to SBC as where surface water flooding is known to have occurred:

- Cocksherd Wood area (combined with groundwater flooding);
- Beechwood School area;
- Bath Road/Kelpatrick Road;
- Bryant Avenue (west of roundabout);
- Banbury Avenue;
- Spackmans Way;
- Oatlands Avenue/Stoke Poges Lane; and
- Church Lane east of Wexham Road and in the area of Wexham Court Primary School.

5.2.2.3. Groundwater

Much of Colnbrook and Poyle is prone to groundwater flooding and SBC is aware of groundwater flooding around Popes Close and Galleymead Road. There has also been evidence of groundwater flooding arising from spring lines in the Wexham and Beechwood School areas, and by Cocksherd Wood, as well as along the toe of the upper terrace, in a line from Spring Lane, watercress beds off Keel drive, Herschel Park pond, and the Marriot Hotel in Langley which stands on former watercress beds. In addition to these, the following areas are also known to SBC as where groundwater flooding is known to have occurred in Farnham Lane, Spring Lane and Keel Drive.

5.2.2.4. Sewer flooding

Thames Water have been contacted regarding historic sewer flooding; Historic flood incidents recorded on their DG5 register are shown by post code area in Figure 8. Figure 7 and Table 10 include areas of historic sewer flooding from SBC records.

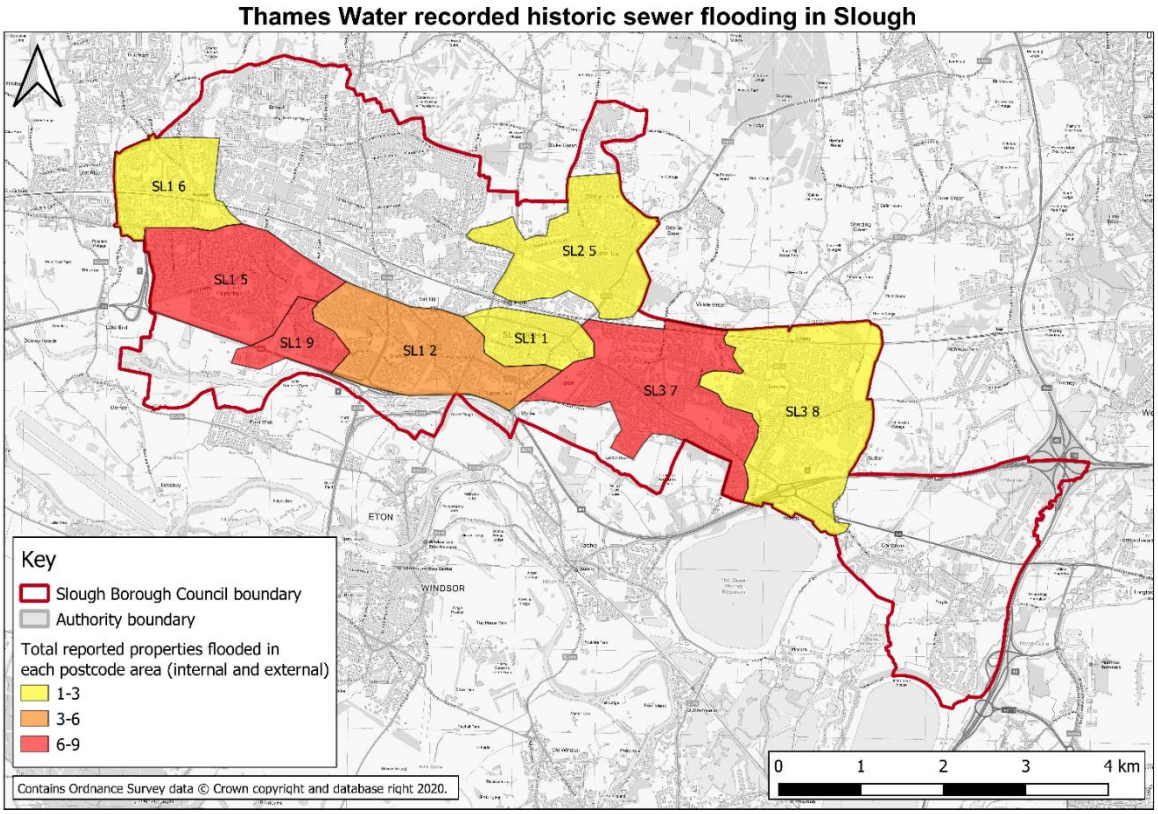

Figure 8 – Thames Water recorded historic sewer flooding in the Slough Borough

See Appendix A for high resolution version of Figure 8

5.3. Present day flood risk

An overview of each source of current and future flood risk is given in this section.

5.3.1. Fluvial flood risk

As detailed in Section 0 above, this SFRA uses the Environment Agency flood maps for planning (rivers and sea) to outline the flood risk from rivers in the Slough Borough. Flooding from the sea is not included in this SFRA as it does not affect the Slough Borough. The tidal limit of the River Thames is at Teddington Locks, this is 33 km downstream of the SBC administrative boundary.

Figure 9 and Figure 10 show the Environment Agency flood zones for the Slough Borough. The majority of land within the Slough Borough is located within areas that have a low risk of fluvial flooding (Flood Zone 1).

Approximately 15% of the Slough Borough area is located within areas that as a medium or high probability of fluvial flooding (Flood Zones 2 (Environment Agency, 2020 g) and 3 (Environment Agency, 2020 h)). These are associated with the watercourses running north/south through the Slough Borough including Huntercombe Lane Stream, Chalvey Ditches, Salt Hill Stream, Datchet Common Brook, Horton Brook, Colne Brook, the Poyle Channel and Wraysbury River. These watercourses are located within urban catchments, and some receive a high level of runoff from London Clay to the north in Buckinghamshire Council. Therefore, the river catchments are particularly susceptible to flash flooding as a result of localised intense rainfall.

There are several flood defences in the area, and the areas they protect are shown in Figure 9 and Figure 10 as areas benefitting from defences (Environment Agency, 2020 f). The residual risk of flooding or the areas at risk should defences fail, is discussed in Section 5.4. Areas benefitting from defences are accounted for in the Environment Agency long term flood risk mapping. While flood defences reduce the risk of flooding, a residual risk remains. Therefore, for planning purposes, the Environment Agency flood zones (flood maps for planning) are the primary source of fluvial flood risk information.

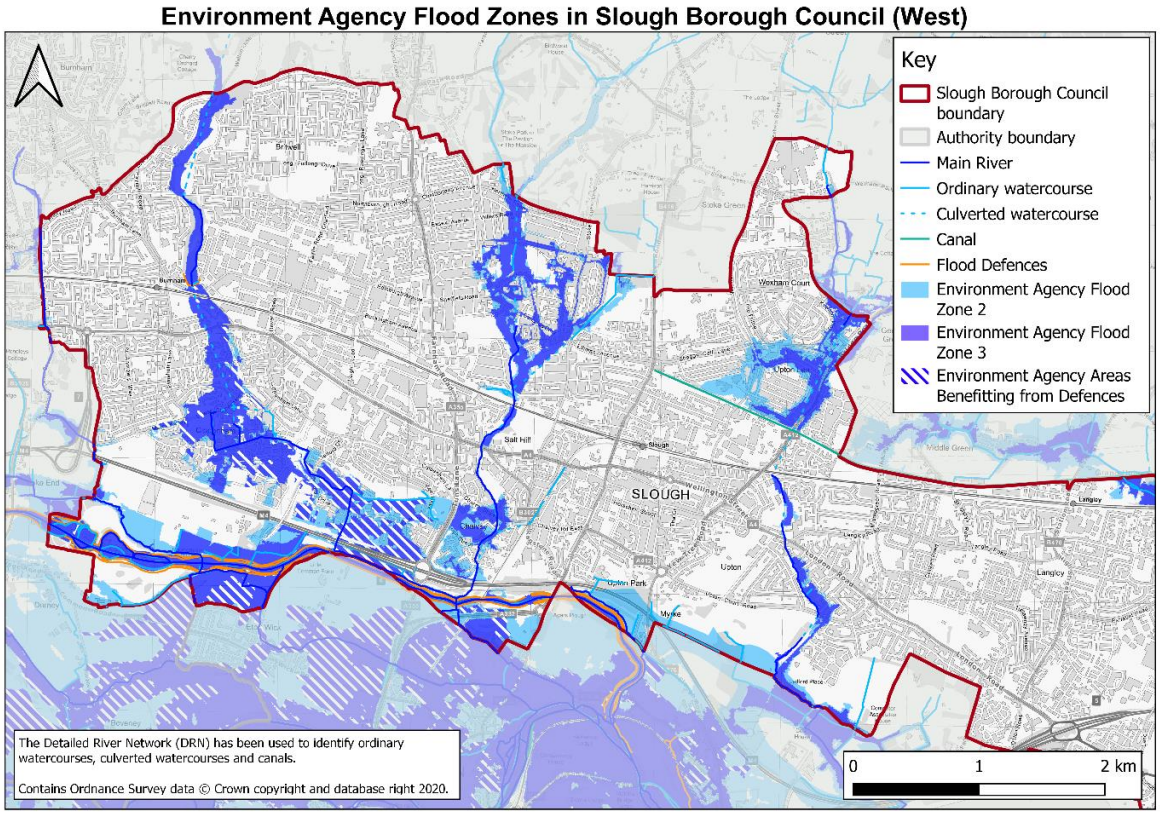

Figure 9 - Environment Agency Flood Zones in Slough Borough Council (West)

See Appendix A for high resolution version of Figure 9.

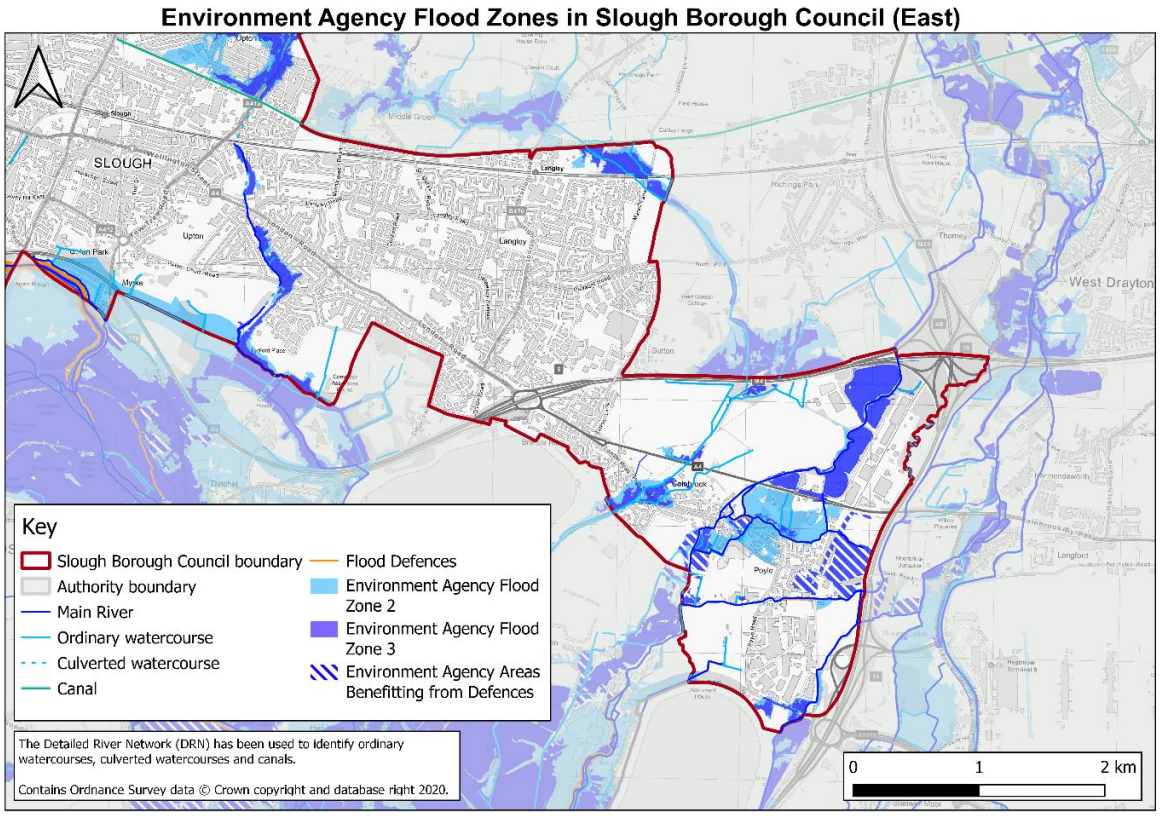

Figure 10 - Environment Agency Flood Zones in Slough Borough Council (East)

See Appendix A for high resolution version of Figure 10.

5.3.1.1. Flood Zone 3b

Fluvial Flood Zones (as outlined in Table 5) have been defined following the NPPF guidance. Flood Zones 1, 2 and 3a follow the same criteria as the Environment Agency flood map for planning (from rivers and sea) and therefore are defined as in Table 5.

Flood Zone 3b is defined as land where water has to flow or be stored in times of flood. This is to be identified in the SFRA, in agreement with the Environment Agency. The PPG (Ministry of Housing, Communities & Local Government, 2016) states that:

"the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration and discussions to identify the functional floodplain."

In the Slough Borough, the functional floodplain (Flood Zone 3b) is shown in Figure 11 and Figure 12 (high resolution figure in Appendix A). This is constructed from two datasets:

- Defined Flood Zone 3b: Modelled 5% (1 in 20 year) AP extents from the Environment Agency for the Lower Colne and the Colnbrook. These outlines take into account local circumstances and defences.
- Proxy Flood Zone 3b: The Flood Zone 3b is only defined for the for the Lower Colne and the Colnbrook. Therefore, the Environment Agency Flood Zone 3a has been used as a proxy for Flood Zone 3b for the rest of Slough Borough.

As further modelling is undertaken for the Slough Borough (as outlined in Section 6.2) this section will be updated to define further areas of Flood Zone 3b.

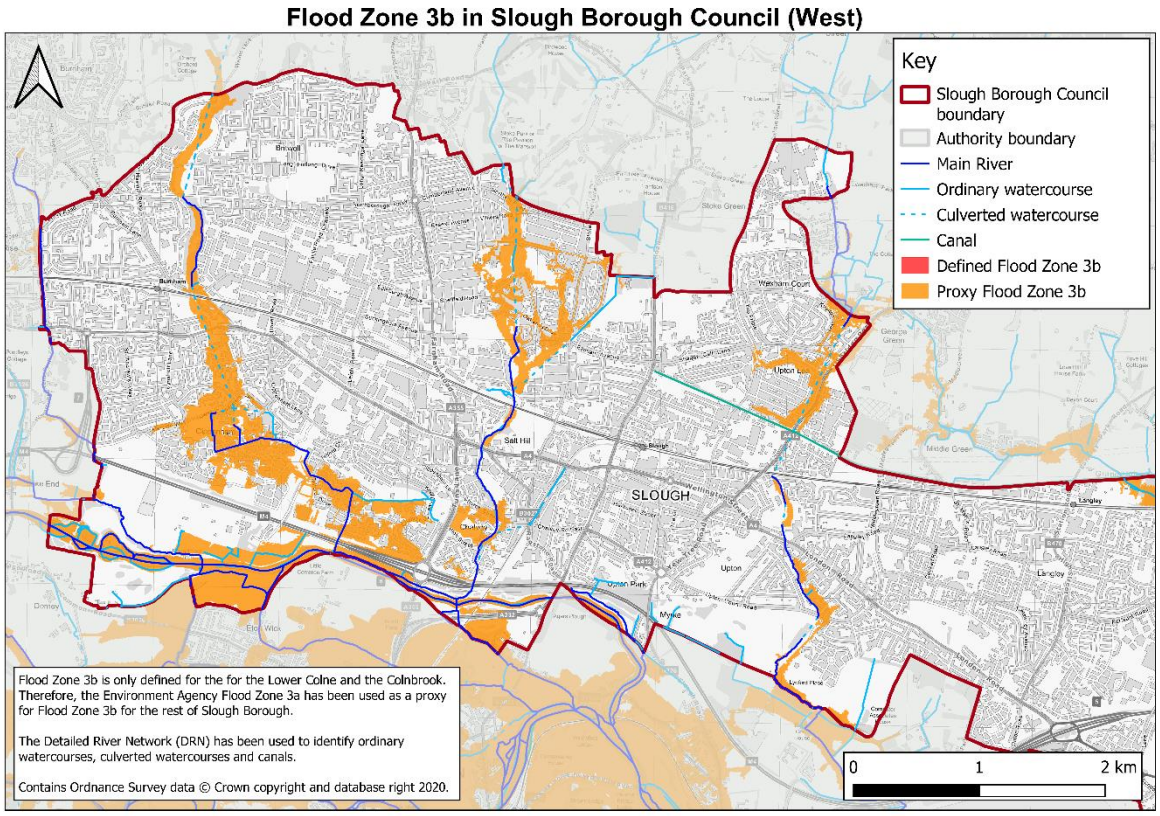

Figure 11 - Flood Zone 3b delineation in Slough Borough Council (West)

See Appendix A for high resolution version of Figure 11.

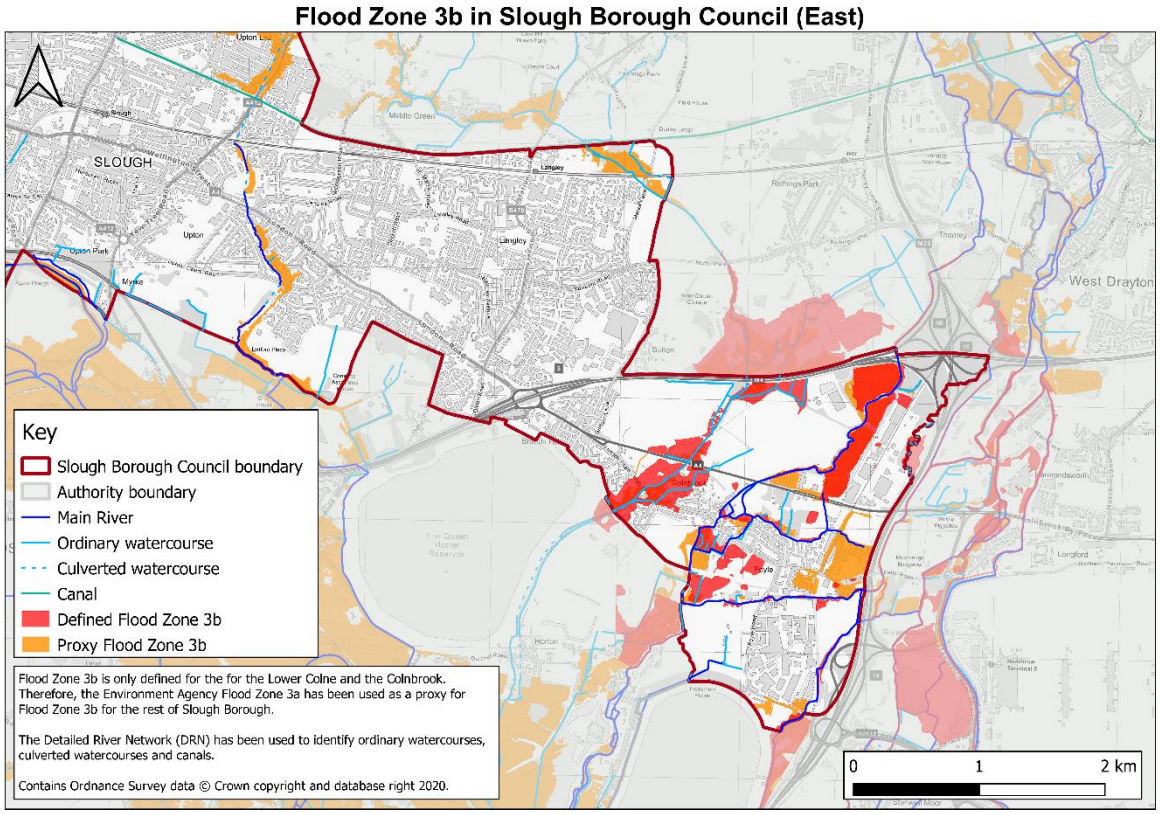

Figure 12 - Flood Zone 3b delineation in Slough Borough Council (East)

See Appendix A for high resolution version of Figure 12.

5.3.2. Surface water flood risk

The Environment Agency RoFSW maps have been used to define surface water flood risk in the Slough Borough and are shown in Figure 13 and Figure 14. The RoFSW mapping classifies areas at risk of surface water flood risk as:

- High: 3.33% AP (1 in 30 year) (Environment Agency, 2020 c);
- Medium: 1% AP (1 in 100 year) (Environment Agency, 2020 d); and
- Low: 0.1% AP (1 in 1,000 year) (Environment Agency, 2020 e).

There are areas of low, medium and high RoFSW across the Slough Borough. Drainage should, therefore, be a high priority for all new developments. More information is provided in Section 8.

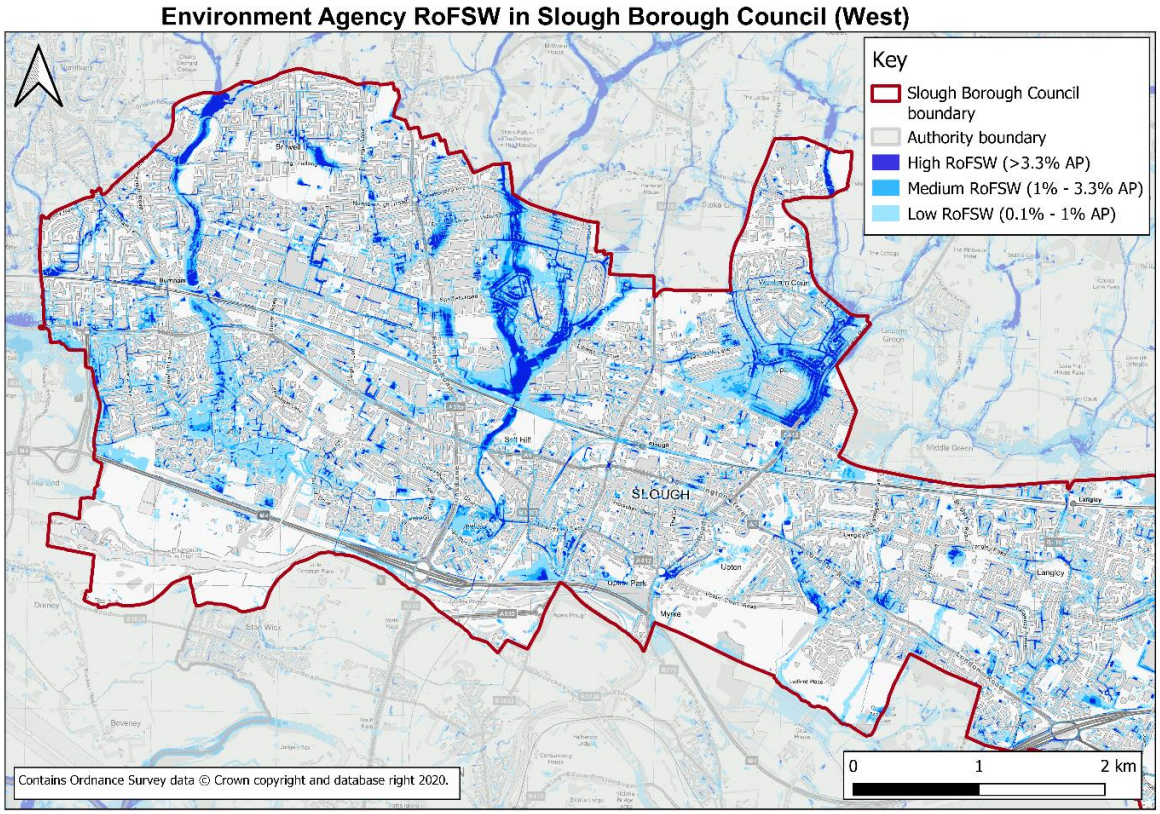

Figure 13 - Environment Agency RoFSW in Slough Borough Council (West)

See Appendix A for high resolution version of Figure 13.

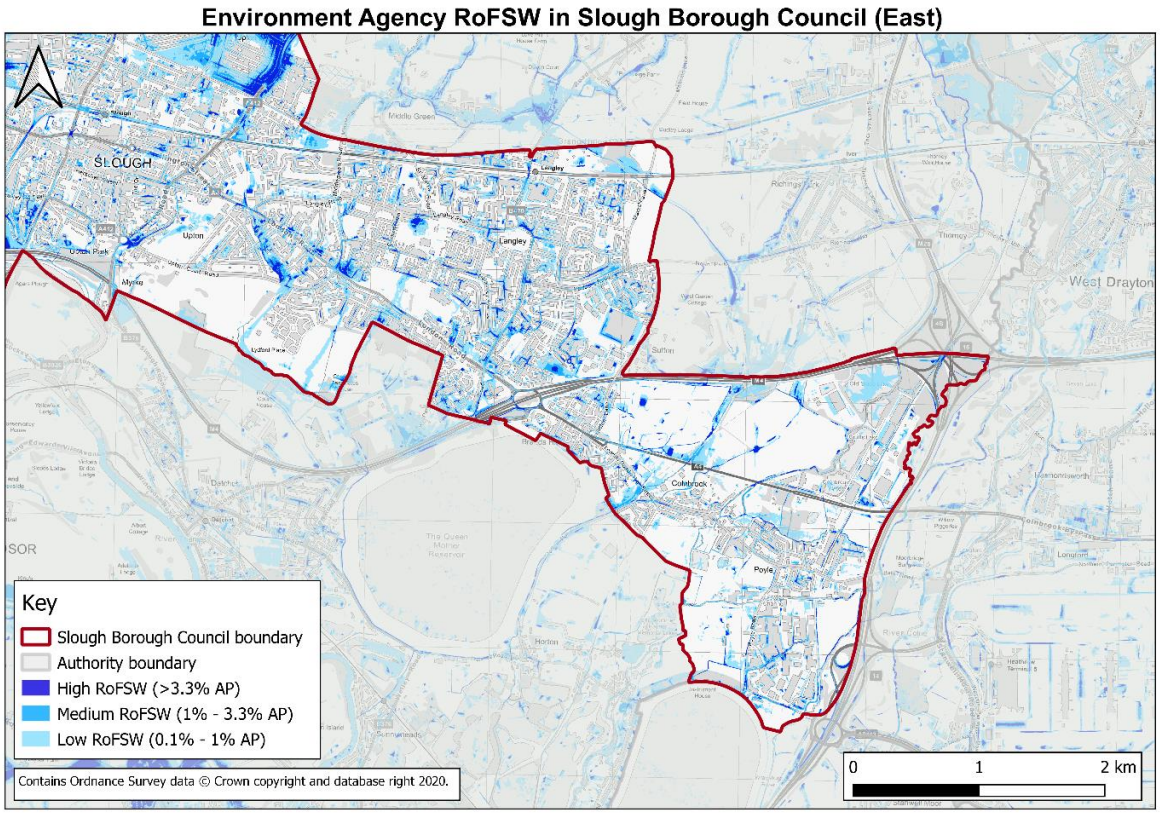

Figure 14 - Environment Agency RoFSW in Slough Borough Council (East)

See Appendix A for high resolution version of Figure 14.

5.3.2.1. Critical Drainage Areas

Current PPG (Ministry of Housing, Communities & Local Government, 2016) guidance states that a FRA is required in Flood Zone 1 in areas with critical drainage problems as notified by the Environment Agency.

The Environment Agency has not defined critical drainage areas (CDAs) for the Slough Borough area. If the Environment Agency were to define CDAs for the Slough Borough, this section will be updated to use the data provided.

Due to the potential impact of not defining areas that would need to undertake a FRA to consider drainage in detail, CDAs have been defined in this SFRA by SBC and thereby work to reduce the likelihood of development causing further drainage issues across the Slough Borough.

CDAs have been defined through the combined assessment of historical surface water flooding records and the Environment Agency RoFSW mapping.

The CDAs are shown in Figure 15 and Figure 16. As shown, there are areas where drainage needs to be considered in greater detail throughout the Slough Borough.

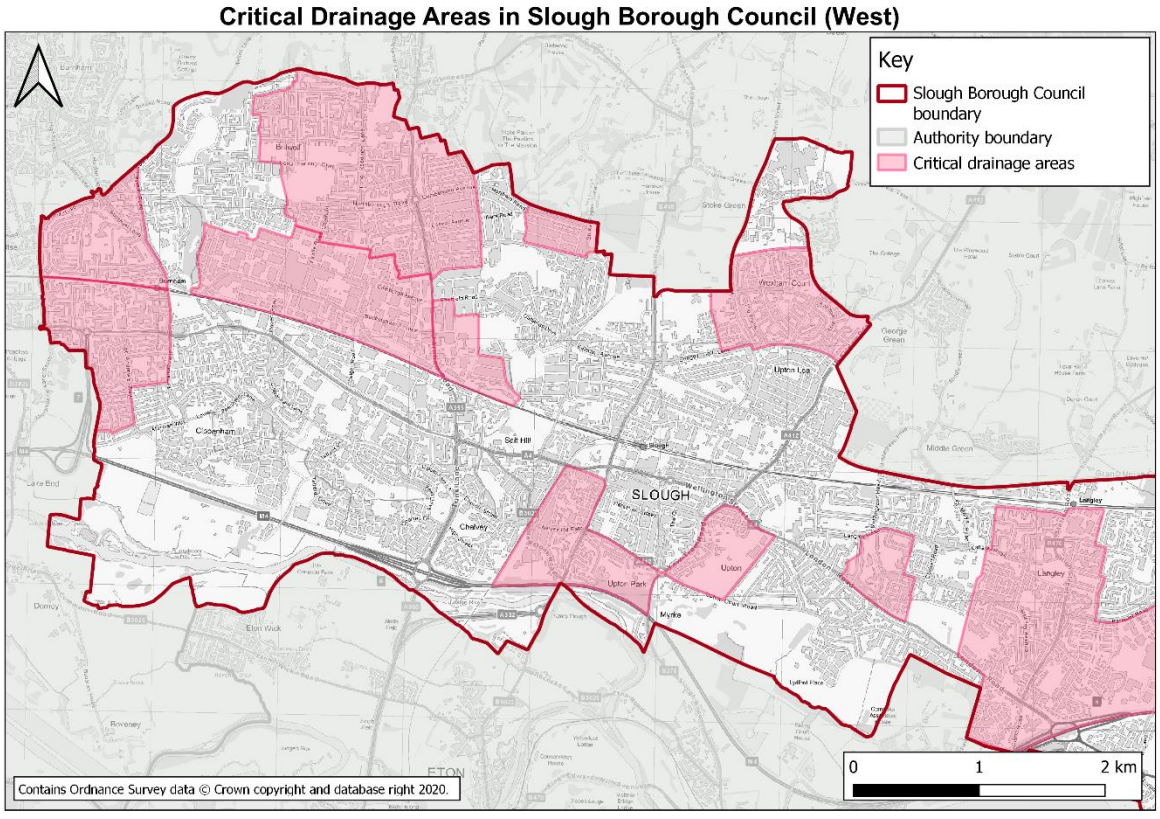

Figure 15 – CDAs in Slough Borough Council (West)

See Appendix A for high resolution version of Figure 15.

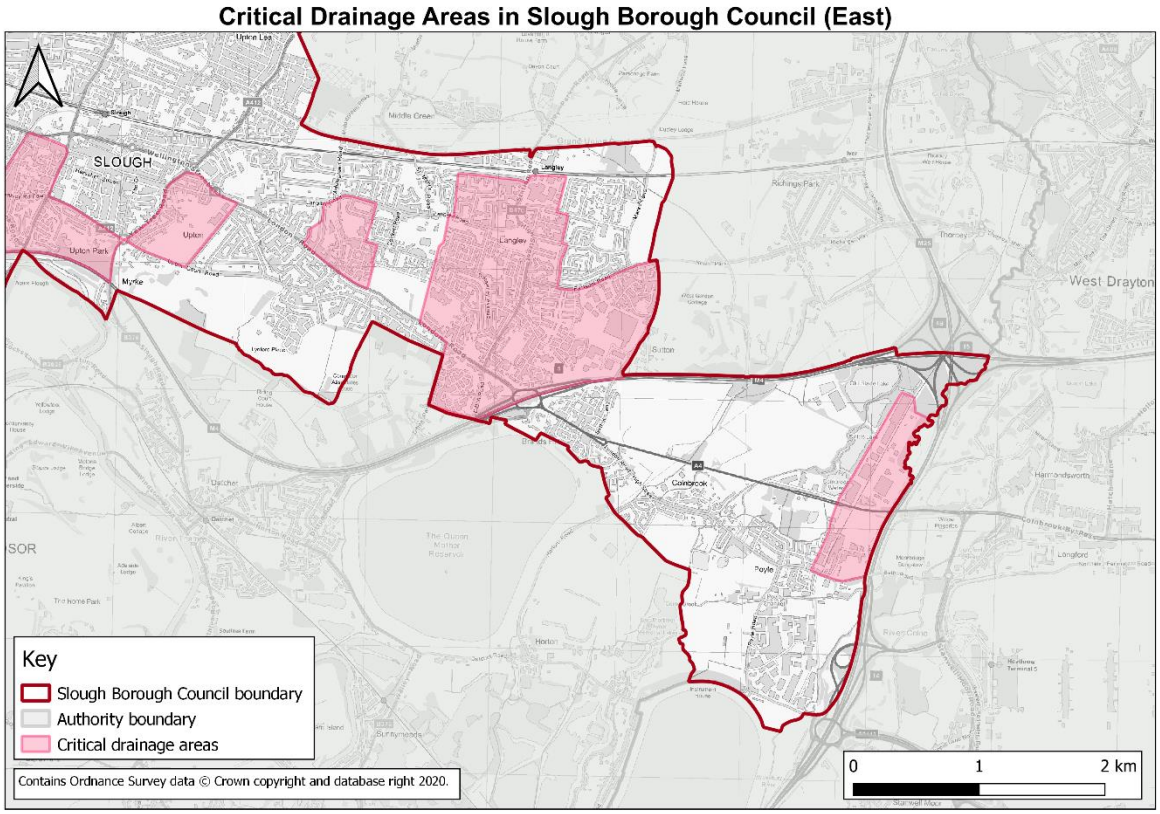

Figure 16 - CDAs in Slough Borough Council (East)

See Appendix A for high resolution version of Figure 16.

5.3.3. Groundwater flood risk

The BGS susceptibility to groundwater flooding mapping has been used to define groundwater flood risk in the Slough Borough and are shown in Figure 17. Based on two conceptual models, a GIS rule-based approach was used by the BGS to map the groundwater flooding susceptibility (British Geological Survey, 2020). The susceptibility to groundwater flooding mapping classifies areas at risk of groundwater flood risk as:

- A: Limited potential for groundwater flooding to occur;
- B: Potential for groundwater flooding of property situated below ground level; and
- C: Potential for groundwater flooding to occur at surface.

There are large areas of the Slough Borough susceptible to groundwater flooding, with almost half of the Slough Borough identified with the “potential for groundwater flooding to occur at surface”.

In the area of the lower terrace (as described in Section 2.3), the groundwater level is influenced by the permeability of the bedrock in conjunction with the River Thames, and is therefore relatively high, between one to two metres below the surface. The whole area of Colnbrook and Poyle is prone to groundwater flooding. Groundwater is also high where impermeable clay forms a perched water table, this can also result in groundwater flooding.

Groundwater flows can also be altered, as has occurred in the Colnbrook and Poyle area, by the backfilling with waste of sites excavated for sand and gravel. Groundwater flows have also been partially or completely blocked as a result of new development, such as the Queen Mother and Wraysbury reservoirs, or the Thames Water’s Iver South Sludge Treatment Works, thereby increasing the local rate of flow and level of groundwater.

It is essential that future development does not exacerbate this problem. Furthermore, close consultation will be required with adjoining local planning authorities to ensure that developments within their boundaries do not adversely affect groundwater flows into or out of the Slough Borough.

High groundwater levels can also impact the use of SuDS; these constraints are outlined in Section 8.2.

The Environment Agency has now assumed a strategic overview role for monitoring groundwater flooding, and will be improving the collation of records, together with the assessment and monitoring of problems associated with groundwater flooding.

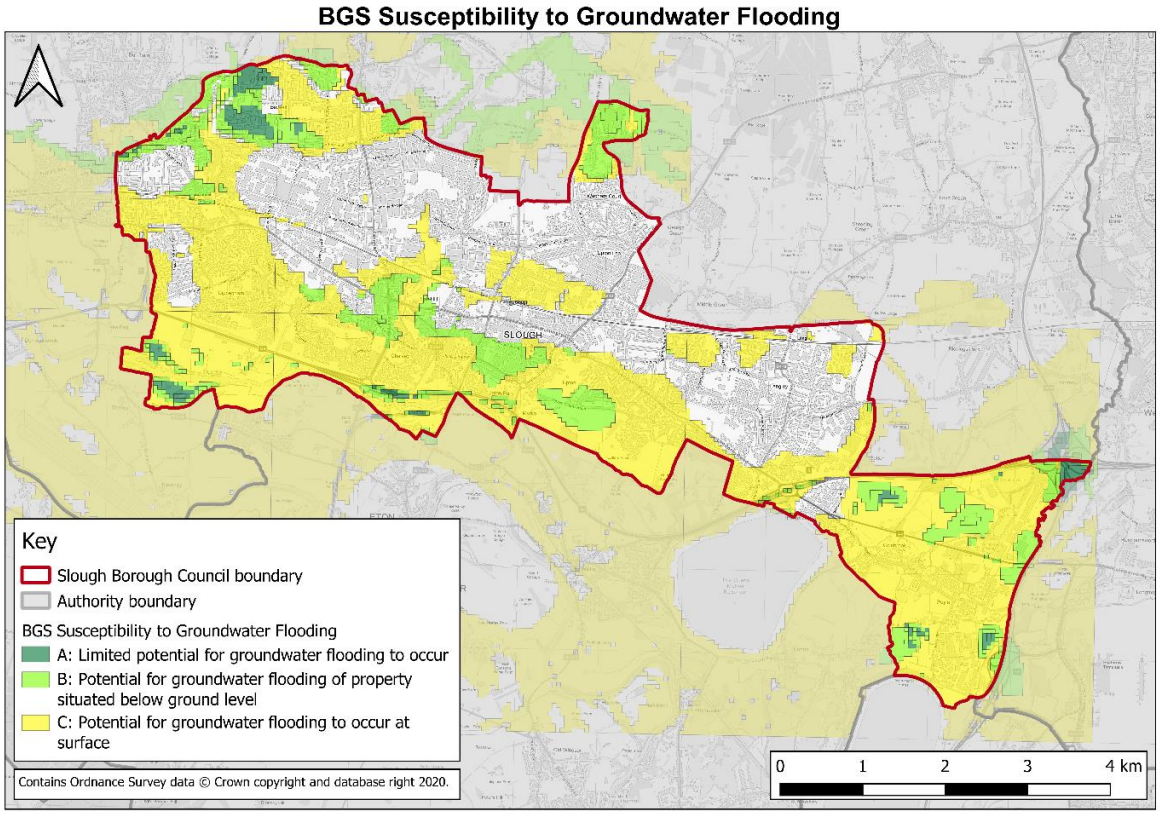

Figure 17 - BGS Susceptibility to Groundwater Flooding

See Appendix A for high resolution version of Figure 17.

5.3.4. Sewer flood risk

5.3.4.1. Surface water sewers

Surface water sewers in the Slough Borough are owned and managed by Thames Water. Prior to 1974, the Council had a strategy which involved integrating the system of watercourses and sewers; following the formation of the water companies, work on this system ceased. The legacy of this approach is that many culverted watercourses are now mapped as public surface water sewers, which Thame Water disputes.

Since 1980, the Sewers for Adoption (WRc plc, 2013) guidelines have ensured that most new surface water sewers are designed to the 3.3% (1 in 30) AP flood event. Until relatively recently, this did not apply to small private systems. Where sewers are built to this specification, they are likely to be overwhelmed in events less frequent than the 3.3% (1 in 30) AP flood event. Existing sewers also can become overwhelmed when new development

increases flow into the sewer or due to an increase in impermeable area within the catchment.

Water companies are required to maintain a register of properties which are at risk of sewer flooding, this is called the DG5 register. This SFRA will be updated if this information is provided by Thames Water and when appropriate. There are known problems of sewer flooding, but this is limited in geographical area and is generally associated with storm events when the sewer system is surcharged with surface water run-off.

There is a finite capacity of the surface water sewers in the Slough Borough therefore new development must provide infiltration and attenuation of surface water runoff where applicable. It is important that surface water runoff from any developments does also not drain onto the highway.

It should be noted that there are no surface water sewers in the Colnbrook and Poyle area to the east of Springfield Road. These areas, which were formerly within Buckinghamshire Council and Spelthorne Borough Councils until 1995, are drained where possible via soakaways.

5.3.4.2. Foul water sewers

The foul sewers are also owned and maintained by Thames Water. Foul sewer flooding is generally associated with storm events when the sewer system is surcharged with surface water in excess of its capacity rather than foul sewerage overload. This problem is exacerbated by factors such as illegal domestic connections of roof/surface water drainage to foul sewers, known hydrological incapacity in the foul sewer system, and the lack of storm balance.

In storm events, there are pinch points at two pumping stations which have resulted in the foul sewers surcharging in low spots within Ditton Park (James Meadow/Parsons Road) and Winvale. Other areas where there has been foul sewer flooding include Bath Road/Huntercombe Lane, Slough Estates, (Perth Avenue/Edinburgh Road), Long Readings Lane, Slough Cricket Club pitch, and Dashwood Close/Upton Court Road.

In most of Poyle and some of Colnbrook, there is the problem of infiltration of groundwater into the foul sewers which affects capacity and increases the likelihood of foul sewer flooding.

There is a finite capacity of the foul water sewers in the Slough Borough and there is also a constraint on the wastewater treatment capacity at Slough STW in that, the receiving watercourse - the Roundmoor and Boveney Ditch are already a flood risk and have no capacity for additional discharge. Therefore, proposals for new development must involve consultation with Thames Water to ensure there is capacity within the network for any increase in foul flow or volume from the development site.

5.3.5. Reservoir flood risk

There are two reservoirs whose failure would have a drastic impact on the Slough Borough:

- Queen Mother Reservoir (Royal Borough of Windsor and Maidenhead); and
- Wraysbury Reservoirs (Spelthorne District Council, Surrey County Council).

There are two additional reservoirs in the Slough Borough; the Stoke Podges Reservoir and the Haymill Reservoir, these are much smaller reservoirs; neither reservoir retains deep water nor is full except in a storm event but would have a capacity greater than 25,000 m^3 when full. The Environment Agency is responsible for the Haymill Reservoir, while SBC is responsible for the Stoke Podges reservoir.

In October 2004, the Environment Agency took over responsibility for assuring the safety of the 2000 reservoirs by enforcing the Reservoirs Act 1975. The purpose of the Act is to prevent escapes of water from large raised reservoirs (such as the Queen Mother and Wraysbury Reservoirs). The Environment Agency aims to bring a more coherent and uniform approach for ensuring reservoirs are operated safely and are properly managed. They are responsible for:

- maintaining a register of reservoirs;
- making sure that undertakers have their reservoirs regularly inspected by Inspecting Engineers;
- making sure that undertakers appoint a Supervising Engineer for each of their reservoirs; and
- enforcing the act by making sure undertakers fully comply.

The Water Act 2003 amended the Reservoirs Act 1975 and introduced a requirement for reservoir undertakers to prepare reservoir flood plans on-site and off-site. It is important that arrangements are in place so that emergency services can respond effectively in an emergency, which, at worst, could lead to flooding following an uncontrolled release of water from a reservoir.

A reservoir flood plan includes:

- an inundation analysis to identify the extent and severity of flooding which could result from an uncontrolled release of water;
- an on-site plan setting out what the undertaker would do in an emergency to try to contain and limit the effects of the incident; and
- an off-site communications plan with external organisations, mainly the emergency services.

In response to the Pitt report, Defra agreed to fund the initial production of the inundation maps for all reservoirs under the Reservoirs Act 1975 in England and Wales. The maximum extent of flooding in the Slough Borough if the reservoirs were to fail is shown in Figure 18 and Figure 19. These maps indicate the widespread inundation of the Slough Borough if the reservoirs were to fail.

The 2012 SFRA reported: *“There has been public concern following the failure of Thames Water’s feed pipe from the River Thames to the Queen Mother reservoir which resulted in a number of houses in the Datchet area being flooded. There are other feed pipes in the Colnbrook and Poyle area; the risk factor of another such failure cannot be determined by this study but is considered to be relatively low. Development in Colnbrook and Poyle is already constrained by the extent of Flood Zone 2 and 3, and by the risk of groundwater flooding.”*

However, the risk of failure these reservoirs is considered to be extremely low owing to the strict maintenance and inspection regime enforced by law and therefore should not be regarded as an issue to constrain development in the Slough Borough. Furthermore, these areas at risk generally follow areas of fluvial flooding and hence mitigation for fluvial flood risk would also largely mitigate the very low risk from reservoir flooding.

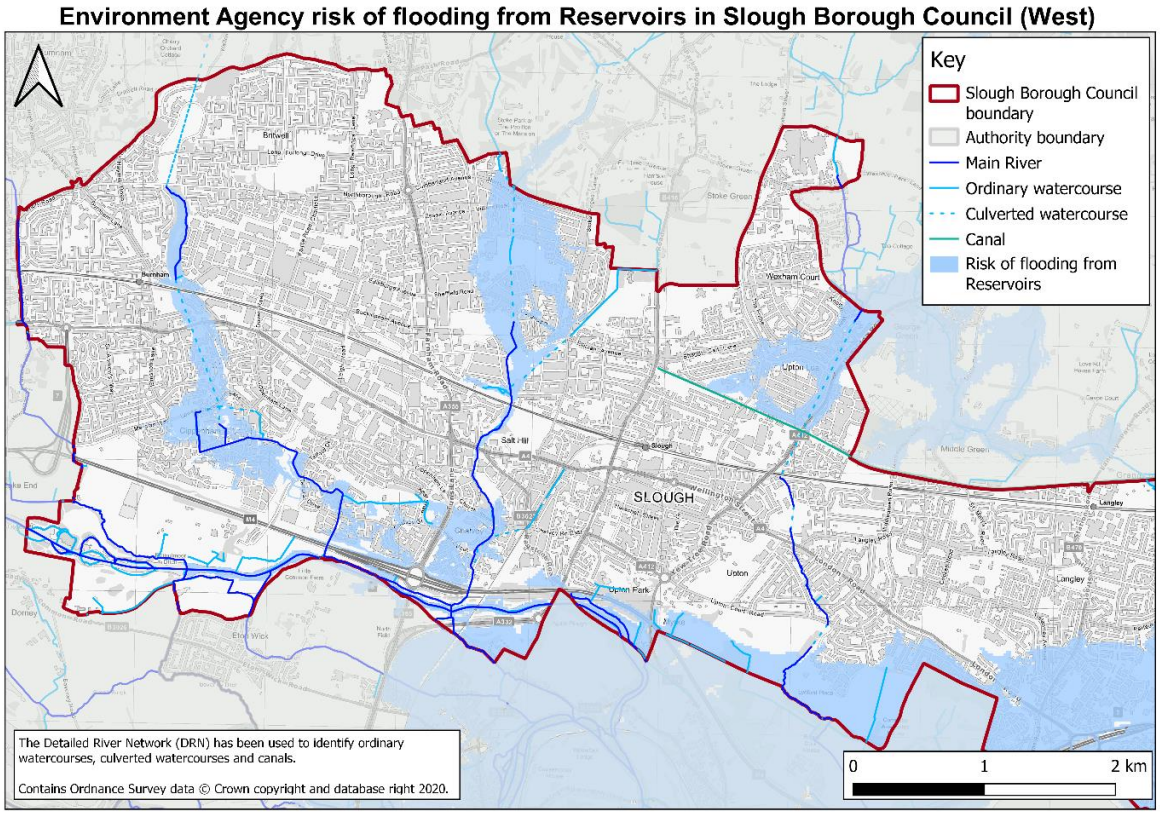

Figure 18 - Environment Agency Risk of Flooding from Reservoirs in Slough Borough Council (West)

See Appendix A for high resolution version of Figure 18.

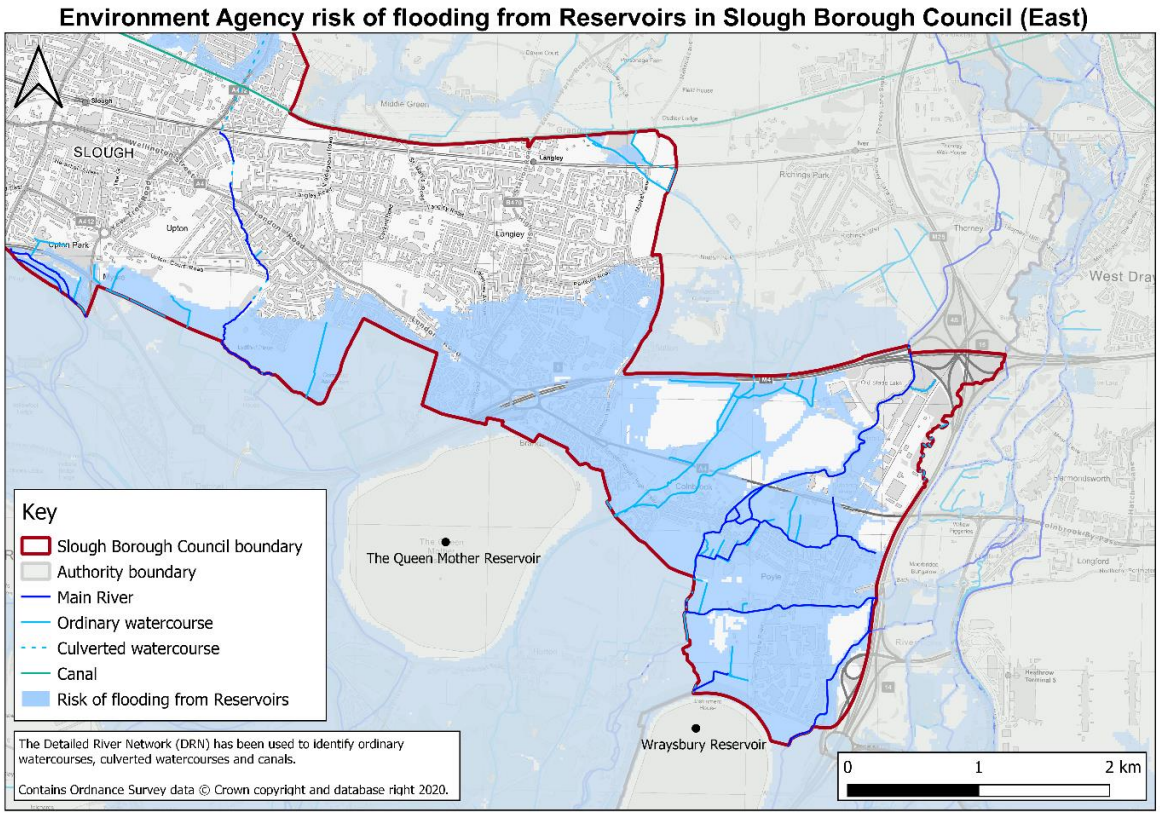

Figure 19 - Environment Agency Risk of Flooding from Reservoirs in Slough Borough Council (East)

See Appendix A for high resolution version of Figure 19.

5.4. Flood defences

Formal flood defences in the Slough Borough include the Jubilee River (and subsequent improvements to the Jubilee River scheme) as flood alleviation for the Lower Thames. The Myrke and the two flood alleviations schemes for the Lower Colne were carried out in the mid 1990's and in 2005. These flood defence schemes are discussed in the following subsections.

Figure 20 below shows the Environment Agency Flood Defences as well as flood assets within the Slough Borough. SBC do not have responsibility of all assets shown on the map.

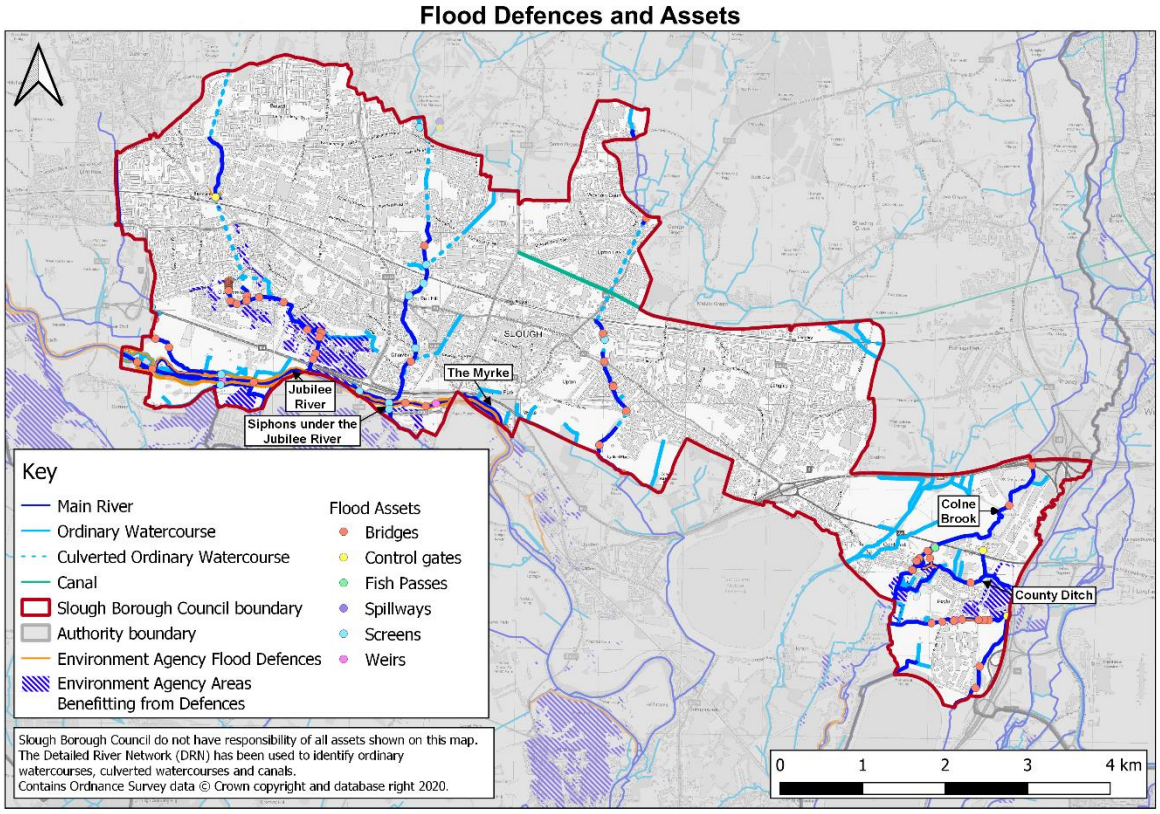

Figure 20 - Flood defences and assets

See Appendix A for high resolution version of Figure 20.

5.4.1. Jubilee River

The purpose of the Jubilee River, which is a man-made channel forming a major part of the Maidenhead, Windsor and Eton Flood Alleviation Scheme, is to provide additional flow capacity and balancing of peak flows for the Maidenhead/Windsor reach of the Thames. The flow into the Jubilee River from the River Thames is controlled by sluice gates at Taplow. The scheme was opened in 2002.

5.4.2. Siphons under the Jubilee River

The Chalvey Ditch and Salt Hill Stream flow under the M4 in large culverts and then under the Jubilee River in a siphon. The areas of the Slough Borough upstream do not flood directly from the River Thames or Jubilee River but rather from the tributaries flowing into them.

It is important to understand the impacts that the screens and siphon under the Jubilee River have on flow and subsequent flooding upstream. The blockage of these screens from trash

was modelled in the Chalvey Ditches work, JBA, 2010. The 2012 SFRA reported on this work and concluded the following:

"This work indicated that blockage on one or other of the screens from the Chalvey Ditch and/or the Salt Hill Stream would have a "significant impact" upstream. This significant impact was an increase in water levels of up to 20mm for a 1 in 100 year flood event with 50% blockage. The extent of the flooding upstream due to a blockage is not given in the report. If all screens were fully blocked, then this impact would potentially be greater. However, there are robust mitigation measures in place to manage blockage and its occurrence and the probability of blockage of both structures is considered as being low. The mitigation measures in place are:

- *Large screens with telemetry to alert the Environment Agency to a blockage;*
- *Structures are checked regularly and are on a high priority flood run for the Environment Agency operational delivery team; and*
- *The side spill on the siphon will allow flows to move between channels in the event of a blockage on one of the screens."*

5.4.3. The Myrke

The Myrke is a low-lying area where localized flooding may occur if the water level in the River Thames is high. The Myrke ditch was sized to contain 4 cumecs of flow based on hydrological hydraulic modelling data. A number of measures are in place to reduce the risk of flooding in this area:

- Culvert at Pococks Lane is large (2.1 m by 1.0 m). This reduces the risk of backing up from high water levels in the River Thames when the flap valves close on this culvert. If flap valves are stuck open, penstocks can be closed;
- If high water levels within the River Thames are expected, a pump will be delivered to the Myrke so that water from the Myrke can be pumped into the Jubilee River. This operation is a part of the Jubilee River Operating Procedures to reduce the risk of flooding along the Myrke; and
- There are three telemetry alarms on the outfalls to alert the Environment Agency of any problems with flap valves, trash screens and penstocks.

5.4.4. Lower Colne scheme

With respect to the Lower Colne scheme, a channel was constructed in the early 1990's to the east of the Colne Brook, linking into the County Ditch; however, these measures did not adequately deal with the volume of water in the County Ditch which backed up, flooding residential areas to the south. Following flooding in 2000 and again in 2003, a further Flood Alleviation Scheme was implemented which involved the creation of a new flood channel through Albany Park, re-joining the Colne Brook south of Cottesbrooke Close. Other works involved the widening of the County Ditch, clearance along the Colne Brook, raising the banks of Colnbrook West Lake, and controls on the County Ditch.

5.4.5. Other flood defences

Other flood defences in the Slough Borough include: The bentonite wall around Thames Water's Iver South Treatment Works is a formal flood defence against both groundwater and fluvial flooding; and Haymill and Stoke Park reservoirs serve as balancing reservoirs, and thus are formal defences.

5.5. Climate change

UKCP18 predicts that by 2070, under a high emission scenario, average winter precipitation is likely to increase, and average summer rainfall is projected to decrease, although intensity of the summer storms is predicted to increase. Both of these predictions will increase flood risk in the Slough Borough as:

- Longer periods of rainfall in the winter will result in:
  - Higher water levels within watercourses increasing risk of fluvial flooding; and
  - Raised water tables which could result in groundwater flooding.
- An increase in short, intense rainfall events in summer could lead to an increase in surface water flooding due to low infiltration capacity and high run-off throughout the Slough urban area.

This means that in the future not only will more properties within the Slough Borough be at risk of flooding, those already at risk will be susceptible to more frequent flooding. Risk of flooding will also increase due to the current standard of protection offered by flood defences reducing as both water levels and flow rates increase.

The Environment Agency climate change guidance (Environment Agency, 2020 a) is set out in Section 3.2.4. The current guidance as of December 2020 is aligned with UKCP09, and update is expected imminently. It outlines the climate change allowances that should be used in flood risk assessments for both peak river flows (Thames Basin) and peak rainfall intensity. For peak river flow, the type of allowance needed within a study depends on the flood zone and type of development proposed. The information pertaining as to which allowance category should be assessed is detailed in The Environment Agency's Flood risk assessments: climate change allowances guidance (Environment Agency, 2020 a). For peak rainfall intensity, both the central and upper end allowances should be used within FRAs.

The impact of climate change will need to be assessed in site specific FRAs if one is required for a proposed development. Any developments should be designed with an allowance for climate change including access routes, drainage design and flood mitigation measures (more information provided in Section 7). Flood risk needs to be investigated for the lifetime of the development. For this purpose, the Environment Agency define the lifetime of a development to be 100 years for residential, and 60 years for commercial/non-residential.

5.5.1. Fluvial flood risk

In the absence of flood risk modelling accounting for climate change for the Slough Borough, the present-day Environment Agency Flood Zone 2 has been used to approximate Flood Zone 3 with an allowance for climate change. This is shown in Figure 21 and Figure 22. SBC are currently working on modelling of areas within the Slough Borough (as outlined in Section 6.2). When this modelling is completed, climate change extents will be available, and the SFRA will be updated when appropriate.

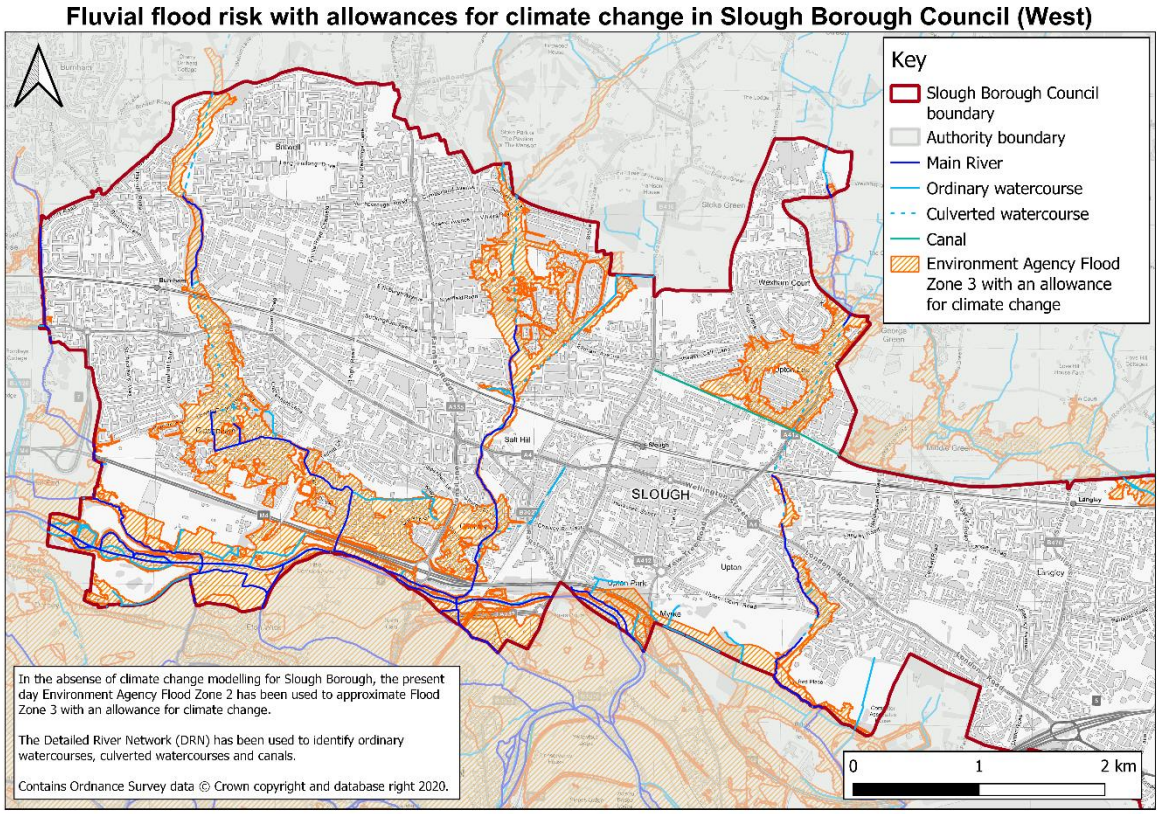

Figure 21 - Fluvial flood risk with allowances for climate change in Slough Borough Council (West)

See Appendix A for high resolution version of Figure 21.

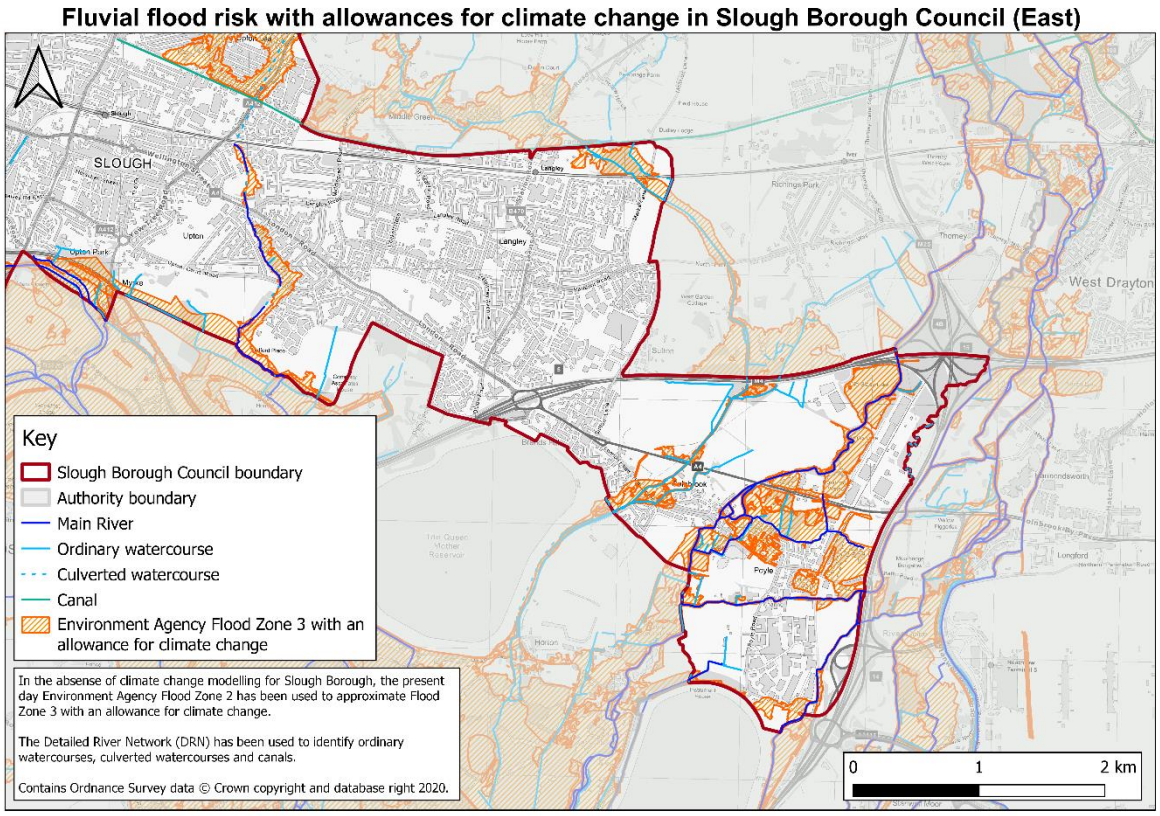

Figure 22 - Fluvial flood risk with allowances for climate change in Slough Borough Council (East)

See Appendix A for high resolution version of Figure 22.

5.5.2. Surface water flood risk

Climate change is predicted to increase rainfall intensity in the future by up to 40% (for the Upper End estimate to the 2080s epoch (2070 to 2115)) by the Environment Agency (Environment Agency, 2020 a). This will increase the frequency and intensity of surface water flooding, especially in impermeable urban areas and areas susceptible to surface water flood risk at present. Changes to rainfall intensity should be incorporated into sire-specific FRAs and drainage strategies. At present there is no groundwater flood risk mapping that includes allowances for climate change.

5.5.3. Groundwater flood risk

The impact on climate change on groundwater flood risk is uncertain. The Environment Agency climate change guidance (Environment Agency, 2020 a) does not provide information on expected changes to groundwater flooding as a result of climate change. In periods of drought is likely that the risk from groundwater flooding will reduce as a result of climate change, however in periods of high groundwater levels, it is likely that the risk of groundwater flooding will increase. The risk of groundwater flooding is closely linked to other sources of flood risk. For example, an increase in fluvial flood risk as a result of climate change could result in an increase in groundwater flood risk if the systems are interlinked. At present there is no groundwater flood risk mapping that includes allowances for climate change.

5.5.4. Other sources flood risk

Surface water sewer flood risk will increase as a result of anticipated increases in peak rainfall intensity with climate change. The impact of new development on surface water sewer flood risk will be mitigated following the information provided in Section 8.

Other sources of flood risk, including the risk of foul sewer flooding and reservoir flood risk will not be significantly impacted by climate change.

6. Managing Flood Risk in the Slough Borough

6.1. Recommendations for locating future development in the Slough Borough

The Sequential Test set out in the NPPF (Ministry of Housing, Communities and Local Government, 2019) must be at the centre of spatial planning and development control decisions relating to flooding. Under the Sequential Test, development sites should be allocated within areas of lowest flood risk. If there are no suitable sites within Zone 1, the area of lowest flood risk, alternative sites may be considered in areas of greater flood risk. The process considers the degree of flood risk of a site and where a development cannot be located within the area at lowest risk from flooding the vulnerability of the proposed use to flooding is also considered.

Information regarding developing in the different Environment Agency Flood Zones is given below in Table 11. This information is also available in the PPG (Ministry of Housing, Communities & Local Government, 2016) and online from Defra and the Environment Agency (Department for Environment, Food and Rural Affairs and Environment Agency, 2014).

Please refer to Figure 9 or Figure 10 to identify which flood zone the development site is within, high resolution versions of these figures are provided in Appendix A. For more information on Flood Risk Assessments see Section 7.

To identify whether the development site is within CDAs please refer to Section 5.3.2.1 and Figure 15 or Figure 16. For developments within or in close proximity to areas at risk of flooding from groundwater, sewer or other sources of flood risk, applicants should contact SBC to determine whether the planning application for the proposed development needs to address the flood risk.

A detailed surface water drainage strategy is required at the application stage for all developments that have the potential to increase surface water runoff, hence those developments proposed within CDAs or that cover more than 1 ha. For more information on surface water drainage strategies see Section 8.

Table 11 – Flood risk considerations for development within Environment Agency Flood Zones

Flood Zone	Appropriate development types	FRA required?
1 (Low Probability)	All development types are appropriate.	An FRA will be required in this zone if: - It is more than 1 ha - Less than 1 ha but a change of use in development type to a more vulnerable class, where they could be affected by sources of flooding other than rivers and the sea; and - In an area which has critical drainage problems as notified by the Environment Agency (See Section 5.3.2.1).

Flood Zone	Appropriate development types	FRA required?
2 (Medium Probability)	All land uses are appropriate except highly vulnerable uses, which would require a passed Exception Test to be demonstrated.	Any development proposals in this zone must be accompanied by a detailed FRA.
3a (High Probability)	Water compatible and less vulnerable uses are appropriate in this zone. The more vulnerable and essential infrastructure* should be permitted only if the Exception Test is passed. The highly vulnerable uses should not be permitted in this zone.	Any development proposals in this zone must be accompanied by a detailed FRA.
3b (Undeveloped Land)	Water compatible** uses are appropriate in this zone. Essential infrastructure** should be permitted only if the Exception Test is passed.	Any development proposals in this zone must be accompanied by a detailed FRA.
3b (Developed Land)	Within these areas, intensification of development must not only be avoided, but the development footprint needs to be reduced to provide sufficient space for surface water infiltration and/or attenuation.	Any development proposals in this zone must be accompanied by a detailed FRA.

*Essential infrastructure should be designed and constructed to remain operational and safe for users in times of flood.

**Both types should be designed and constructed to:

- Remain operational and safe for users in times of flood;
- Result in no net loss of floodplain storage; and
- Not impede water flows and not increase flood risk elsewhere.

6.2. Flood Alleviation Schemes

A wide range of measures are considered to manage flood risk within the Slough Borough, one of these measures is flood alleviation schemes. There are currently three proposed flood alleviation schemes across the Slough Borough, at different stages of design and development:

- Slough flood alleviation scheme (Environment Agency lead);
    - The Environment Agency and SBC are working in partnership to investigate whether there are economically viable options to reduce the risk of fluvial and surface water flooding within the Chalvey Ditch, Salt Hill Stream and Datchet Common Brook catchments.
    - This project is currently on hold.
    - More information can be found on the gov.uk website (Environment Agency, 2015).
- Colne Brook flood alleviation scheme (Environment Agency lead);
    - The Environment Agency and SBC are working in partnership to investigate whether there are economically viable options to reduce the risk of fluvial flooding within the Colne Brook catchment.
    - This was on hold while the Colne Brook modelling is updated in relation to the Heathrow expansion.
- Salt Hill Stream flood alleviation scheme (SBC lead).
    - SBC and the Environment Agency are working in partnership to investigate whether there are economically viable options to reduce the risk of fluvial and surface water flooding within the Salt Hill Stream catchment.
    - This project is currently being progressed by SBC and is at initial assessment stage.

6.3. Emergency Planning

SBC's emergency planning department ensures that there is a coordinated response to emergencies in the local area. The SBC Flood Plan (Slough Borough Council, 2019), which is a generic response to a major incident, sets out how the Council will respond in the event of a flood. A risk assessment has been carried out to ensure the scope of the plan fits the risk of flooding in the Slough Borough.

The aim of the Flood Plan is to:

- Raise awareness of the key agencies involved and their roles and responsibilities;
- Provide a framework document for responding to flooding;
- Warn and inform the public and other key stakeholders;
- Raise public awareness to important information and resources available for their own benefit; and
- Explain the risks and responses to different types of flooding.

The SBC Flood Plan includes a section on historical flooding incidents and thus is continuously updated to reflect flood events in the Slough Borough.

Work will continue to ensure consistency between the SFRA and the Flood Plan; to this end, SBC's Flood Management Officers have been closely involved with the preparation of both documents.

6.4. Flood warning and evacuation plans

Environment Agency flood alerts and warnings can enable timely actions by residents or building occupants to evacuate unaided. Rescue by the emergency services is likely to be required where prior evacuation has not been possible.

The requirement for a flood warning and evacuation plan should be determined through a site specific FRA. This would demonstrate the actions site managers and users will take before, during and after the flood event to ensure their safety and demonstrate that the development will not impact SBC or the emergency services' ability to safeguard the existing population.

For sites located in Flood Zone 1 on 'dry islands', it may also be necessary to prepare a flood warning and evacuation plan as flood water would likely impede safe access or egress from the site. The plan would determine the most suitable routes to and from the site.

Flood warning and evacuation plans need to take account of the likely impacts of climate change and should include information such as:

- How flood warnings are provided;
- What will be done to protect the development and contents;
- Ensuing safe occupancy and access to and from the development site; and
- Where to remain on sire if safe egress from the site is not possible.

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

6.5. Flood warnings

The Environment Agency manage a free flood warning service (Environment Agency, 2020 b) for areas in England at risk of flooding from rivers and the sea. The Environment Agency have three levels of flood warning:

- **Flood alert**: Flooding is possible – be prepared;
- **Flood warning**: Flooding is expected – immediate action required; and
- **Sever flood warning**: Sever flooding, danger to life.

There are 5 flood alert areas within the Slough Borough, and 6 flood warning areas. These are listed in Table 12 and shown on Figure 23. The Environment Agency will issue flood alerts or warnings to residents or businesses that have registered to this service in these specific areas.

The status of flood warnings in specific areas can be determined on the Environment Agency website[2].

[2] https://flood-warning-information.service.gov.uk/warnings

Table 12 – Environment Agency flood alert and warning areas

Area name	Description
Flood alert areas	
Colne Brook at Iver and Colnbrook	The Colne Brook at Iver and Colnbrook including Fulmer
Lower River Colne and Frays River	The Lower River Colne and Frays River at Uxbridge, West Drayton, Poyle and Stanwell Moor
Slough Watercourses	The Huntercombe Lane Stream, The Chalvey Ditch, The Salt Hill Stream and The Datchet Common Brook
River Thames from Datchet to Shepperton Green	River Thames from Datchet to Shepperton Green including Old Windsor, Wraysbury, Horton, Staines, Egham, Laleham and Chertsey
River Thames from Maidenhead to Windsor and Eton	River Thames from Maidenhead to Windsor and Eton including Bray and Dorney
Flood warning areas	
Colne Brook at Colnbrook	The Colne Brook at Colnbrook including Horton and Wraysbury
River Colne and Frays River at West Drayton and Stanwell Moor	River Colne and Frays River at West Drayton and Stanwell Moor
Colne Brook at Iver	The Colne Brook at Iver including Thorney
Moorings and properties closest to the River Thames between Maidenhead, Windsor and Eton	River Thames from Maidenhead down to Romney Lock including moorings on and those properties closest to the river
River Thames at Maidenhead to Windsor and Eton	River Thames at Maidenhead, Bray, Dorney, Windsor and Eton
River Thames at Datchet	River Thames at Datchet village, including Slough Road, Eton Road, Horton Road, Southlea Road and the Datchet Common areas

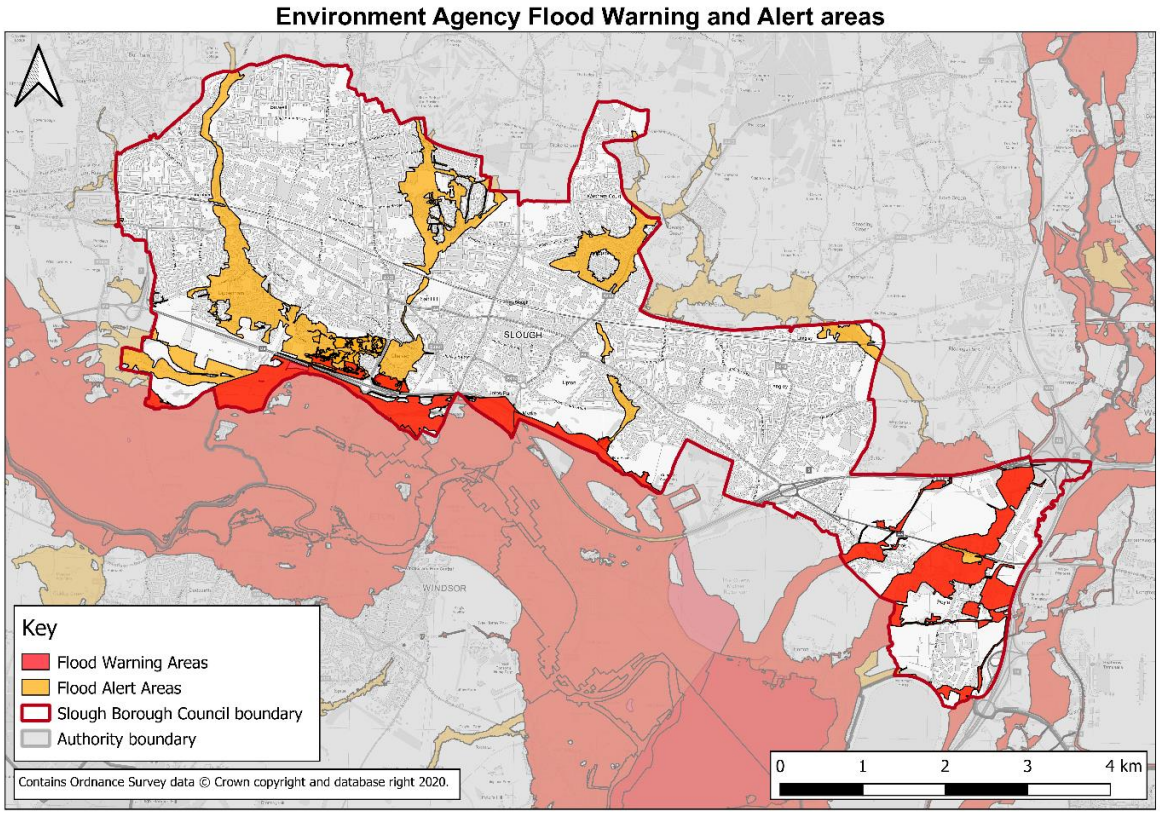

Figure 23 - Environment Agency Flood Warning and Alert Areas

See Appendix A for high resolution version of Figure 23.

7. Site specific flood risk assessments

7.1. When is a site specific FRA required?

As outlined in Table 11, in accordance with the NPPF (Ministry of Housing, Communities and Local Government, 2019), a site-specific FRA should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, a FRA should accompany all proposals involving:

- *"sites of 1 hectare (ha) or more;*
- *land which has been identified by the Environment Agency as having critical drainage problems;*
- *land identified in a strategic flood risk assessment as being at increased flood risk in future; or*
- *land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."*

The PPG (Ministry of Housing, Communities & Local Government, 2016) outlines that the FRA detail should be proportionate to the degree of flood risk and the scale, nature and location of development. The objectives of a site-specific FRA are r:

- Determine if the proposed development is at risk of current or future flooding from any sources (including the impact of climate change. Climate change considered will need to be in line with the guidance at the time of writing the site-specific FRA);
- Identify if the proposed development will increase flood risk elsewhere;
- Outline the mitigation measures, if required, and demonstrate these will be effective and appropriate;
- Provide evidence to support the Sequential Test; and
- Provide evidence to support part 2 of the Exception Test if necessary.

The NPPF outlines that development could be allowed in areas at risk of flooding if it has been demonstrated that:

- '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;
- the development is appropriately flood resistant and resilient;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.'

These will be explored further both in this section and Section 8.

7.2. How detailed should a site specific FRA be?

The PPG (Ministry of Housing, Communities & Local Government, 2016) states that a site-specific FRA should be proportionate to the degree of flood risk, the scale and type of development, the vulnerability classification (Table 6) of the proposed development and the level of information required to demonstrate the application of the Sequential and Exception Tests. The site-specific FRA should make use of all readily available information including information provided in this SFRA and the Environment Agency flood risk mapping.

The scope of a site-specific FRA will vary considerably. For example, where the development it an extension to an existing house (for which planning permission is required), the LPA would generally need a less detailed assessment to make an informed decision. Whereas, for a new, larger development of multiple houses in a similar location, the LPA would need a more detailed assessment.

7.3. Pre-application advice

Pre-application advice at all stages, SBC and where necessary the Environment Agency and / or Thames Water may need to be consulted to ensure the FRA provides the necessary information to fulfil the requirements for planning applications. SBC[3] and the Environment Agency[4] offer pre-application advice services which can be used to discuss requirements for specific applications.

7.4. Information available to inform a site-specific FRA

As mentioned above, there is readily available information that can be used to inform a site specific FRA. Key information that could be used in a site-specific FRA is listed below:

- Local policy statements and guidance
- This SFRA for information regarding:
    - Historic flood risk information;
    - An overview of flood risk from all sources in the Slough Borough;
    - Areas of known flood risk from all sources in the Slough Borough; and
    - Areas of critical drainage.
- SFRAs of neighbouring LPAs;
- SBC LFRMS and SWMS;
- Environment Agency flood mapping:
    - Environment Agency flood maps for planning[5] for fluvial flood zones, flood defences and areas benefitting from defences;
    - Environment Agency long term flood risk mapping[6] for surface water and reservoir flood risk;
- Environment Agency flood risk assessments: climate change allowances[7];
- BGS geology viewer[8]; and
- Cranfield University Soilscapes[9].

Additional information to request where applicable:

[3] http://www.slough.gov.uk/planning-and-building-control/pre-application-advice.aspx
[4] www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion.
[5] https://flood-map-for-planning.service.gov.uk/location?easting=525581&northing=150771&placeOrPostcode=RH20Jr
[6] https://flood-warning-information.service.gov.uk/long-term-flood-risk
[7] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[8] http://mapapps.bgs.ac.uk/geologyofbritain/home.html?&_ga=2.178148965.1334123222.1603795233-33569811.1601542927
[9] http://www.landis.org.uk/soilscapes/

- The Environment Agency data request products[10]
    - Products 1 – 4 are mapped deliverables including flood level and flood depth information and the presence of flood defences local to the proposed development site;
    - Product 5 includes reports for hydraulic modelling of Main Rivers;
    - Product 6 includes model output data; and
    - Product 7 includes the hydraulic model.
- Thames water sewer network information; and
- JBA groundwater flooding mapping.

Further to this information FRAs may require:

- Site survey or detailed topographic survey to determine ground levels across the site and levels of any formal or informal flood defences;
- Hydrological modelling;
- Hydraulic modelling.

7.5. Approach to a site-specific FRA

The Environment Agency have published a sire-specific FRA checklist[11]. This should be followed when writing a site specific FRA. As detailed in the checklist, the site-specific FRA should include:

1. Development and site location;

    Describe the proposed development site, including its current use and which flood zone it is located within. It is useful to provide a location plan of the proposed site.

2. Development proposals;

    Describe the proposed development, its vulnerability classification and the estimated lifetime for the proposed development. It is useful to provide a plan of the proposed development.

3. Sequential Test;

    Please see Section 7.5.1 for more information on the application of the Sequential Test.

4. Climate change;

    Describe how flood risk at the site is likely to be affected by climate change.

5. Site specific flood risk;

    Describe the risk of flooding to and from the proposed development over its expected lifetime, including appropriate allowances for the impacts of climate change.

6. Surface water management;

[10] https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications
[11] https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section

Describe the existing and proposed surface water management at the site. SuDS should be used wherever appropriate, to ensure flood risk is not increased off-site.

7. Occupants and users of the development;

   Describe the numbers of future occupants and users of the proposed development.

8. Exception Test;

   Please see Section 7.5.2 for more information on the application of the Sequential Test.

9. Residual risk; and

   Describe residual risks that remain after the flood risk management and mitigation measures have been implemented, and to explain how these risks can be managed over the lifetime of the proposed development.

10. Flood risk assessment credentials.

Additional consideration should be made for the management of surface water and the proximity of the site to Main Rivers.

7.5.1. Sequential Test

A sequential approach to the location of development should be applied to all development. Areas of little or no risk of flooding from any source should be sought in preference to those with higher risk. The Sequential Test ensures that this approach has been followed.

The Sequential Test compares the proposed development site to other available sites to find out which has the lowest flood risk. The Environment Agency sets out the procedure for applying the Sequential Test to individual planning applications in the flood risk and coastal change guidance[12].

The sequential test should conclude whether any of the alternative identified sites have a lower risk of flooding than the proposed development site. The LPA will review all sequential tests and determine whether it is accepted.

The sequential test should be applied to all proposed development sites, unless, the site has been allocated through a local plan which has already applied the Sequential Test or for minor developments. The sequential test should be applied to windfall sites. The application of the Sequential Test is illustrated in Figure 24.

Within the site, a sequential approach should also be taken, making sure that the most vulnerable development is located in areas of lowest flood risk.

[12] https://www.gov.uk/guidance/flood-risk-and-coastal-change#Sequential-Test-to-individual-planning-applications

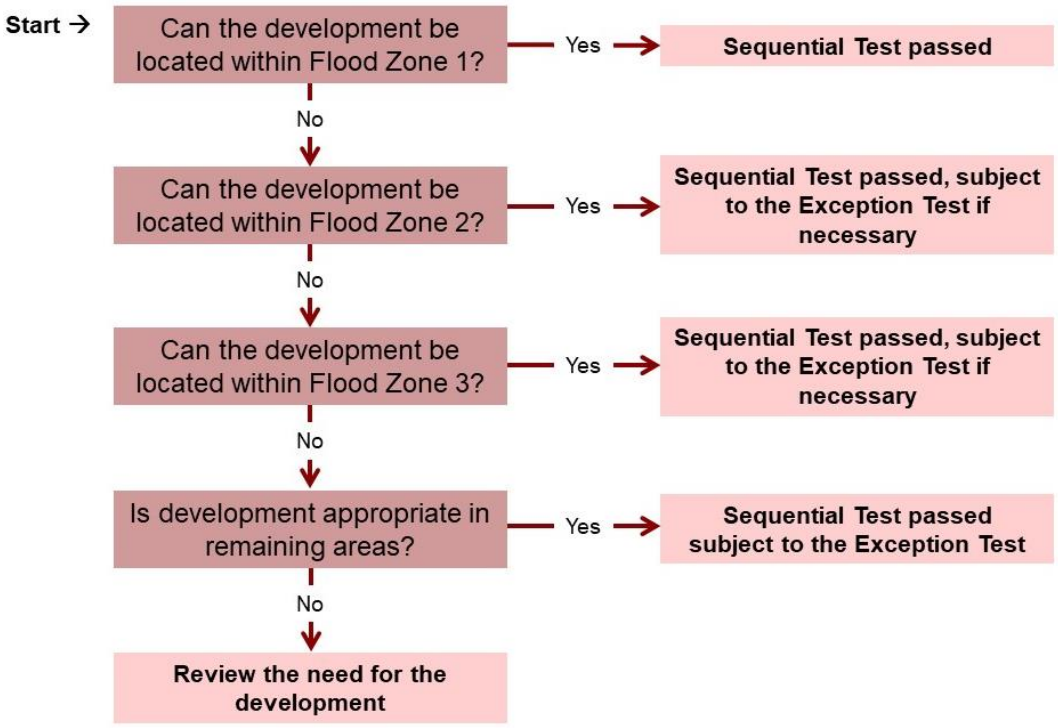

Figure 24 – Application of the Sequential Test

7.5.2. Exception Test

The Exception Test is required for some developments development on flood risk as shown in Table 7. A passed Exception Test would demonstrate (as set out by NPPF) that:

- *'the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
- *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.'*

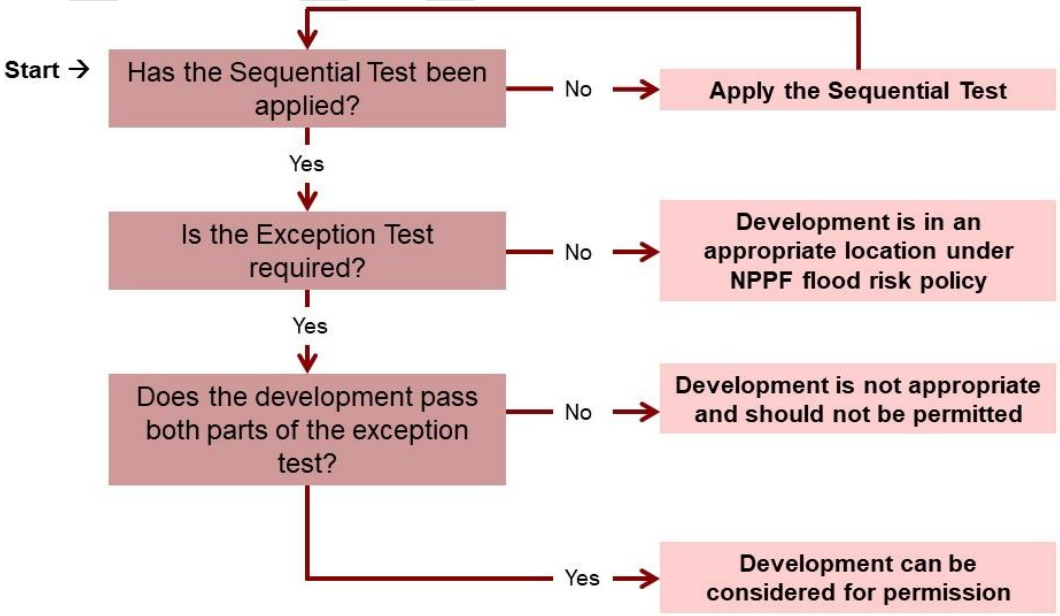

Figure 25 – Application of the Exception Test

The Environment Agency flood risk and coastal change guidance (Environment Agency, 2014) states that in order for the development to be approved, both parts of the Exception Test will need to be satisfied (Figure 25).

Even though the Sequential Test does not need to be re-applied for sites allocated during plan-making, the Exception Test may need to be applied for these sites due to some aspects of the proposal not being considered in plan-making, or if more up-to-date information about either current or future flood risk needs to be taken into account.

The Exception Test should demonstrate how flood risk will be managed on the proposed development site. The Environment Agency sets out the procedure for applying the Exception Test to individual planning applications in the flood risk and coastal change guidance[13].

7.5.3. Measures to reduce flood risk on site

7.5.3.1. Vulnerable developments

For all vulnerable developments specific advice should be followed for surface water management, access and evacuation and floor levels as indicated by guidance (Department for Environment, Food & Rural Affairs and Environment Agency, 2012):

- Surface water management should follow guidance set out in the local authority's SWMP or SFRA;
- Details of emergency escape for any parts of the development below estimated flood level should be provided; and
- Finished floor levels should be a minimum of whichever is higher of: 300 mm above the general ground level of the site or 600 mm above the estimate river flood level. In order to show this, average ground levels of the building and finished floor levels should be provided.

7.5.3.2. Safe access and escape routes

As discussed in Section 6.3, a flood warning and evacuation plan should be prepared for all proposed developments (excluding minor developments and change of use) in Environment Agency classified Flood Zone 2 or 3. This would demonstrate the actions site managers and users will take before, during and after the flood event to ensure their safety and demonstrate that the development will not impact SCC or the emergency services' ability to safeguard the existing population. For more detail see Section 6.3.

The PPG (Ministry of Housing, Communities & Local Government, 2016) outlines that the FRA will need to provide details of emergency escape plans for any parts of the building below the estimate flood level. The plans will need to show:

- *'Single storey buildings or ground floors that do not have access to high floors can access a space above the estimate flood level;*
- *basement rooms have clear internal access to an upper level (for example a staircase); and*
- *occupants can leave the building if there's a flood and there's enough time for them to leave after flood warnings'* (See Section 6.5).

[13] https://www.gov.uk/guidance/flood-risk-and-coastal-change#The-Exception-Test-section

7.5.3.3. Flood mitigation measures

The Environment Agency (Department for Environment, Food & Rural Affairs and Environment Agency, 2012) provides guidance on requirements for extra flood resistance and resilience measures for developments in areas where ground floor levels are lower than the estimated flood level on site. These are set out in three categories: water depth up to 300 mm; water depth from 300 mm to 600 mm; and water depth above 600 mm.

Information on what measures should be taken for each category can be found in the Environment Agency Flood Risk Assessment Standing Advice (Department for Environment, Food & Rural Affairs and Environment Agency, 2012).

7.5.4. Measures to reduce flood risk off-site

New development could increase flood risk off-site in a number of ways;

- A new building of raised ground levels in a flood risk area, could result in the that water that would have previously occupied the site during a flood event being displaced and increasing flood risk off-site.
- A new building of raised ground levels on or across a flow route, could result in the flow route being obstructed and / or diverted, increasing flood risk off-site.
- Increasing the number of buildings in flood risk areas, increases the number of people exposed to flood risk in a storm event.

The NPPF (paragraph 157) makes it clear that a proposed development should provide betterment where possible and not increase the risk of flooding elsewhere. It is always better to avoid risk rather than mitigate it. To reduce the flood risk off-site, the following on-site measures could be implemented:

- Compensation greater than required by a level for level, volume for volume basis;
- The proposed development could reduce the existing rate of run-off from the site in flood events up to and including the 1% (1 in 100) AP flood event and an allowance for climate change;
- Run-off from previously-developed sites should aim to reduce run-off back to the original greenfield run-off rates; and
- The SuDS hierarchy should be used where possible.

8. Surface water drainage requirements

8.1. Drainage Strategies

As outlined in Section 6 a surface water drainage strategy incorporating a risk assessment will be required at application stage for all development applications where there is a potential to increase surface water flood risk.

The drainage strategy should:

- Outline the site characteristics;
- Calculate the surface water runoff rates and required runoff storage volume;
- Outline where the runoff is being discharged to and the existing methods for managing surface water runoff;
- Outline how the drainage system is going to be managed and maintained, making sure there is no increase in the volume and rate of surface water runoff;
- Applying the drainage hierarchy; and
- Take account of any SuDS features.

8.2. Sustainable Drainage Systems

The NPPF (Ministry of Housing, Communities and Local Government, 2019), outlines that in areas at risk of flooding, development could be allowed as long as it can be demonstrated that, along with other criteria (outlined in Section 7), it incorporates sustainable drainage systems unless there is clear evidence that it would be inappropriate. The PPG outlines that the final decision of whether SuDS are practical in a development is for the LPA (SBC) through consultation with the LLFA.

SuDS are defined by the PPG as *'designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible*'. SuDS work to:

- Reduce both the causes and impacts of flooding;
- Remove pollutants at the source from urban run-off; and
- Combine water management with green space and with benefits for amenity, recreation and wildlife.

There is a hierarchy of drainage options set out by the PPG. SuDS used should aim to discharge as high up the hierarchy as possible.

1. Into the ground (infiltration);
2. To a surface water body;
3. To a surface water sewer, highway drain, or another drainage system;
4. To a combined sewer.

The government have released technical standards for SuDS (Department for Environment, Food and Rural Affairs, 2015) which should be followed when designing SuDS. This includes guidance for both peak flow and volume control and greenfield run-off rates.

SuDS should be designed in accordance with the CIRIA SuDS Manual (C753) (CIRIA, 2015).

8.2.1. SuDS within the Slough Borough

The Slough Borough is largely an urban area, therefore, is it likely that there is insufficient space to incorporate measures such as swales, basins and ponds. Green roofs may be considered for developments as a source control measure and, for low order rainfall events, would reduce run-off volumes. However, they have a finite capacity to hold water and therefore the developer must demonstrate the impact if the capacity is exceeded or if the system fails.

Traditionally, SBC has promoted the use of soakaways for the disposal for drainage of private areas where the ground conditions are suitable. However, where the groundwater levels are high, infiltration via soakaways is not possible due to the insufficient thickness of unsaturated ground. Similarly, as the permeability of the underlying ground decreases (due to clayey soils), the possibility of infiltration reduces. In addition, soakaways cannot be used on sites where the land is contaminated. It is therefore critical that the geology, ground and groundwater conditions of a site is understood in order to design a suitable surface water drainage system which will provide an effective means of disposal without detriment to other areas.

Evidence of the permeability of the ground will be an important consideration to ensure there is a sufficient infiltration rate. Infiltration rates should be obtained from tests at or as close to the areas of proposed soakage as possible, and at the depth proposed for the base of the soakage.

It is essential that the design of the surface water drainage system is considered in the very initial stages of a development to ensure that adequate space is made available to accommodate appropriate attenuation measures. A detailed surface water drainage system at the application stage would demonstrate whether the proposed footprint of development could be satisfactorily achieved or whether the development footprint would need to be reduced in order to provide enough space for infiltration and attenuation.

8.2.2. Groundwater source protection zones

Another factor which will affect the design of the surface water drainage system are the SPZs for groundwater such as wells, boreholes and springs used for public drinking water supply. The zones act as a risk screening tool for the major aquifers storing and producing the groundwater. These three zones are defined by the Environment Agency and are shown in Figure 26 below and defined as:

- Zone 1 (Inner Zone) – This zone has a travel time of 50 days or less from any point within the zone at, or below, the water table. This zone has a minimum radius of 50 m.
- Zone 2 (Outer Zone) – This zone has a travel time of 400 days from a point below the water table. This zone has a minimum radius of 250 or 500 mm around the source, depending on the size of abstraction.
- Zone 3 (Total Catchment) – This zone is the total area needed to support the abstraction or discharge from the protected groundwater source.

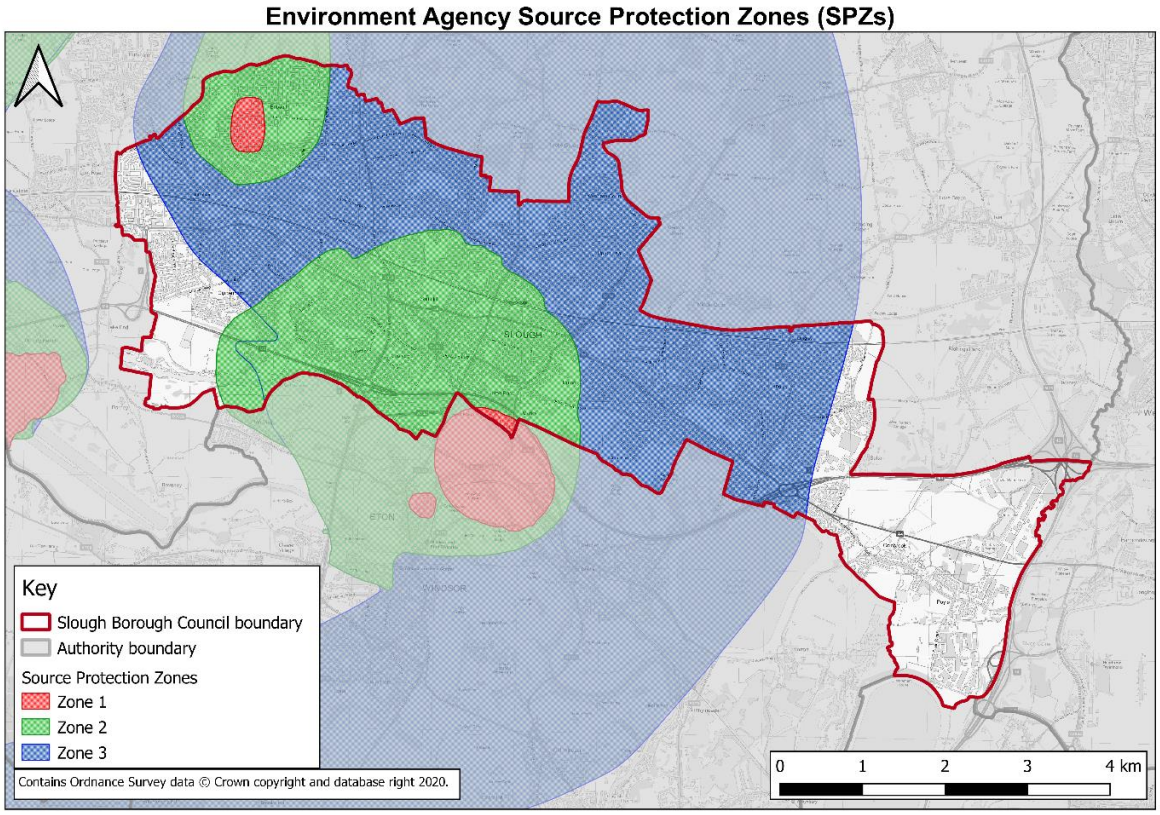

Figure 26 - Environment Agency SPZs

See Appendix A for high resolution version of Figure 26.

Much of the Slough Borough (with the exception of the eastern edge of Langley and Colnbrook and Poyle, as well as the southwestern part of Cippenham) falls within either Zone 1 or Zone 2 SPZs.

The manner in which these groundwater SPZs are interpreted has a bearing on the design of surface water drainage systems for development sites within these zones. In addition, any change in the use of an aquifer could have significant implications for drainage systems within these zones.

Where a site is located within a groundwater SPZ, the use of shallow infiltration techniques for surface water disposal may be acceptable where the receiving groundwater is isolated from the deeper aquifer by impermeable strata, subject to a risk assessment.

It is not possible to provide specific recommendations for surface water drainage schemes within the different SPZs in the Slough Borough as there are too many factors to consider. It is recommended that early consultations with the Environment Agency and SBC take place to ensure a satisfactory drainage scheme can be designed.

There are two additional groundwater abstraction sites located in the Slough Borough:

- The old Horlicks (previously Glaxosmithkline) site: abstraction in the Lower Greensand which are some 300 metres underground and protected by the Gault Clay; the site also draws groundwater from the River Terrace Deposits which is more vulnerable to pollution. An agreement has been made with Berkeley Homes, that as they redevelop this site, a limited abstraction will continue to supplement flow in Salt Hill Stream.
- Slough Trading Estate: ‘private supply’ abstraction from the Chalk and Lower Greensand aquifers.

9. Key development sites in the Local Plan: Flood risk assessments

The core strategy (2006-2026) is currently being updated and will be replaced by the new Local Plan for Slough 2026-2036. When this document is published this section will be updated. This section is a place holder for flood risk assessment of key development sites identified in SBC's Emerging Local Plan for Slough 2016-2036.

In preparation for the new Local Plan a draft preferred Spatial Strategy has been prepared indicating very broadly what parts of the town might accommodate growth or be protected. It does not allocate specific sites but it has taken account of flood risk. This SFRA will be part of the evidence base for the new Local Plan and subsequent specific site allocations.

10. Conclusions

This 2020 SFRA has been produced to reflect the changes in policy, legislation and flood information since the document was last published in 2012. This SFRA provides advice to developers on:

- Information on historic flood incidents within the Slough Borough;
- The current sources of flood risk within the Slough Borough;
- Consideration of Climate Change;
- Recommendations for locating future development in the Slough Borough including evidence required to inform the Sequential Test and, when necessary, the Exceptions Test;
- Site-specific Flood Risk Assessments and when they are required; and
- Surface Water drainage requirement.

Flood risk information is continuously being updated; this SFRA has been developed using the best available data at the time of preparation. The SFRA should be updated when appropriate to reflect new information on flood risk, flood warnings, planning guidance or legislation.

10.1. Sources of flood risk

This SFRA has identified that the Slough Borough is at risk of flooding from fluvial, surface water, groundwater, sewer and other sources of flood risk. Data used and a summary of the flood risk is summarised below:

- Environment Agency Fluvial Flood Zone mapping (flood maps for planning) is used to define fluvial flood risk in the Slough Borough. This is associated with the watercourses running North to South through the Slough Borough.
- The Environment Agency Risk of Flooding from Surface Water (RoFSW) maps have been used to define surface water flood risk in the Slough Borough. There are areas of low, medium and high RoFSW across the whole of the Slough Borough. Drainage should, therefore, be a high priority for all new developments.
- The BGS susceptibility to groundwater flooding mapping has been used to define groundwater flood risk in the Slough Borough. There are large areas within the Slough Borough susceptible to groundwater flooding, with almost half of the Slough Borough identified with the “potential for groundwater flooding to occur at surface”.
- Foul and surface water sewers are owned, managed and maintained by Thames Water. Thames Water have been contacted regarding historic sewer flooding and this SFRA will be updated once this information has been received. The Slough Borough is at risk of sewer flooding across the borough and therefore new development must provide attenuation and infiltration for surface water run-off. As part of development planning the developer must contact Thames Water in order to ensure there is capacity for any increase in foul flow or volume from a development site.
- The Slough Borough is at risk of flooding from the failure of four reservoirs, however, the risk of failure is considered extremely low and therefore should not constrain development in the Slough Borough.

10.2. Development

In accordance with NPPF and PPG, development should be directed to areas at the lowest probability of flooding through the application of the Sequential Test. Development allocated within the Local Plan does not require the Sequential Test and this has been undertaken during allocation.

For some cases, an Exception Test is required. This is required to demonstrate that the wider sustainability benefits of the proposed development outweigh the flood risk and that the development will be safe for its lifetime without increasing flood risk elsewhere. Both flood risk and development type define whether a development is suitable for a specific location. This also defines when an Exception Test should be applied.

The SFRA will be used as evidence in the preparation of the new Local Plan for Slough (2016-2036) including the related site allocation process plus development management policies.

10.3. Site Specific Flood Risk Assessment

A site-specific FRA should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, a FRA should accompany all proposals involving:

- sites of 1 hectare (ha) or more;
- land which has been identified by the Environment Agency as having critical drainage problems;
- land identified in a strategic flood risk assessment as being at increased flood risk in future; or
- land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

This site-specific FRA should assess all types of flooding from all sources, including the impact of future climate change.

10.4. Surface water management

A surface water drainage strategy incorporating a risk assessment will be required at application stage for all development applications.

This drainage strategy should:

- Outline the site characteristics;
- Calculate the surface water runoff rates and required runoff storage volume;
- Outline where the runoff is being discharged to and the existing methods for managing surface water runoff;
- Outline how the drainage system is going to be managed and maintained, making sure there is no increase in the volume and rate of surface water runoff; and
- Take account of any SuDS features.

The NPPF outlines that all development should incorporate SuDS unless there is clear evidence that it would be inappropriate. The PPG outlines that the final decision of whether SuDS are practical in a development is for the LPA (SBC).

10.5. Recommendations

The SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from all sources, and the potential impacts of climate change. Both SBC and developers should be using the most up to date information available. While this SFRA will be regularly updated, other sources of information should be checked and used if more recently updated.

It is recommended that the SBC SWMP (2012) is updated, however Level 2 SFRAs will not be required as areas that could be considered for a Level 2 SFRA are being assessed through other projects.

SBC's emergency planning team ensures that there is a coordinated response to emergencies in the local area. The SBC Flood Plan (2019) should reflect the information contained in this SFRA.

Prior to submitting applications for development in the Slough Borough, it is recommended that the applicant contacts the LPA (SBC), the Environment Agency and Thames Water to discuss the development proposal.

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Appendix A. High resolution mapping