Stockton-On-Tees Borough Council Level 1 Strategic Flood Risk Assessment

Final Report

March 2018

Stockton-On-Tees Borough Council
Planning Development Services
Municipal Buildings
Church Road
Stockton-On-Tees
TS18 1LD

JBA Project Manager

Howard Keeble
JBA Consulting
Bank Quay House
Sankey Street
Warrington
WA1 1NN

Revision History

Revision Ref / Date Issued	Amendments	Issued to
Initial Draft v1.0	-	John Dixon
Final Draft V1.1	Council comments	John Dixon
Final V1.3	Updated following council and EA comments	John Dixon
Final V1.4	Boathouse Lane and Billingham Riverside update	John Dixon

Contract

This report describes work commissioned by John Dixon, on behalf of Stockton-On-Tees Borough Council. Stockton-On-Tees Borough Council's representative for the contract was John Dixon. Mike Williamson, Charlotte Lloyd-Randall, Tasmin Fletcher of JBA Consulting carried out this work.

Prepared by ..... Michael Williamson BSc MSc EADA FRGS CGeog
Chartered Senior Analyst

..... Charlotte Lloyd-Randall BSc
Technical Assistant

..... Tasmin Fletcher BSc
Technical Assistant

Reviewed by ..... Howard Keeble MPhil BEng BSc CEng CEnv CSci CWEM MICE MCIWEM MCMI
Technical Director

Purpose

This document has been prepared as a Draft Report for Stockton-On-Tees Borough Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Stockton-On-Tees Borough Council.

Acknowledgements

Copyright

Carbon Footprint

A printed copy of the main text in this document will result in a carbon footprint of 330g if 100% post-consumer recycled paper is used and 420g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Executive Summary

This Level 1 Strategic Flood Risk Assessment (SFRA) updates the previous Level 1 assessment published in 2010 using up-to-date flood risk information together with the most current flood risk and planning policy available from the National Planning Policy Framework[1] (NPPF) and Flood Risk and Coastal Change Planning Practice Guidance[2] (FRCC-PPG). Stockton-On-Tees Borough Council (SBC) requires this update to initiate the sequential risk-based approach to the allocation of land for development and to identify whether application of the Exception Test is likely to be necessary. This will help to inform the Stockton-On-Tees Local Plan.

Stockton-On-Tees Borough Council provided their latest potential sites data and information. An assessment of flood risk to all sites is provided to assist SBC in their decision making process for sites to take forward as part of their Local Plan.

The aims and objectives of this SFRA update are:

- To understand flood risk from all sources and to investigate and identify the extent and severity of flood risk throughout the borough. This assessment will enable SBC to apply the Sequential Test in the preparation of the Local Plan, steer development away from those areas where flood risk is considered greatest, ensuring that areas allocated for development can be developed in a safe, cost effective and sustainable manner.
- To form part of the evidence base and inform the Sustainability Appraisal (Incorporating the Strategic Environmental Assessment) for the council's Local Plan.
- To provide guidance for developers and planning officers dealing with applications as well as for the council to fulfil its role as LLFA including advice on the application of the council's role in SuDS approval and adoption.
- To provide a reference document (this report) to which all parties involved in development planning and flood risk can reliably turn to for initial advice and guidance.
- To provide guidance for developers and planning officers on planning requirements.
- To identify land required for current and future flood management that should be safeguarded as set out in the NPPF.
- To reflect current national policy documentation including the NPPF and its accompanying Flood Risk and Coastal Change Planning Practice Guidance to enable SBC to meet its obligations as defined by the NPPF.
- To supplement current policy guidelines and to provide a straightforward risk based approach to development management in the area.
- To make recommendations on the suitability of potential development sites based on flood risk for SBC's Local Plan.
- To assess surface water flood risk, using the Environment Agency's (EA) third generation surface water flood map, the Risk of Flooding from Surface Water map (RoFSW).
- To provide a reference document (this report) to which all parties involved in development planning and flood risk can reliably turn to for initial advice and guidance.
- To develop a report that forms the basis of an informed development management process that also provides guidance on the potential risk of flooding associated with future planning applications and the basis for site-specific Flood Risk Assessments (FRAs) where necessary.
- To consider a precautionary approach to climate change.
- To provide a suite of interactive GeoPDF flood risk maps illustrating the interaction between flood risk and potential development sites.
- To recommend opportunities offered by new development to reduce the causes and impacts of flooding including to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water.
- To consider any flood risk management infrastructure requirements for new development to feed into the infrastructure delivery plan.

1 http://planningguidance.planningportal.gov.uk/blog/policy/

2 http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

The Local Planning Authority (LPA) provided its latest potential sites data and information for assessment. An assessment of flood risk to all 146 sites is provided to assist the LPA in its decision-making process for sites to take forward as part of the Local Plan. This assessment has shown there to be 146 sites at varying risk from fluvial, tidal and surface water flooding. Table 1-1 summarises the number of sites at risk from each flood zone as per the Environment Agency's Flood Map for Planning.

Table 1-1: Number of Potential Development Sites at Risk from Flood Map for Planning Flood Zones

Potential Development Site	Flood Zone 1*	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Residential	75	3	3	22
Employment	22	3	11	5
Mixed use	2	0	0	0
Total	**99**	**6**	**14**	**27**
*Sites with 100% area within Flood Zone 1				

(Sites provided by the Council from the Strategic Housing Land Availability Assessment and Economic Land Review which were undertaken in 2016 - see Section 6.3.1 for more details).

Strategic recommendations, in Section 6.5 of this report, are made for each site at risk, broadly entailing the following:

- Consider withdrawing the site based on level of flood risk (strategic recommendation A);
- Exception Test required if site passes Sequential Test (strategic recommendation B);
- Consider site layout and design if site passes Sequential Test (strategic recommendation C);
- Site-specific FRA required (strategic recommendation D); and
- Site permitted on flood risk grounds due to no perceived risk, subject to consultation with the LPA / LLFA (strategic recommendation E).

In summary:

- Out of the 146 sites provided for assessment by SBC, 27 are within or partially within the functional floodplain (Flood Zone 3b), it is recommended that Flood Zone 3b areas are excluded from development planning. On this basis that 3b is avoided then none of these sites would be recommended for withdrawal.
- Based on this initial screening there are 6 sites which require further investigation into whether appropriate application of SuDS or onsite storage can be proposed due to significant risk from surface water flooding, if not they will be recommended for withdrawal based on significant surface water flood risk.
- Additionally, there are four residential sites which are located within Flood Zone 3A, which may require the appropriate application of SuDS or onsite storage to help pass the sequential test.

Included along with this report as part of the SFRA are:

- Detailed interactive GeoPDF maps showing all available flood risk information together with the potential development sites - Appendix A;
- Development Site Assessment spreadsheet detailing the risk to each site with recommendations on development - Appendix B;
- A note on the delineation of the functional floodplain following discussion and agreement between SBC and the EA - Appendix C; and
- Stockton-On-Tees Borough Council Supporting Drainage Information Chart for Planning Applications - Appendix D.

Contents

List of Figures

List of Tables

Abbreviations

ABD ..... Areas Benefitting from Defences
ACD ..... Area of Critical Drainage
AEP ..... Annual Exceedance Probability
AIMS ..... Asset Information Management System
AStGWF ..... Areas Susceptible to Groundwater Flooding
CC ..... Climate change
CCA ..... Civil Contingencies Act
CDA ..... Critical Drainage Area
CFMP ..... Catchment Flood Management Plan
CIL ..... Community Infrastructure Levy
CFB ..... Cleveland Fire Brigade
CSO ..... Combined Sewer Overflow
DCLG ..... Department for Communities and Local Government
DPD ..... Development Plan Documents
DTM ..... Digital Terrain Model
EA ..... Environment Agency
FAA ..... Flood Alert Area
FCA ..... Flood Consequence Assessment
FCDPAG ..... Flood and Coastal Defence Project Appraisal Guidance
FCERM ..... Flood and Coastal Erosion Risk Management Network
FDGiA ..... Flood Defence Grant in Aid
FEH ..... Flood Estimation Handbook
FRA ..... Flood Risk Assessment
FRCC-PPG ..... Flood Risk and Coastal Change Planning Practice Guidance
FRM ..... Flood Risk Management
FRMP ..... Flood Risk Management Plan
FRMS ..... Flood Risk Management Strategy
FRR ..... Flood Risk Regulations
FSA ..... Flood Storage Area
FWA ..... Flood Warning Area
FWMA ..... Flood and Water Management Act
GI ..... Green Infrastructure
GIS ..... Geographical Information Systems
HFM ..... Historic Flood Map
IDB ..... Internal Drainage Board
LA ..... Local Authority
LDF ..... Local Development Framework
LFRMS ..... Local Flood Risk Management Strategy
LLFA ..... Lead Local Flood Authority

LPA ..... Local Planning Authority
LRF ..... Local Resilience Forum
MAFRP ..... Multi-Agency Flood Response Plan
NGO ..... Non-Governmental Organisation
NPPF ..... National Planning Policy Framework
NWL ..... Northumbrian Water Limited
PCPA ..... Planning and Compulsory Purchase Act
PFRA ..... Preliminary Flood Risk Assessment
RBD ..... River Basin District
RBMP ..... River Basin Management Plan
RMA ..... Risk Management Authority
RoFRS ..... Risk of Flooding from Rivers and the Sea Map
RSS ..... Regional Spatial Strategy
SA ..... Sustainability Appraisal
SBC ..... Stockton-On-Tees Borough Council
SEA ..... Strategic Environmental Assessment
SFRA ..... Strategic Flood Risk Assessment
SHLAA ..... Strategic Housing and Land Availability Assessment
SoP ..... Standard of Protection
SPD ..... Supplementary Planning Documents
SuDS ..... Sustainable Drainage Systems
SWMP ..... Surface Water Management Plan
UDP ..... Unitary Development Plan
uFMfSW ..... updated Flood Map for Surface Water
UKCIP02 ..... UK Climate Projections 2002
UKCP09 ..... UK Climate Projections 2009
WFD ..... Water Framework Directive

1 Introduction

Stockton-On-Tees Borough Council (SBC) is a unitary authority consisting of the Local Planning Authority (LPA) and the Lead Local Flood Authority (LLFA). The LPA require a Strategic Flood Risk Assessment (SFRA) to develop the evidence base for its Local Plan and accompanying Sustainability Appraisal (SA). The LLFA, is responsible for managing flood risk from ordinary watercourses, surface water and groundwater whilst also being a statutory consultee on all planning applications submitted to the LPA.

1.1 Commission

SBC commissioned JBA Consulting to undertake an update of the existing Stockton-On-Tees Borough Council Level 1 Strategic Flood Risk Assessment (SFRA) completed in June 2010. At the time of writing, SBC is in the process of preparing its new Local Plan which will take forward the spatial strategy for the Borough and will include the allocation of sites and detailed policies to guide development. As such, the Local Plan will play a direct role in delivering the borough's regeneration and growth objectives which will be informed by this Level 1 SFRA update. The new Local Plan will replace the current Local Plan, and will cover the period up to 2032.

The Local Plan will set out the long term land allocations and other planning policies that will guide development proposals in the borough and will be used to determine planning applications. This SFRA update will help to provide the evidence base in making decisions on where to direct new development to ensure development is located in sustainable locations, in terms of flood risk, enabling the council to initiate the sequential risk-based approach to the allocation of land for development and to identify whether the application of the Exception Test is likely to be necessary.

This update has been carried out in accordance with the Government's latest development planning guidance including the National Planning Policy Framework[3] (NPPF) and flood risk and planning guidance called the Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG). The latest guidance is available online via:

https://www.gov.uk/guidance/flood-risk-and-coastal-change

Other parts of the National Planning Practice Guidance that are relevant to flood risk management include guidance on:

Water Supply, Wastewater and Water Quality (ID34), including measures to ensure the Local Plan contributes to a catchment based approach to water (ID: 34-002) and supports the Northumbria River Basin Plan (ID: 34-003):

https://www.gov.uk/guidance/water-supply-wastewater-and-water-quality

Natural Environment and Green Infrastructure (ID8), measures to encourage green infrastructure can help improve drainage and manage flooding and water resources (ID: 8-030):

https://www.gov.uk/guidance/natural-environment

Climate change (ID6), including considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development (ID: 6-003):

https://www.gov.uk/guidance/climate-change

The full list of PPG documents can be found via:

https://www.gov.uk/government/collections/planning-practice-guidance

This updated SFRA makes use of the most up-to-date flood risk datasets to assess the extent of risk, at a strategic level, to potential development allocation sites identified by SBC. Included within the SFRA are this report together with appendices containing SFRA maps showing the potential sites overlaid with the latest, readily available, gathered flood risk information and a Development Site Assessment spreadsheet indicating the level of flood risk to each site following a strategic assessment of risk. This information will allow SBC to identify the strategic

3 http://planningguidance.communities.gov.uk/blog/policy/

development options that may be applicable to each site and to inform on the need for the application of the Sequential Test.

1.2 Stockton-On-Tees Borough Council Level 1 SFRA Update

The Level 1 SFRA Update was undertaken by JBA Consulting in June 2010. SBC, as LPA requires a SFRA to develop the evidence base for their new Local Plan and to inform the Sustainability Appraisal (SA). This SFRA update is required to initiate the sequential risk-based approach to the allocation of land for development and to identify whether application of the Exception Test is likely to be necessary.

1.2.1 Scope and Objectives:

The objectives of this Level 1 SFRA update are:

- To update on the previous 2010 SFRA using new or updated flood risk information including the climate change allowances.
- To understand flood risk from all sources and to investigate and identify the extent and severity of flood risk throughout the borough. This assessment will enable SBC to apply the Sequential Test in the preparation of the Local Plan, steer development away from those areas where flood risk is considered greatest, ensuring that areas allocated for development can be developed in a safe, cost effective and sustainable manner.
- To form part of the evidence base and inform the Sustainability Appraisal (Incorporating the Strategic Environmental Assessment) for the council's Local Plan.
- To provide guidance for developers and planning officers dealing with applications as well as for the council to fulfil its role as LLFA including advice on the application of SuDS.
- To provide a reference document (this report) to which all parties involved in development planning and flood risk can reliably turn to for initial advice and guidance.
- To provide guidance for developers and planning officers on planning requirements.
- To identify land required for current and future flood management that should be safeguarded as set out in the NPPF.
- To reflect current national policy documentation including the NPPF and its accompanying Flood Risk and Coastal Change Planning Practice Guidance to enable SBC to meet its obligations as defined by the NPPF.
- To supplement current policy guidelines and to provide a straightforward risk based approach to development management in the area.
- To make recommendations on the suitability of potential development sites based on flood risk for SBC's Local Plan.
- To assess surface water flood risk, using the Environment Agency's (EA) third generation surface water flood map, the Risk of Flooding from Surface Water map (RoFSW).
- To provide a reference document (this report) to which all parties involved in development planning and flood risk can reliably turn to for initial advice and guidance.
- To develop a report that forms the basis of an informed development management process that also provides guidance on the potential risk of flooding associated with future planning applications and the basis for site-specific Flood Risk Assessments (FRAs) where necessary.
- To consider a precautionary approach to climate change.
- To provide a suite of interactive GeoPDF flood risk maps illustrating the interaction between flood risk and potential development sites.
- To recommend opportunities offered by new development to reduce the causes and impacts of flooding including to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water.

- To consider any flood risk management infrastructure requirements for new development to feed into the infrastructure delivery plan.

This report begins by outlining the connections between the planning framework and flood risk policy thus discussing legislation, planning policy, flood risk management policy and the roles and responsibilities of key stakeholders. All available sources of flood risk within the local authority area are then examined before an assessment of flood risk to the potential development sites. Conclusions and recommendations are cited at the end of the report.

1.3 SFRA Future Proofing

As discussed, this SFRA has been developed using the most up-to-date data information available at the time of submission. The SFRA has been future proofed as far as possible though the reader should always confirm with the source organisation (SBC) that the latest information is being used when decisions concerning development and flood risk are being made. The Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG), alongside the NPPF, is referred to throughout this SFRA, being the current primary development and flood risk guidance information available at the time of the finalisation of this SFRA.

The EA would usually recommend updating an SFRA every three to four years, unless there is a significant flood affecting the area, in which case an immediate review should be undertaken.

This SFRA uses the EA's Flood Map for Planning version issued in February 2017 to assess fluvial and tidal risk to potential development sites. The Flood Map for Planning is updated at quarterly intervals by the EA, as and when new modelling data becomes available. The reader should therefore refer to the online version of the Flood Map for Planning to check whether the flood zones may have been updated since February 2017. In august 2017 the flood zone were updated however the outlines have not changed.

http://apps.environment-agency.gov.uk/wiyby/37837.aspx

2 Study Area

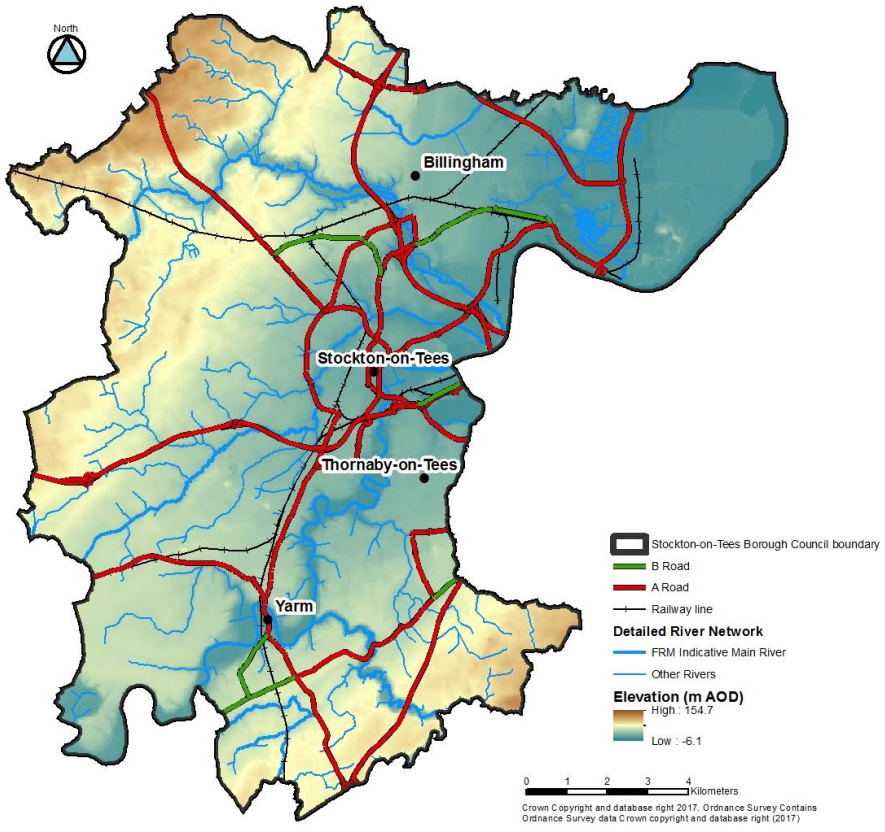
According to the 2011 census population estimates[4], 191,610 people live in the Stockton-On-Tees Borough. The borough covers approximately 20,500 hectares of land and comprises part of the Tees Valley area, along with Hartlepool, Darlington, Middlesbrough and Redcar and Cleveland. The main urban area of the borough is the town of Stockton, which lies to the north of the River Tees. The other main settlements in the area are Billingham to the north and Thornaby-on-Tees, Ingleby-Barwick and Yarm to the south.

The main settlement of Stockton-On-Tees is a market town, established in Anglo-Saxon times next to the River Tees. Historically, the area has relied on trade and shipbuilding, with the engineering and manufacturing industries becoming dominant in the late 19th and early 20th centuries. There was major decline in these industries in the late 20th century, and the main industries are now manufacturing and services. There has been significant regeneration in the town in recent decades, including retail and leisure developments.

The borough lies entirely within the catchment of the River Tees, with most main rivers discharging into the Tees between Stockton and Middlesborough. Cowbridge Beck is a tributary of Greatham Creek, which has its outflow at Tees Mouth.

The topography of the borough reflects the river valley, with steeper ground to the north-west and south-east and lower, flatter ground along river and estuary. The bedrock geology predominantly consists of interbedded mudstone, siltstone, sandstone and conglomerate, with localised areas of limestone to the north-west. The bedrock is overlain by superficial deposits of till, with lacustrine clay around Stockton and Billingham. Alluvial deposits can be found in the Tees river valley, with marine sand and gravel closer to the estuary.

Figure 2-1 Stockton-On-Tees Borough Council SFRA study area



4 http://www.ons.gov.uk/ons/guide-method/census/2011/index.html

2.1 River Tees

The origins of the River Tees are found at Cross Fell in the North Pennines, 760m above sea level. The river flows 160km through the Tees Valley before meeting the North Sea, and collects water from a drainage basin of 1930 square kilometres.

The River Tees runs through a diverse landscape of rolling countryside and picturesque villages to industrial towns and large housing estates. It drains an area of 710 square miles and has a number of tributaries including the River Greta, River Lune, River Balder, River Leven and River Skerne. Despite the industrial riverbanks, the Tees estuary is surprisingly important for its wildlife and plant life, with each season bringing different experiences.

Water levels on part of the River Tees is now controlled by the Tees Barrage. The barrage is located across the River Tees just upriver of Blue House Point in the borough of Stockton-On-Tees and is used to control the flow of the river, maintaining water levels upstream and managing tidal flood risk and climate change impacts. The Tees Barrage comprises a river barrage, road bridge, footbridge, barge lock, and white water course. The waters above the barrage are permanently held at the level of an average high tide and are used for water sports such as canoeing, jet skiing, dragon boat racing and incorporates a 1 km rowing course.

3 Understanding Flood Risk

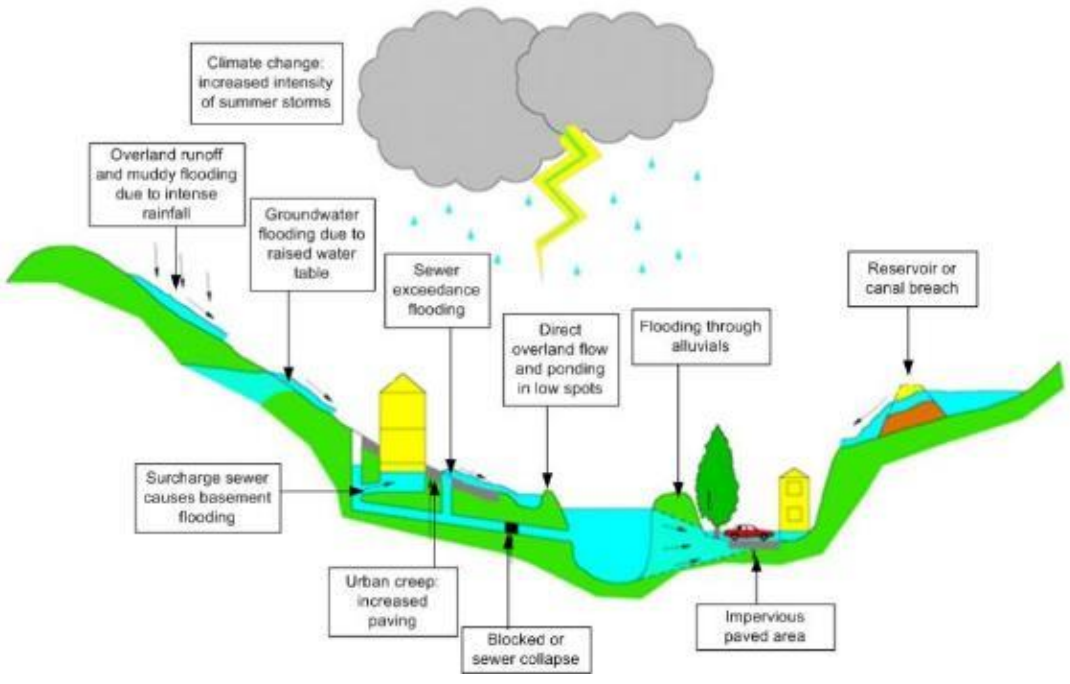
3.1 Sources of Flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and in many different ways. Major sources of flooding include (also see Figure 3-1):

- **Fluvial** (rivers) - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- **Tidal** - sea; estuary; overtopping of defences; breaching of defences; other flows (e.g. fluvial surface water) that could pond due to tide locking; wave action.
- **Surface water** - surface water flooding covers two main sources including direct run-off from adjacent land (pluvial) and surcharging of piped drainage systems (public sewers, highway drains, etc.)
- **Groundwater** - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- **Infrastructure failure** - reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

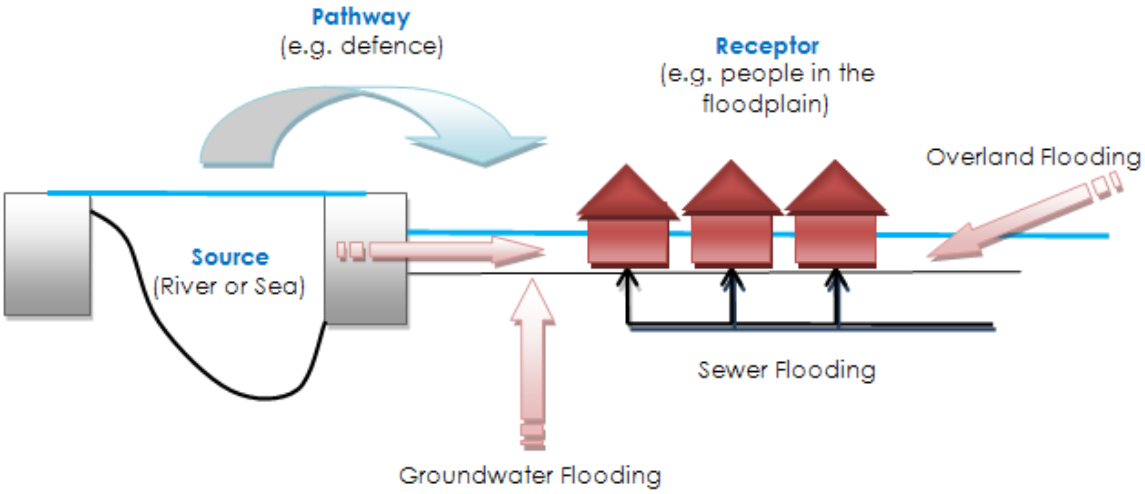
Figure 3-1: Flooding from all sources



3.2 Likelihood and Consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown in Figure 3-2 below. This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. However, it should be remembered that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

Figure 3-2: Source-Pathway-Receptor Model



The principal sources are rainfall or higher than normal sea levels, the most common pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets and the receptors can include people, their property and the environment. All three elements must be present for flood risk to arise. Mitigation measures have little or no effect on sources of flooding but they can block or impede pathways or remove receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk in order to apply this guidance in a consistent manner.

3.2.1 Likelihood

Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates the flood level that is expected to be reached on average once in a hundred years, i.e. it has a 1% chance of occurring in any one year, not that it will occur once every hundred years. Table 3-1 provides an example of the flood probabilities used to describe Flood Zones as defined in the FRCC-PPG and as used by the EA in their Flood Map for Planning (Rivers and Sea)[5].

5 https://flood-map-for-planning.service.gov.uk/

Table 3-1: NPPF Flood Zones[6]

Flood Zone	Annual Probability of Flooding
Zone 1 - Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
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 Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map)

Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 26% (1 in 4) chance of occurring at least once in a 30-year period - the period of a typical residential mortgage
- And a 49% (1 in 2) chance of occurring in a 70-year period - a typical human lifetime

3.2.2 Consequence

The consequences of flooding include fatalities, property damage, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

3.3 Risk

Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above.

3.3.1 Actual Risk

This is the risk 'as is' taking into account any flood defences that are in place for extreme flood events (typically these provide a minimum Standard of Protection (SoP)). Hence, if a settlement lies behind a fluvial flood defence that provides a 1 in 100-year SoP then the actual risk of flooding from the river in a 1 in 100-year event is generally low. However, the residual risk may be high in that the impact of flood defence failure would likely have a major impact.

Actual risk describes the primary, or prime, risk from a known and understood source managed to a known SoP. However, it is important to recognise that risk comes from many different sources and that the SoP provided will vary within a river catchment. Hence, the actual risk of flooding from the river may be low to a settlement behind the defence but moderate from surface water, which may pond behind the defence in low spots and is unable to discharge into the river during high water levels.

6 Table 1, Paragraph 065 of the Flood Risk and Coastal Change Planning Practice Guidance

3.3.2 Residual Risk

Defended sites, located behind EA flood defences remain at residual risk as there is a risk of overtopping or defence breach during significant flood events. Whilst the potential risk of failure may be reduced, consideration of inundation and the impact on development needs to be taken into account.

Paragraph 041 of the FRCC-PPG defines residual risk as:

"…those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual flood risk include:

The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system".

Even when flood defences are in place, there is always a likelihood that these could be overtopped in an extreme event or that they could fail or breach. Where there is a consequence to that occurrence, this risk is known as residual risk. Defence failure can lead to rapid inundation of fast flowing and deep floodwaters, with significant consequences to people, property and the local environment behind the defence.

Whilst the actual risk of flooding to a settlement that lies behind a fluvial flood defence that provides a 1 in 100-year SoP may be low, there will always be a residual risk from flooding if these defences overtopped or failed that must be taken into account. Because of this, it is never appropriate to use the term "flood free".

Developers must be able to demonstrate that development will be safe to satisfy the second part of the Exception Test (see Section 6.7.1). To that end, Paragraph 042 of the FRCC-PPG states:

"Where residual risk is relatively uniform, such as within a large area protected by embanked flood defences, the Strategic Flood Risk Assessment should indicate the nature and severity of the risk remaining, and provide guidance for residual risk issues to be covered in site-specific flood risk assessments. Where necessary, local planning authorities should use information on identified residual risk to state in Local Plan policies their preferred mitigation strategy in relation to urban form, risk management and where flood mitigation measures are likely to have wider sustainable design implications".

4 The Planning Framework and Flood Risk Policy

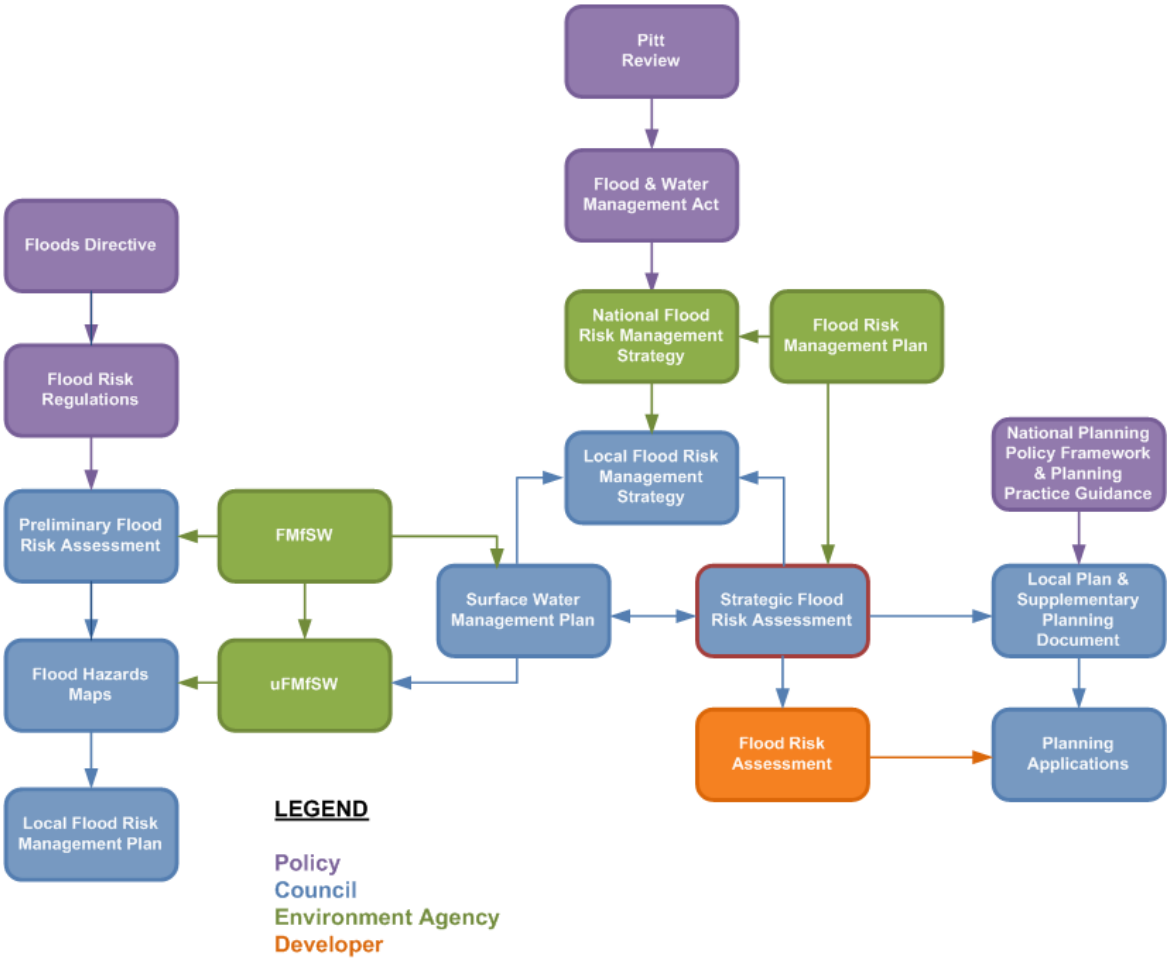
4.1 Introduction

The main purpose of this section of the SFRA is to provide an overview of the key planning and flood risk policy documents that have shaped the current planning framework. This section also provides an overview and context of SBC's responsibilities and duty in respect to managing local flood risk including but not exclusive to the delivery of the requirements of the Flood Risk Regulations (FRR) 2009 and the Flood and Water Management Act (FWMA) 2010.

Figure 4-1 illustrates the links between legislation, national policy, statutory documents and assessment of flood risk. The figure shows that whilst the key pieces of legislation and policy are separate, they are closely related and their implementation should aim to provide a comprehensive and planned approach to asset record keeping and improving flood risk management within communities.

It is intended that the non-statutory SWMPs and SFRAs can provide much of the base data required to support the delivery of the council's statutory flood risk management tasks as well supporting local authorities in developing capacity, effective working arrangements and informing Local Flood Risk Management Strategies (LFRMS) and Local Plans, which in turn help deliver flood risk management infrastructure and sustainable new development at a local level. This SFRA should be used to support SBC's Local Plan and to help inform planning decisions.

Figure 4-1: Key documents and strategic planning links with flood risk



4.2 Legislation

4.2.1 EU Floods Directive & the Flood Risk Regulations

The European Floods Directive (2007) sets out the EU's approach to managing flood risk and aims to improve the management of the risk that floods pose to human health, the environment, cultural heritage and economic activity. The Directive was translated into English law by the Flood Risk Regulations (FRR) 2009 which require Lead Local Flood Authorities (LLFAs) and the EA to produce Flood Risk Management Plans (FRMPs).

The Directive puts in place a six year cycle of producing Preliminary Flood Risk Assessments (PFRAs) with the aim of identifying significant Flood Risk Areas, prepare flood hazard and risk maps and prepare Flood Risk Management Plans (FRMPs). The first six year cycle was completed in December 2015 and the second six year cycle is currently underway.

Figure 4-2: EU Floods Directive

PFRAs should cover the entire area for local flood risk (focusing on ordinary watercourses, surface water and groundwater flooding). Where significant Flood Risk Areas are identified using a national approach (and locally reviewed), the LLFA is then required to undertake flood risk hazard mapping and to produce Flood Risk Management Plans as illustrated in Figure 4-2.

The FRMP would need to consider objectives for flood risk management (reducing the likelihood and consequences of flooding) and measures to achieve those objectives.

The EA has implemented one of the exceptions for creating PFRAs, etc. for main rivers and coastal flooding, as they already have mapping (i.e. EA Flood Map for Planning (Rivers and Sea), Risk of Flooding from Rivers and Sea Map) and plans (i.e. CFMPs, SMPs) in place to deal with this. The EA has therefore focused their efforts on assisting LLFAs through this process.

4.2.1.1 Stockton-On-Tees Borough Council Preliminary Flood Risk Assessment

The SBC PFRA was published in 2011, as required by the FRR, and states the local sources of flooding, excluding Main Rivers but including surface water, groundwater, ordinary watercourses and canals.

The PFRA analysis identified four 1km squares within the Borough of Stockton-On-Tees where 'local flood risk is an issue', as defined by Defra, however there were no significant clusters above the EA threshold of 30,000 people therefore the scale of risk was not considered to be sufficient to consider the borough as a Flood Risk Area at a European level. SBC therefore was not required to produce a Flood Risk Management Plan for its area due to the absence of any designated Flood Risk Areas.

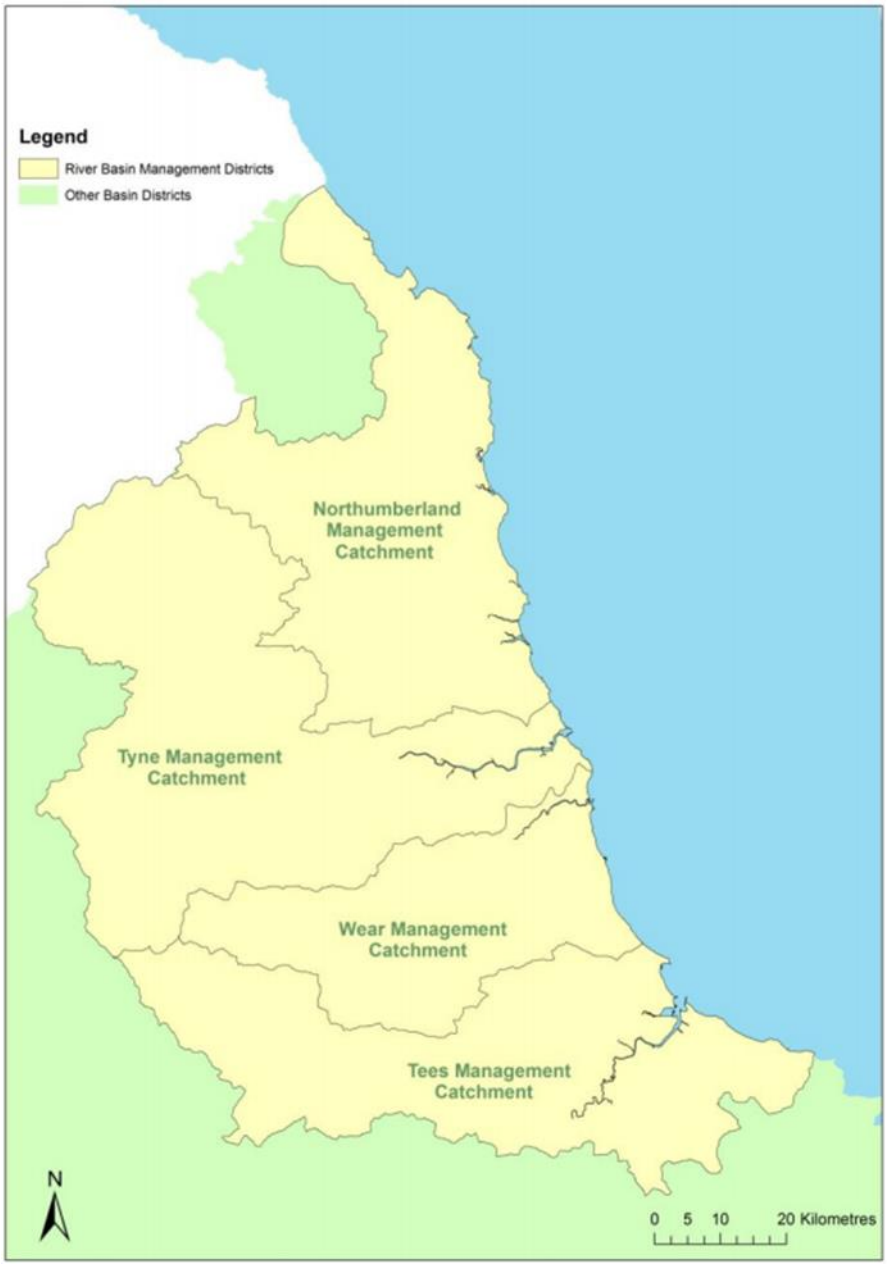
The PFRA process is cyclical and the document was reviewed in June 2017. There have been no significant changes to the original PFRA.

4.2.2 Northumbria River Basin District Flood Risk Management Plan, 2016

Flood Risk Management Plans are designed to set out the risk of flooding from rivers, sea, surface water, groundwater and reservoirs and to detail how risk management authorities will work with communities to manage flood risk up to 2021 for this cycle. Both the River Basin Management Plan and FRMP have been developed by the EA in tandem to ensure that flood defence schemes can provide wider environmental benefits during the same six-year cycle. Both flood risk management and river basin planning form an important part of a collaborative and integrated approach to catchment planning for water. Each EU member country must produce FRMPs as set out in the EU Floods Directive 2007.

The Stockton authority area is within the Northumbria River Basin District and covers 9,029 km2 and four catchments containing 2.78 million people. There are almost 13,000 people at high risk of surface water flooding (more than a 1 in 30 chance of being flooded in any year) and over 6,000 people are at high risk of flooding from rivers and sea with a high 1 in 30 chance of being flooded in any one year, within the Northumbria RBD. Figure 4-3 is an extract from the Northumbria RBD FRMP showing all the catchments within the RBD.

Figure 4-3: Overview of Northumbria RBD catchments



During the December 2015 storms, Desmond, Eva and Frank brought record breaking levels of rainfall and significant flooding to parts of the UK. The highest ever recorded flows were registered in several large catchments including the River Tees, December 2015 was the wettest on record with over 19,000 properties flooded and thousands more affected by loss of power supply or travel disruption across the country. The existing flood defences played an essential role in protecting thousands of homes from further damage.

River Tees Catchment

The Tees catchment is located in the north east of England. It has three main rivers, the River Tees, the River Skerne and the River Leven. The River Tees drains the eastern slopes of Cross Fell in the Pennines and flows eastward to the North Sea. The length of the channel from source to sea is approximately 160 kilometres.

The River Tees drains the eastern slopes of Cross Fell in the Pennines and flows eastward to the North Sea. The length of the channel from source to sea is approximately 160 kilometres. The catchment has areas with distinctly different characteristics. The rivers in the Upper Tees have steep channel gradients and valley sides. In the mid-catchment, the valley widens out and channel slopes become much gentler. The lower catchment is close to sea level and predominantly tidal in nature. The Tees Barrage forms an artificial barrier between the Tees Estuary and the upstream catchment. This helps maintain water levels for amenity purposes and eliminates tidal effects further upstream.

Figure 4-4: River Tees Catchment

4.2.3 Flood & Water Management Act

The Flood and Water Management Act (FWMA) was passed in April 2010. It aims to improve both flood risk management and the way we manage our water resources.

The FWMA has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for LAs, as LLFAs, designed to manage local flood risk (from surface water, ground water and ordinary watercourses) and to provide a strategic overview role of all flood risk for the EA.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by LAs and other key partners. The

integration and synergy of strategies and plans at national, regional and local scales, is increasingly important to protect vulnerable communities and deliver sustainable regeneration and growth. Table 4-1 provides an overview of the key LLFA responsibilities under the FWMA.

Table 4-1: Key LLFA Duties under the FWMA

FWMA Responsibility	Description of duties and powers	SBC LLFA Status
Local Strategy for Flood Risk Management	A LLFA has a duty to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategies will build on information such as national risk assessments and will use consistent risk based approaches across different Local Authority areas and catchments. The local strategy will not be secondary to the national strategy; rather it will have distinct objectives to manage local flood risks important to local communities.	Final version complete and adopted in March 2016
Duty to contribute to sustainable development	The LLFA has a duty to contribute towards the achievement of sustainable development.	Ongoing
Duty to comply with national strategy	The LLFA has a duty to comply with national flood and coastal risk management strategy principles and objectives in respects of its flood risk management functions.	Ongoing
Investigating Flood Incidents	The LLFA, on becoming aware of a flood in its area, has (to the extent it considers necessary and appropriate) to investigate and record details of "locally significant" flood events within their area. This duty includes identifying the relevant risk management authorities and their functions and how they intend to exercise those functions in response to a flood. The responding risk management authority must publish the results of its investigation and notify any other relevant risk management authorities.	Ongoing - investigates flood incidents, prepares S19 reports, maintains incident register 3 investigation reports have been published in 2012/13
Asset Register	A LLFA has a duty to maintain a register of structures or features, which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.	All existing assets mapped. Ownership & condition details ongoing
Duty to co-operate and Powers to Request Information	The LLFA must co-operate with other relevant authorities in the exercise of their flood and coastal erosion management functions.	Ongoing - regular meetings with NW, LPA, EA. Attends RFCC
Ordinary Watercourse Consents	A LLFA has a duty to deal with enquiries and determine watercourse consents where the altering, removing or replacing of certain flood risk management	Ongoing - receives 6-7 per year

FWMA Responsibility	Description of duties and powers	SBC LLFA Status
	structures or features that affect flow on ordinary watercourses is required. It also has provisions or powers relating to the enforcement of unconsented works.	
Works Powers	The Act provides a LLFA with powers to undertake works to manage flood risk from surface runoff, groundwater and on ordinary watercourses, consistent with the local flood risk management strategy for the area.	Ongoing
Designation Powers	The Act provides a LLFA with powers to designate structures and features that affect flooding or coastal erosion. The powers are intended to overcome the risk of a person damaging or removing a structure or feature that is on private land and which is relied on for flood or coastal erosion risk management. Once a feature is designated, the owner must seek consent to alter, remove, or replace it.	Yet to designate structures
Emergency Planning	A LLFA is required to play a lead role in emergency planning and recovery after a flood event.	Cleveland Local Resilience Forum (see Section 7.1.1)
Community Involvement	A LLFA should engage local communities in local flood risk management issues. This could include the training of community volunteers, the development of local flood action groups and the preparation of community flood plans, and general awareness raising around roles and responsibilities plans.	Various ongoing (see Section 7.1.1.2) Community engagement is carried out by the Community Resilience Officer, who is based within the Emergency Planning unit and funded through local levy.
Planning Requirements for SuDS	Sustainable Drainage Systems (SuDS) are to become a planning requirement for major planning applications of 10 or more residential units or equivalent commercial development schemes with sustainable drainage. The LLFA is now a statutory planning consultee and it will be between the LPA and the LLFA to determine the acceptability of these proposed sustainable drainage schemes subject to exemptions and thresholds. Approval must be given before the developer can commence construction. Planning authorities should use planning conditions or obligations to make sure that arrangements are in place for ongoing maintenance of any SuDS over the lifetime of the development.	Flood Risk Engineers provide pre-application advice & statutory consultee responses to major development. Also provides advice to DM on local flood risk issues for non-major development.
Reservoirs	Designate high risk reservoirs, with preparation of a flood plan by the owner, including all relevant data.	

4.2.4 Water Framework Directive & Water Environment Regulations

The purpose of the Water Framework Directive (WFD), which was transposed into English Law by the Water Environment Regulations (2003), is to deliver improvements across Europe in the management of water quality and water resources through a series of plans called River Basin Management Plans (RBMP). The SBC area is covered by the Northumbria Basin Management Plan, managed by the EA and published in 2015. Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques. The Northumbria RBMP, 2015, includes such examples whereby land management techniques have been designed to reduce flood risk whilst also reducing sediment loss and improving water quality.

The EA is responsible for monitoring and reporting on the objectives of the WFD on behalf of Government. They work with Government, Ofwat, local government, non-governmental organisations (NGOs) and a wide range of other stakeholders including local businesses, water companies, industry and farmers to manage water[7].

The second management cycle of the WFD[8] has already begun and the second river basin management plans were completed in 2015, building upon the first set of RBMPs completed in 2009.

The main responsibility for SBC is to work with the EA to develop links between river basin management planning and the development of Local Authority plans, policies and assessments. In particular, the programme of actions (measures) within the RBMP highlights the need for:

- Water Cycle Studies to promote water efficiency in new development through regional strategies and local development frameworks,
- Surface Water Management Plan implementation,
- Considering the WFD objectives (achieving good status or potential as appropriate) in the spatial planning process, including LDDs and Sustainable Community Strategies, and
- Promoting the wide scale use of Sustainable Drainage Systems (SuDS) in new development.

The Tees Valley Water Cycle Study 2012 includes the Stockton-On-Tees Borough (see Section 4.4.4).

4.2.5 Northumbria River Basin District River Basin Management Plan

The Northumbria River Basin District RBMP, managed by the EA, has been updated since the first cycle in 2009. The latest version was published in December 2015. Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques. The Northumbria RBMP includes such examples whereby land management techniques have been designed to reduce flood risk whilst also reducing sediment loss and improving water quality. The plan includes an assessment of river basin characteristics, a review of the impact on human activity, statuses of water bodies, and an economic analysis of water use and progress since the first plan in 2009.

4.3 Planning Policy

4.3.1 National Planning Policy Framework

The NPPF was published in March 2012, and is based on core principles of sustainability. It forms the national policy framework in England and is accompanied by a number of Planning Practice Guidance notes. It must be taken into account in the preparation of Local Plans and is a material consideration in planning decisions. Section 10 Paragraph 100 of the NPPF states that Local Plans…

"...should be supported by a Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other

7 https://www.gov.uk/government/policies/improving-water-quality/supporting-pages/planning-for-better-water

8 http://ec.europa.eu/environment/water/water-framework/info/timetable_en.htm

relevant flood risk management bodies, such as Lead Local Flood Authorities and Internal Drainage Boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by applying the Sequential Test, if necessary applying the Exception Test, safeguarding land from development that is required for current and future flood management, using opportunities offered by new development to reduce the causes and impacts of flooding 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 facilitate the relocation of development including housing to more sustainable locations".

The Sequential Test must be performed when considering the placement of future development and for planning application proposals. The Sequential Test is used to direct all new development to locations at the lowest probability of flooding. It states that development should not be permitted or allocated if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding.

The Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG) sits alongside the NPPF and sets out detailed guidance on how this policy should be implemented.

4.3.2 Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG)

On 6 March 2014, the Department for Communities and Local Government (DCLG) launched their planning practice guidance, including guidance for flood risk and coastal change, which replaces the previous Technical Guidance. This new guidance is available as a web-based resource[9], which is accessible to all and is regularly updated. Whilst the NPPF concentrates on high level national policy, the FRCC-PPG is more detailed. The practice guidance advises on how planning can take account of the risks associated with flooding and coastal change in plan making and the development management process. This is in respect of Local Plans, SFRAs, the sequential and exception tests, permitted development, site-specific flood risk, Neighbourhood Planning, flood resilience and resistance techniques and the vulnerability of development to make development safe from flooding.

The national PPG also includes guidance for water supply, wastewater and water quality. The Local Plan will need to grapple with the contribution that can be made to a 'catchment-based approach' to water.

4.3.3 Planning Act, 2008

This act predominantly applies to streamlining the approval of major national infrastructure development. However, this act also allowed for the streamlining of planning appeals for minor developments by allowing appeals to be heard and considered by a panel of local councillors rather than by a planning inspector. The Community Infrastructure Levy (CIL) was also formed from the Planning Act whereby a local authority could place a levy on a new development to help finance local infrastructure projects designed to benefit the local area, such as a new school, health centre or park improvements.

4.3.4 Localism Act

The Localism Act was given Royal Assent in November 2011 with the purpose of shifting power from Central Government back to local councils, communities and individuals. The Government abolished Regional Spatial Strategies, providing the opportunity for councils to re-examine the local evidence base and establish their own local development requirements for employment, housing and other land uses through the plan making process.

Additionally, this act places a duty to cooperate on local authorities, including statutory bodies and other groups, in relation to the planning of sustainable development. This duty to cooperate requires local authorities to:

9 http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

"...engage constructively, actively and on an ongoing basis in any process by means of which development plan documents are prepared so far as relating to a strategic matter." (Provision 110).

This act, together with the Neighbourhood Planning (General) Regulations 2012, also provides new rights to allow Parish or Town Councils to deliver additional development through neighbourhood planning (Neighbourhood Plans). This means local people can help decide where new homes and businesses should go and what they should look like. Local planning authorities can provide technical advice and support as neighbourhoods draw up their proposals. Neighbourhood Plans have a number of conditions and requirements as set out in the NPPF. Also refer to Paragraph 061-064 of the FRCC-PPG for information on neighbourhood planning and flood risk.

4.3.5 Local Plan

A Local Plan[10] is a statutory document prepared in consultation with the local community. It is designed to promote and deliver sustainable development. Local Plans have to set out a clear vision, be kept up to date and to set out a framework for future development of the local area, addressing needs and opportunities in relation to housing, the economy, community facilities and infrastructure as well as safeguarding the environment and adapting to climate change and securing good design.

Local plans set the context for guiding decisions and development proposals and along with the NPPF, set out a strategic framework for the long-term use of land and buildings, thus providing a framework for local decision making and the reconciliation of competing development and conservation interests. The aim of a Local Plan is to ensure that land use changes proceed coherently, efficiently, and with maximum community benefit. Local plans should indicate clearly how local residents, landowners, and other interested parties might be affected by land use change. They are subject to regular periods of intensive public consultation, public involvement, negotiation and approval. The Local Plan should be the starting point when considering planning applications.

The NPPF requires that the evidence base for the Local Plan must clearly set out what is intended over the lifetime of the plan, where and when this will occur and how it will be delivered. The NPPF states that local plans should be supported by a SFRA and should take account of advice provided by the EA and other flood risk management bodies. The SFRA should be used to ensure that when allocating land or determining planning applications, development is located in areas at lowest risk of flooding. Policies to manage, mitigate and design appropriately for flood risk should be written into the Local Plan, informed by both the Sustainability Appraisal and this SFRA.

Government guidance on Local Plans can be found in Pain the NPPF Local Plan PPG (ID12):

https://www.gov.uk/guidance/local-plans--2

4.3.5.1 Sustainability Appraisal

The Sustainability Appraisal (SA) is a key component of the Local Plan evidence base, ensuring that sustainability issues are addressed during the preparation of local plans. The SA is a technical document which has to meet the requirements of the Strategic Environmental Assessment Directive 2001/42/EC which assesses and reports on a plan's potential impact on the environment, economy, and society. The SA carries out an assessment of the draft policies at various stages throughout the preparation of the Local Plan, and does this by testing the potential impacts, and consideration of alternatives are tested against the plan's objectives and policies. This ensures that the potential impacts from the plan on the aim of achieving sustainable development are considered, in terms of the impacts, and that adequate mitigation and monitoring mechanisms are implemented.

The council has started working towards a new Local Plan for the borough, scheduled for adoption by summer 2018 and a Draft SA Main Report was produced in November 2016 containing the results of a sustainability appraisal and strategic environmental assessment for

10 Town and Country Planning, England. The Town and Country Planning (Local Planning) (England) Regulations 2012

the draft plan. This document was available for consultation between November 2016 and January 2017.

4.3.5.2 The Stockton-On-Tees Local Plan

The Stockton-On-Tees Local Plan, which is currently in the Production phase, is scheduled for adoption by Summer 2018 and will look ahead to the year 2032. A Draft Local Plan was published in November 2016. The aim of the Local Plan is to establish a planning framework for future development, identifying how much land is available and where such land should be provided for new homes and employment, alongside associated infrastructure.

The Draft Local Plan 2016 sets out strategic objectives relating to business, people, place and infrastructure, which will provide a basis for the policies of the Local Plan. Policy SD5 - Environment and Climate Change Strategy includes statements that the Council will meet the challenge of climate change, flooding and coastal change by directing new development towards areas of low flood risk (Flood Zone 1), working with partners and developers to ensure the flood risk is reduced. Additionally, ENV4 is the main flood risk policy flowing from the SD5. This policy aims to reduce and mitigate flood risk. ENV4 discusses that new development will be directed towards areas of low flood risk (Flood Zone 1). In considering proposals elsewhere, the sequential and exception tests will be applied.

4.4 Flood Risk Management Policy

4.4.1 Stockton-On-Tees Borough Council Level 1 SFRA (June 2010)

In 2009, a Level 1 SFRA was commissioned by SBC in order to review the existing Tees Valley SFRA (2007) and produce a Level 1 SFRA for Stockton alone. This SFRA was prepared in accordance with PPS25 and its Practice Guidance. The study analysed current and future flooding issues in order to support the LPA assessment of future development sites, including providing data to inform the application of the Sequential Test.

4.4.2 Stockton-On-Tees Borough Council Level 2 SFRA (June 2010)

The 2010 Level 2 SFRA provided a greater detail on the flood risk at key development and regeneration sites identified in the Level 1 Assessment. These included both tidal and fluvial sites, at Bowesfield, Boathouse Lane, Chandler's Wharf, the Tees Marshalling Yard, Seal Sands and Haverton Hill. The report provided evidence as to whether these sites can be brought forward for development safely, which has been used to fulfil part of the Exception Test.

4.4.3 Flood Risk Management Plans

Flood risk management plans (FRMPs) explain the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs with each FRMP covering a specific river basin district. FRMPs set out how risk management authorities, including the EA and LLFAs, will work with communities to manage flood risk over the period 2015 - 2021. Each EU member country must produce FRMPs as set out in the EU Floods Directive 2007.

The Northumbria FRMP[11] is within the Northumbria River Basin District which covers approximately 9000 square kilometres from the Scottish border to just south of Guisborough and from the Pennines to the North Sea.

Developed by the EA, the 2009 Tees Catchment Flood Management Plan (CFMP)[12] covers the Stockton Borough. The CFMP contains useful information about how the Tees catchment works, previous flooding and the sensitivity of the river system to increased rainfall. The SBC area is contained with Sub-areas 4 (Eastern) and 8 (Northern). The key factors affecting Sub-area 4, which contains Stockton-On-Tees, include future coastal flood risk as a result of sea level rise, high urban flood risk due to culvertisation and channel straightening, and increasing development pressure in the sub-area. Because of this, the CFMP policy is to take further action to reduce flood risk there by actions such as investigating flood storage options, developing a SWMP and developing an asset management plan for flood defences and channel maintenance.

11 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/507123/LIT_10200_NORTHUMBRIA_FRMP_

12 https://www.gov.uk/government/publications/river-tees-catchment-flood-management-plan

Sub-area 8 contains the urban area of Billingham and other northern parts of the SBC area. The CFMP policy for this area is to continue managing flood risk at the current level, and the report therefore recommends continued maintenance of flood defences, as well as investigating the option of utilising flood storage and wetland creation to help reduce the risk of future flooding in Stockton.

The EA may draw on the evidence and previous proposals set out in the CFMP to help develop the FRMP.

4.4.4 Tees Valley Scoping Water Cycle Study (2012)

The objective of the Tees Valley Water Scoping Cycle Study (WCS) was to identify any constraints on housing and employment growth planned for the area up to 2026 that may be imposed by the water cycle and how these can be resolved i.e. by ensuring that appropriate water infrastructure is provided to support the proposed development. Furthermore, it will provide a strategic approach to the management and use of water which ensures that the sustainability of the water environment in the region is not compromised.

The Scoping WCS carried out a high level review of potential future development against the Water Cycle, such as water resources, water treatment and supply, wastewater, sewage treatment, flood risk and other environmental considerations.

4.4.5 National and Local Flood Risk Management Strategies

As presented in Figure 4-1 in Section 4.1, the FWMA establishes how flood risk will be managed within the framework of National Strategies for England and Local Strategies for each LLFA area.

The National Strategy for England has been developed by the EA with the support and guidance of Defra. It sets out principles for how flood risk should be managed and provides strategic information about different types of flood risk and which organisations are responsible for their effective management. The Act requires risk management authorities (local authorities, internal drainage boards, sewerage companies and highways authorities) to work together and act consistently with the National Strategy in carrying out their flood and coastal erosion risk management functions effectively, efficiently and in collaboration with communities, business and infrastructure operators to deliver more effective flood risk management.

LLFAs have responsibility for developing a Local Flood Risk Management Strategy (LFRMS) for their area covering local sources of flooding (see Table 4-2). The local strategy produced must be consistent with the National Strategy. The strategy should set out the framework for local flood risk management functions and activities and should raise awareness of local organisations with responsibilities for flood risk management in the area. The strategy should also facilitate partnership arrangements to ensure co-ordination between local organisations and an assessment of flood risk and plans and actions for managing risk, as set out under section 9 of the FWMA.

4.4.5.1 Stockton-On-Tees Local Flood Risk Management Strategy

The SBC LFRMS was published in June 2016. The Strategy sets out how SBC will manage flood risk from surface water runoff, groundwater and ordinary watercourses for which the Borough Council has a responsibility as LLFA, and other types of flooding where local agents can play a supporting role to lead agencies.

The LFRMS has five objectives:

- Improving flood risk to communities severely affect by recent flooding
- Reducing the incidence of surface water flooding
- Ensuring flood risk is managed in new development
- Keeping our highways safe and passable
- Delivering wider benefits

Measures set out to achieve these objectives are detailed in the report, and include maintenance and improvement to flood risk assets and drainage systems; implementation of flood alleviation schemes at Port Clarence and Lustrum Beck; and a programme of inspection of ordinary watercourses within the borough.

4.4.6 Local Flood Studies

Key findings of recent local flood investigations are detailed below.

4.4.6.1 Flooding Incidents in various locations in the Borough of Stockton-On-Tees, Flood Investigation Report (2012)

On the 25th and 26th September 2012, 24 hours of persistent heavy rain followed the wettest summer on record, resulting in fluvial and surface water flooding of several communities. The most severely affected were those along Lustrum Beck, and those in Norton near Billingham Beck. Traffic disruption also occurred following flooding of the A19/A66 trunk road. The report estimates that 150 properties and businesses were flooded internally, and investigates six specific locations were flooding was severe. Recommendation made in the report included consideration of all potential flood alleviation schemes and Property Level Protection (PLP) at Browns Bridge/Newton, Hartburn, Orde Wingate Way Businesses/Primrose Hill Area and Portrack Retail Park. The report includes an Action List for each specific location, with a review date for each action recommended.

4.4.6.2 Ilkeston Walk, Hardwick Flood Investigation Report (2013)

On 18th May 2013, localised intense rainfall caused surface water flooding on Ilkeston Walk in the Hardwick area of Stockton-On-Tees. 9 properties were flooded internally, with a further 3 evacuated due to the risk of flooding. The report determined that the flooding was a result of run off from an adjacent field known as the Arquiva site, and suggests that mitigation measures may include the installation of a drainage system in the field, which would be for the consideration of the site owners. PLP measures such as flood doors and one way brick covers were also recommended for properties at risk, which it would be the responsibility of the Council to bid for funding for.

4.4.6.3 Tees Tidal Flooding Flood Investigation Report (2013)

On 5th December 2013, tidal flooding occurred within the Stockton borough due to a combination of a high spring tide and a low pressure system causing a positive tidal surge. The total tide height was 4.09m AOD, which surpassed the recorded historic events in the area. 32 residential properties were internally flooded at Port Clarence, as well as 20 businesses across Port Clarence, Billingham Reach Industrial Estate and Seal Sands. There was significant infrastructure damage, including the closure of the A19 Portrack interchange and partial closure of the A66 trunk road at Teesside Park. Breach of the flood defences at Greatham Creek flooded a large area of land, which had a significant and long lasting effect on the local chemical industry. The speed of inundation and late issue of flood warnings lead to issues with evacuations in Billingham Reach, and at the peak of the event around 250 residents were evacuated from Port Clarence.

The report states that a flood defence scheme at Port Clarence and Greatham South was due to be started in March 2015, which was reported as completed in early 2016. These defences aim to provide the standard of protection to withstand the 1% AEP event. The report also recommends a review of the incident warning process, which may allow more time for evacuation in future events.

4.4.6.4 Lustrum Beck Flood Alleviation Scheme (2016)

A flood alleviation scheme has been constructed at Lustrum Beck, the scheme includes a lifting screen at Primrose Hill culvert, which is operated during high flow conditions. Londonderry Bridge has been demolished and rebuilt, going from a four span bridge to a single span, allowing for greater flows. Flood walls and embankments have been constructed at Bedford Street, Bishopton Road and Duddon Walk, with a sustainable drainage scheme being constructed on the site of the former Adult Training Centre on Wrensfield Road. A second phase of the scheme

is due to be constructed in 2018-20, which provides increased protection through a natural flood risk management approach in the upstream area of Coatham Woods.

4.4.7 Surface Water Management Plans

In June 2007, widespread extreme flooding was experienced in the UK. The Government review of the 2007 flooding, chaired by Sir Michael Pitt recommended that…

"…Local Surface Water Management Plans (SWMPs) … coordinated by local authorities, should provide the basis for managing all local flood risk."

The Government's guidance document[13] 2011 for SWMPs defines a SWMP as:

- *A framework through which key local partners with responsibility for surface water and drainage in their area, work together to understand the causes of surface water flooding and agree the most cost-effective way of managing surface water flood risk.*
- *A tool to facilitate sustainable surface water management decisions that are evidence based, risk based, future proofed and inclusive of stakeholder views and preferences.*
- *A plan for the management of urban water quality through the removal of surface water from combined systems and the promotion of SuDS.*

As a demonstration of its commitment to SWMPs as a structured way forward in managing local flood risk, Defra announced an initiative to provide funding for the highest flood risk authorities to produce SWMPs. *No high risk locations were identified in Stockton-On-Tees as part of this process*.

4.4.8 Flood Risk Partnerships and Partnership Plans

SBC has been involved in the development of several partnerships designed to provide collaboration between public agencies, businesses and the community. Partnerships and plans that affect the borough include:

- Community Emergency Plans (at the town / parish council level)
- Cleveland Local Resilience Forum (CLRF)
- Community Risk Register
- Tees Valley Strategic Flood Risk Management Partnership
- NWL Liaison Meetings
- Northumbria Regional Flood and Coastal Committee, (NRFCC)
- Inland Liaison Meeting
- Northumbria Integrated Drainage Partnership
- Darlington Partnership

See Section 7 on Emergency Planning for more information.

4.4.9 Green Infrastructure Assessments

Open space, or Green Infrastructure, should be designed and managed as a multifunctional resource capable of delivering a wide range of environmental and quality of life benefits for local communities and should be provided as an integral part of all new development, alongside other infrastructure such as utilities and transport networks.

Open space can provide many social, economic and environmental benefits close to where people live and work including:

- Places for outdoor relaxation and play;
- Space and habitat for wildlife with access to nature for people;
- Environmental education;
- Local food production - in allotments, gardens and through agriculture;

13 Surface Water Management Plan Technical Guidance - https://www.gov.uk/government/publications/surface-water-management-plan-technical-guidance

- Improved health and well-being – lowering stress levels and providing opportunities for exercise;
- Climate change adaptation - for example flood alleviation and cooling urban heat islands.

The NPPF explains that open space can perform many functions, including flood risk mitigation, and that Local Plans should account for increased flood risk, resulting from climate change, through the planning of Green Infrastructure (GI). GI can have an important role to play in reducing the likelihood of flooding by providing space for flood storage, reducing runoff and increasing infiltration, whilst also providing other benefits as stated above.

Alongside GI should be the implementation of Sustainable Drainage Systems (SuDS), specifically within potential development sites, where possible. The suitability of GI and SuDS can be informed by this SFRA through utilisation of open space for water in the areas of greatest flood risk.

4.4.10 Stockton-On-Tees Green Infrastructure Strategy Supplementary Planning Document (2011)

Green Infrastructure incorporates all types of open spaces, water bodies and environmental features within and between our towns and cities. Strategically planned and well-managed green infrastructure performs many different functions which in turn deliver multiple environmental, social, health and economic benefits. This Strategy and associated Action Plan provides a framework for the future development and management of the Borough's green infrastructure. The Strategy has been developed, and will be delivered, through a partnership approach - overseen by the Stockton-On-Tees Green Infrastructure Steering Group

The Stockton-On-Tees Green Infrastructure Strategy provides a framework for the future development and management of the Borough's green infrastructure. It aims to enhance our environment and to maximise the contribution it makes to people's well-being and quality of life. It also looks ahead to the challenges facing the Borough and shows how we can begin to meet some of those challenges through the way we plan and manage green infrastructure; for example, by helping to adapt to climate change and contributing to the on-going regeneration of Stockton-On-Tees.

The Stockton-On-Tees Strategy is not one standing report and is not meant to be seen in isolation. It complements the existing Tees Valley Green Infrastructure Strategy14, supports delivery of the Borough's Sustainable Community Strategy15, and is integrated into the emerging Stockton-On-Tees Borough Local Development Framework.

4.5 Roles and Responsibilities

The responsibilities for the Risk Management Authorities (RMA) under the Flood and Water Management Act and the Flood Risk Regulations are summarised below.

4.5.1 EA as a RMA

- Has a strategic overview role for all forms of flooding;
- Has the power to request information from any partner in connection with its risk management functions;
- Must exercise its flood or coastal erosion risk management functions in a manner consistent with the National Strategy and Local Strategies;
- Must be consulted on Local Strategies, if affected by the strategy, by the LLFA;
- Must help advise on sustainable development.

4.5.2 SBC LPA as a RMA

- Has a duty to act in a manner that is consistent with the National Strategy and have regard to Local Strategies;

14 Published in 2008 and available at: http://www.stockton.gov.uk/greeninfrastructure

15 Shaping Our Future: A Sustainable Community Strategy for the Borough of Stockton-on-Tees 2008-2021: http://www.stockton.gov.uk/citizenservices/plans/sustainablecommunitystrategy/

- Must be consulted on Local Strategies, if affected by the strategy, by the LLFA;
- Has a duty to be subject to scrutiny from the LLFA;
- Has a duty to cooperate and share information with other RMAs;

4.5.3 SBC LLFA as a RMA

- Must develop, maintain, apply and monitor a strategy for local flood risk management. This must be consulted on with all RMAs, the public and all other partners with an interest in local flood risk, and must comply with the National Strategy;
- Is required to coordinate and share information on local flood risk management between relevant authorities and partners;
- Is empowered to request information from others when it is needed in relation to its flood risk management functions;
- Must investigate significant flooding incidents in its area where it considers it necessary or appropriate;
- Has a duty to establish and maintain a record of structures within its area that it considers to have a significant impact on local flood risk;
- Is empowered to designate structures and features that affect flooding;
- Has powers to undertake works to manage flood risk from surface runoff, groundwater and ordinary watercourses;
- Must exercise its flood and coastal erosion risk management functions in a manner consistent with the National Strategy and the Local Strategy;
- Is permitted to agree the transfer of responsibilities for risk management functions (except the production of a Local Strategy) to other RMAs;
- Must aim to contribute to sustainable development;
- Should consider flooding issues that require collaboration with neighbouring LLFAs and other RMAs.
- The LLFA is a statutory consultee of the planning process and provides advice on major planning applications.

4.5.4 Northumbrian Water Limited as a RMA

- Has a duty to act in a manner that is consistent with the National Strategy and have regard to Local Strategies;
- Must be consulted on Local Strategies, if affected by the strategy, by the relevant LLFA;
- Has a duty to be subject to scrutiny from LLFAs;
- Has a duty to cooperate and share information with other RMAs;
- Is responsible for managing the risks of flooding from water and foul or combined sewer systems providing drainage from buildings and yards.

4.5.5 Highways Authority (SBC) and Highways England as RMAs

- Have a duty to act consistently with the National Strategy and Local Strategies;
- Have responsibility for ensuring effective drainage of local roads in so far as ensuring drains and gullies are maintained;
- Must be consulted on Local Strategies, if affected by the Strategy, by the LLFA;
- Have a duty to be subject to scrutiny from LLFAs.

4.5.6 The Local Community

- Must be consulted on Local Strategies by the LLFA;
- Has a key role in ensuring local strategies are capable of being successfully delivered within the community. They should actively participate in this process and be engaged by the LLFA.

4.5.7 Riparian Owners

A riparian owner is someone who owns land or property alongside a river or other watercourses. A watercourse is any natural or artificial channel through which water flows including flow through a culvert, ditch, drain, cut, dyke, sluice or private sewer.

Riparian owners have statutory responsibilities, including:

- Maintaining watercourses;
- Allowing the flow of water to pass without obstruction;
- Controlling invasive alien species

Further guidance for riverside property owners can be found in the EA's helpful booklet 'Living on the Edge'[16].

4.5.8 Developers

- Have a vital role in ensuring effective local flood risk management by avoiding development in areas at risk of flooding. Local Strategies should form a key element of local planning guidance.

Table 4-2 provides an overview of the key LLFA responsibilities under the FWMA.

Table 4-2: Key LLFA Duties under the FWMA

FWMA Responsibility	Description of duties and powers	SBC LLFA Status
Local Strategy for Flood Risk Management	A LLFA has a duty to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategies will build on information such as national risk assessments and will use consistent risk based approaches across different LA areas and catchments. The local strategy will not be secondary to the national strategy; rather it will have distinct objectives to manage local flood risks important to local communities.	Adopted
Duty to contribute to sustainable development	The LLFA has a duty to contribute towards the achievement of sustainable development.	Ongoing
Duty to comply with national strategy	The LLFA has a duty to comply with national flood and coastal risk management strategy principles and objectives in respects of its flood risk management functions.	Ongoing
Investigating Flood Incidents	The LLFA, on becoming aware of a flood in its area, has (to the extent it considers necessary and appropriate) to investigate and record details of "locally significant" flood events within their area. This duty includes identifying the relevant risk management authorities and their functions and how they intend to exercise those functions in response to a flood. The responding risk management authority must publish the results of its investigation and notify any other relevant risk management authorities.	Ongoing
Asset Register	A LLFA has a duty to maintain a register of structures or features, which it considers to have a significant effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.	Available
Duty to co-operate and Powers to Request Information	The LLFA must co-operate with other relevant authorities in the exercise of their flood and coastal erosion management functions.	Ongoing

16 https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities

FWMA Responsibility	Description of duties and powers	SBC LLFA Status
Ordinary Watercourse Consents	A LLFA has a duty to deal with enquiries and determine watercourse consents where the altering, removing or replacing of certain flood risk management structures or features that affect flow on ordinary watercourses is required. It also has provisions or powers relating to the enforcement of unconsented works.	Ongoing
Works Powers	The Act provides a LLFA with powers to undertake works to manage flood risk from surface runoff, groundwater and on ordinary watercourses, consistent with the local flood risk management strategy for the area.	Ongoing
Designation Powers	The Act provides a LLFA with powers to designate structures and features that affect flooding or coastal erosion. The powers are intended to overcome the risk of a person damaging or removing a structure or feature that is on private land and which is relied on for flood or coastal erosion risk management. Once a feature is designated, the owner must seek consent to alter, remove, or replace it.	Ongoing
Emergency Planning	A LLFA is required to play a lead role in emergency planning and recovery after a flood event.	Cleveland Local Resilience Forum (Section 7.1.1)
Community Involvement	A LLFA should engage local communities in local flood risk management issues. This could include the training of community volunteers, the development of local flood action groups and the preparation of community flood plans, and general awareness raising around roles and responsibilities plans.	Various ongoing (Section 7.1.1)
Planning Requirements for SuDS	Sustainable Drainage Systems (SuDS) are to become a planning requirement for major planning applications of 10 or more residential units or equivalent commercial development schemes with sustainable drainage. The LLFA is now a statutory planning consultee and it will be between the LPA and the LLFA to determine the acceptability of these proposed sustainable drainage schemes subject to exemptions and thresholds. Approval must be given before the developer can commence construction. Planning authorities should use planning conditions or obligations to make sure that arrangements are in place for ongoing maintenance of any SuDS over the lifetime of the development.	Adopted November 2015
Latest changes to FWMA legislation[17]		

17 http://www.legislation.gov.uk/ukpga/2010/29

5 Flood Risk within Stockton-On-Tees Borough

5.1 Flood Risk Datasets

This section of the SFRA provides a strategic overview of flood risk from all sources within the borough. The information contained is the best available at the time of publication and is intended to provide SBC with an overview of risk. Where further detail is available, then the source of information is provided. Table 5-1 provides a summary of the key datasets used in this SFRA according to the source of flooding.

Table 5-1: Flood source and key datasets

Flood Source	Datasets / Studies
Fluvial	EA Flood Map for Planning (Rivers and Sea) (Feb 2017 version)
	EA Risk of Flooding from Rivers and the Sea Map
	EA Flood Risk Mapping Studies
	Historic evidence – EA Historic Flood Map
	Tees Catchment Flood Management Plan
	EA 2009 Bowesfield-Boathouse Lane Model - rerun with latest LiDAR for SFRA
Pluvial (surface water runoff)	EA updated Risk of Flooding from surface Water (RoFSW)
	SBC Preliminary Flood Risk Assessment
Sewer	NWL DG5 Register
	NWL Drainage Area Zones
Groundwater	EA Areas Susceptible to Groundwater Flooding (AStGWF)
Canal	Canal & River Trust Asset Database
Reservoir	EA Reservoir Flood Maps (available online)
All sources	SBC Local Flood Risk Management Strategy
	Cleveland Fire Brigade historic flood incident data
	Northumbria River Basin Management Plan
	Northumbria Flood Risk Management Plan
	SBC Level 1 SFRA 2010; SBC Level 2 SFRA 2010
Flood risk management infrastructure	EA flood defence data
	Canal & River Trust Asset Database

5.2 Fluvial Flooding

Fluvial flooding is associated with the exceedance of channel capacity during higher flows. The process of flooding from watercourses depends on a number of characteristics associated with the catchment including geographical location and variation in rainfall; steepness of the channel and surrounding floodplain; and infiltration and rate of runoff associated with urban and rural catchments.

Judging from the EA's Flood Map for Planning, the majority of fluvial flood risk comes from the River Tees. The areas at risk are predominantly within Stockton-On-Tees town.

The interactive SFRA Maps in Appendix A present the EA's Flood Map for Planning which shows the fluvial and tidal coverage of flood zones 2 and 3 across the borough.

5.2.1 EA Flood Map for Planning

The EA's Flood Map for Planning is the main dataset used by planners for predicting the location and extent of fluvial and tidal flooding. This is supported by the CFMPs and FRMPs along with a number of detailed hydraulic river modelling reports which provide further detail on flooding mechanisms.

The Flood Map for Planning provides flood extents for the 1 in 100 AEP fluvial event (Flood Zone 3), the 1 in 200 AEP tidal event (also Flood Zone 3) and the 1 in 1000 AEP fluvial and tidal flood events (Flood Zone 2). Flood zones were originally prepared by the EA using a methodology based on the national digital terrain model (NextMap), derived river flows from the Flood Estimation Handbook (FEH) and two dimensional flood routing. Since their initial release, the EA has regularly updated their flood zones with detailed hydraulic model outputs as part of their national flood risk mapping programme.

The EA Flood Map for Planning is precautionary in that it does not take account of flood defence infrastructure (which can be breached, overtopped or may not be in existence for the lifetime of the development) and, therefore, represents a worst-case scenario of flooding. The flood zones do not consider sources of flooding other than fluvial and tidal, and do not take account of climate change.

The EA also provides a 'Risk of Flooding from Rivers and the Sea Map'. This map shows the EA's assessment of the likelihood of flooding from rivers and the sea, at any location, and is based on the presence and effect of all flood defences, predicted flood levels and ground levels. This dataset is not used in the assessment of flood risk for planning applications. This dataset is further discussed in Section 5.2.3.

This SFRA uses the EA's Flood Map for Planning version issued in February 2017 to assess fluvial and tidal risk to potential development sites, as per the NPPF and the accompanying Flood Risk and Coastal Change Planning Practice Guidance (see Section 6.5.1 for this assessment). The Flood Map for Planning is updated at quarterly intervals by the EA, as and when new modelling data becomes available. The reader should therefore refer to the online version of the Flood Map for Planning to check whether the flood zones may have been updated:

https://flood-map-for-planning.service.gov.uk/

Also, to search for a particular property by postcode to check on the likelihood of flooding in the future, what local factors could cause or contribute to any potential flooding and where to find out more information about managing flood risk to the property, follow the link below:

https://flood-warning-information.service.gov.uk/long-term-flood-risk

5.2.2 Functional Floodplain (Flood Zone 3b)

The functional floodplain forms a very important planning tool in making space for flood waters when flooding occurs. Development should be directed away from these areas.

Table 1, Paragraph 065 of the FRCC-PPG defines Flood Zone 3b as:

"…land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency."

Paragraph 015 of the FRCC-PPG explains 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 to help identify the functional floodplain.

The area identified as functional floodplain should take into account the effects of all flood risk management infrastructure including defences. Areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be identified as functional floodplain. If an area is intended to flood, e.g. an upstream flood storage area designed to protect communities further downstream, then this should be safeguarded from development and identified as functional floodplain, even though it might not flood very often.

A technical note is provided in Appendix C which explains the methodology used in creating the functional floodplain outline. The outline is also displayed on the SFRA Maps in Appendix A.

As part of this SFRA, the Environment Agency provided all its most recent, readily available hydraulic river model 20 or 25 year defended scenario modelled flood outlines for the borough.

Where a 1 in 20 year, defended scenario outline was available, this was used to help define the functional floodplain. Where a 1 in 20 year defended scenario, outline had not been produced, the 1 in 25 year defended scenario outline was used. Where neither outline has been produced, Flood Zone 3 has been used to update the functional floodplain.

The 25 year undefended model outline for the section of the River Tees between Queen Elizabeth Way and the Tees Barrage was updated by rerunning the EA Bowesfield-Boathouse Lane model with the latest LiDAR from 2011. Section 5.2.3 lists the outputs used from the relevant modelling study provided by the EA. The EA Historic Flood Map and Flood Storage Area datasets were also used to create the functional floodplain. The functional floodplain outline was assessed and agreed upon by the LPA, the LLFA and the Environment Agency, based on their local knowledge.

Any site-specific FRAs should further assess areas of functional floodplain through detailed investigation and assessment of the actual risk and extent of any possible functional floodplain.

5.2.3 EA Risk of Flooding from Rivers and the Sea Map

This map shows the likelihood of flooding from rivers and the sea based on the presence and effect of all flood defences, predicted flood levels and ground levels. The map splits the likelihood of flooding into four risk categories:

- High – greater than or equal to 1 in 30 (3.3%) chance in any given year
- Medium – less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%) chance in any given year
- Low – less than 1 in 100 (1%) but greater than or equal to 1 in 1,000 (0.1%) chance in any given year
- Very Low – less than 1 in 1,000 (0.1%) chance in any given year

The Risk of Flooding from Rivers and the Sea Map (RFRSM) is included on the SFRA Maps to act as a supplementary piece of information to assist the LPA in the decision making process for site allocation.

This dataset is not suitable for use with any planning application nor should it be used for the sequential testing of site allocations. The EA's Flood Map for Planning should be used for all planning purposes, as per the FRCC-PPG.

5.3 Surface Water Flooding

Surface water flooding, in the context of the SBC SFRA, includes:

- **Surface water runoff (also known as pluvial flooding); and**
- **Sewer flooding**

Judging from the Risk of Flooding from Surface Water (RoFSW), surface water flooding is prevalent across the borough, particularly in the eastern part along the urbanised coastal plain. The higher, more rural ground to the west of the borough is less at risk, although in settlements such as Hart and Dalton Piercy the risk is higher.

There are certain locations, generally within urban areas, where the probability and consequence of pluvial and sewer flooding are more prominent due to the complex hydraulic interactions that exist in the urban environment. Urban watercourse connectivity, sewer capacity, and the location and condition of highway gullies all have a major role to play in surface water flood risk.

It should be acknowledged that once an area is flooded during a large rainfall event, it is often difficult to identify the route, cause and ultimately the source of flooding without undertaking further site-specific and detailed investigations.

5.3.1 Pluvial Flooding

Pluvial flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. In these instances, the volume of water from rural land can exceed infiltration rates in a short amount of time, resulting in the flow of water over land. Within urban areas, this intensity can be too great for the urban drainage network resulting in excess water

flowing along roads, through properties and ponding in natural depressions. Areas at risk of pluvial flooding can, therefore, lie outside of the fluvial flood zones.

Pluvial flooding within urban areas will typically be associated with events greater than the 1 in 30 year design standard of new sewer systems. NW however are required to provide a lower capacity of a 1 in 20 year design standard though flood risk reduction schemes do strive for a 1 in 40 year design standard. Sewers for adoption use a 1 in 30 year design standard. There is also a residual risk associated with these networks due to possible network failures, blockages or collapses.

The RoFSW are the third generation national surface water flood map, produced by the EA, aimed at helping to identify areas where localised, flash flooding can cause problems even if the Main Rivers are not overflowing. The RoFSW used in this SFRA to assess risk from surface water, has proved extremely useful in supplementing the EA Flood Map for Planning, by identifying areas in Flood Zone 1 which may have critical drainage problems.

5.3.2 Risk of Flooding from Surface Water

The EA updated the second generation uFMfSW in 2013 to produce a third generation national surface water flood map, the updated Flood Map for Surface Water (uFMfSW), now referred to the Risk of Flooding from Surface Water map (RoFSW). RoFSW includes surface water flood outlines, depths, velocities and hazards for the following events:

- 1 in 30 AEP event (high risk)
- 1 in 100 AEP event (medium risk)
- 1 in 1000 AEP event (low risk)

The RoFSW is much more refined than the second generation map in that:

- More detailed hydrological modelling has been carried out using several design rainfall events rather than one for the second generation,
- A higher resolution Digital Terrain Model (DTM) has been used – 2m, compared to 5m for the second generation,
- Manual edits of DTM to improve flow routes at over 91,000 locations compared to 40,000 for the second generation,
- DTM edited to better represent road network as a possible flow pathway, this was not done for the second generation,
- Manning's n roughness (used to represent the resistance of a surface to flood flows in channels and floodplains) values varied using MasterMap Topography layer compared to blanket values for urban and rural land use applied in the second generation surface water flood map.

The National Modelling and Mapping Method Statement, May 2013 details the methodology applied. The RoFSW is displayed on the SFRA Maps.

5.3.3 Sewer Flooding

Combined sewers spread extensively across urban areas serving residential homes, business and highways, conveying waste and surface water to treatment works. Combined Sewer Overflows (CSOs), provide an EA consented overflow release from the drainage system into local watercourses or large surface water systems during times of high flows. Some areas may also be served by separate waste and surface water sewers which convey waste water to treatment works and surface water into local watercourses.

Flooding from the sewer network mainly occurs when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. Pinch points and failures within the drainage network may also restrict flows. Water then begins to back up through the sewers and surcharge through manholes, potentially flooding highways and properties. It must be noted that sewer flooding in 'dry weather' resulting from blockage, collapse or pumping station mechanical failure (for example), is the sole concern of the drainage undertaker.

NWL is the water company responsible for the management of the majority of the borough's drainage network.

5.3.4 Locally Agreed Surface Water Information

EA guidance on using surface water flood risk information recommends that the LLFA, should:

"…review, discuss, agree and record, with the Environment Agency, Water Companies, Internal Drainage Boards and other interested parties, what surface water flood data best represents their local conditions. This will then be known as locally agreed surface water information".

For the purposes of the PFRA, SBC considered locally agreed surface water information that best represents local conditions to be the second generation Flood Map for Surface Water. SBC should now consider the third generation RoFSW as its locally agreed surface water flood information, along with the information provided with the SWMPs.

5.3.5 Critical Drainage Areas (or Council defined Areas of Critical Drainage)

The Town and Country Planning (Development Management Procedure) (England) Order 2010 defines a Critical Drainage Area (CDA) as:

"…an area within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency".

EA guidance on carrying out Flood Risk Assessments[18] states that a FRA should be carried out for sites in Flood Zone 1 that are…

"…in an area with critical drainage problems as notified by the Environment Agency."

The EA has not formally designated any CDAs within the Stockton-On-Tees Borough. The 2010 Level 1 SFRA found that the flooding incidents are sporadically spread throughout Stockton BCs urban area. There were three candidate CDAs identified in the Level 1 SFRA were, Billingham and Seal Sands. Nevertheless, an additional location of Yarm was added in the 2010 Level 2 SFRA.

Table 5-2: 2011 Draft Critical Drainage Areas

CDA	Recommendation
Lustrum Beck	Lustrum Beck has been identified as a Critical Drainage Area (CDA), due to a combined surface water and fluvial flood risk and will probably require a Surface Water Management Plan (SWMP). A SWMP should look in detail at drainage assets and local flood risk and assess feasible options for reducing risk. This may include a drainage strategy for the collection of development sites to identify areas suitable for SUDS and where surface water flow paths could be opened up in new development. A green infrastructure workshop was undertaken for Lustrum Beck and recommends various catchment, source control options.
Billingham	The area of Billingham has a high coverage of surface water flood risk, which ties in (to some extent) with historic flooding records. When feedback from NWL is received, it should be confirmed whether there is an existing risk here, from multiple drainage sources that should be studied in a SWMP. Halidon Way, Billingham has had several instances of flooding, most recently in 2013 due to heavy rainfall affecting a number of individual properties in the area and the shops.
Yarm	High river levels in the Tees cause backing up of the surface water drainage system around Yarm High Street. Development on higher ground in Yarm could increase runoff and exacerbate the problem. This location is

18 https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zone-1-and-critical-drainage-areas

	recommended as a CDA due to the existing drainage system problems and the potential for this risk to increase. The nearby network of Nelly Burdens Beck Catchment is mixture of combined and separate surface and foul sewers with a number of surface water sewers draining east to the River Tees and west to Nelly Burdon's Beck. Nelly burden Beck is known to have flooding in the past.

5.4 Groundwater flooding

Groundwater flooding is caused by the emergence of water from beneath the ground, either at point or diffuse locations. The occurrence of groundwater flooding is usually local and unlike flooding from rivers and the sea, does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

There are several mechanisms that increase the risk of groundwater flooding including prolonged rainfall, high in-bank river levels, artificial structures, groundwater rebound and mine water rebound. Properties with basements or cellars or properties that are located within areas deemed to be susceptible to groundwater flooding are at particular risk. Development within areas that are susceptible to groundwater flooding will generally not be suited to SuDS; however, this is dependent on detailed site investigation and risk assessment at the FRA stage.

5.4.1 Areas Susceptible to Groundwater Flooding (AStGWF)

The EA's national dataset, Areas Susceptible to Groundwater Flooding (AStGWF), is a low resolution map which uses four susceptibility categories to show the proportion of a network of 1 km grid squares where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and is not suitable for planning considerations at a site-specific level. It should only be used as a trigger for further investigation as to the possibility of groundwater flooding.

The AStGWF is shown on the SFRA Maps in Appendix A.

5.5 Canal and Reservoir Flood Risk

5.5.1 Canals

There are canalised watercourses within Stockton-On-Tees Borough. The Canal which is located within Stockton-On-Tees is the River Tees canal. The Tees barrage is used to control the flow of the river, preventing flooding and the effects of tidal change. The Tees Barrage comprises a river barrage, road bridge, footbridge, barge lock, fish pass and white water course. The waters above the barrage are permanently held at the level of an average high tide. Canal & River Trust (CRT) are the navigation authority for the River Tees from a point 200m downstream of the tidal barrage at Stockton on Tees to the extent of the tidal reach a point approximately 200m upstream of Holme Farm at Low Worsall, a total distance of approximately 22Km.

The river is used by a variety of users including:

- Commercial passenger boats,
- Leisure craft - powered and unpowered.
- Smaller craft involved in various river events and activities.
- Water Skiing
- Jet Skiing
- Athletes in unpowered boats training for local, national and international competition
- Angling, walking and other land based activities

- Canal & River Trust (CRT) maintenance vessels also operate at various locations on the river

Canal & River Trust have joint responsibilities for the ornamental canals which run from a point 100m downstream of Princess Diana Bridge to a point 250m downstream of Victoria Bridge covering approximately 1.1km. The ornamental canals are not navigable and CRT's responsibilities are limited to that of land owner only. Some sections of the ornamental canals are managed by adjoining third party land owners. In addition to the ornamental canals CRT also have responsibility for the river basins located on the south side of the river in Stockton on Tees. The basins are not navigable19.

The risk of flooding along a canal is considered residual and is dependent on a number of factors. As canals are manmade systems that are heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with residual risks, similar to those associated with river defences, such as overtopping of canal banks, breaching of embanked reaches or asset (gate) failure as highlighted in Table 5-3. Canals can also have a significant interaction with other sources, such as watercourses that feed them and minor watercourses or drains that cross underneath.

Table 5-3: Canal flooding mechanisms

Potential Mechanism	Significant Factors
Leakage causing erosion and rupture of canal lining leading to breach	Embankments Sidelong ground Culverts Aqueduct approaches
Collapse of structures carrying the canal above natural ground level	Aqueducts Large diameter culverts Structural deterioration or accidental damage
Overtopping of canal banks	Low freeboard Waste weirs
Blockage or collapse of conduits	Culverts

The risks associated with these events are also dependent on their potential failure location with the consequence of flooding higher where floodwater could cause the greatest harm due to the presence of local highways and adjacent property. The focus should be on areas adjacent to raised embankments. The pound length of the canal also increases the consequence of failure, as flows will only cease due to the natural exhaustion of supply. Stop plank[20] (log) arrangements, stop gates and the continued inspection and maintenance of such assets by the Canal & River Trust help to manage the overall risk of a flood event.

5.5.2 Reservoirs

A reservoir can usually be described as an artificial lake where water is stored for use. Some reservoirs supply water for household and industrial use, others serve other purposes, for example, as fishing lakes or leisure facilities. The risk of flooding associated with reservoirs is residual and is associated with failure of reservoir outfalls or breaching. This risk is reduced through regular maintenance by the operating authority. Reservoirs in the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

The EA is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers. LAs are responsible for coordinating emergency plans for reservoir flooding and ensuring communities are well prepared. LAs should work with other members of the Cleveland Local Resilience Forum to develop these plans. See Section 7.1.1 for information on the Cleveland Local Resilience Forum of which SBC is a member.

19 https://canalrivertrust.org.uk/media/library/11811-river-tees-guidance-notes.pdf

20 Wooden boards for dropping into grooves at a narrows; to permit drainage for maintenance work on a canal section or to isolate a leaking section

5.5.3 Reservoir Flood Maps

The EA has prepared reservoir flood maps for all large reservoirs that they regulated under the Reservoirs Act 1975 (reservoirs that hold over 25,000 cubic meters of water).

The maps show the largest area that might be flooded if a reservoir were to fail and release the water it holds, as well as information about the depth and speed of the flood waters. SBC Emergency Planners should have access to this information so they can develop effective Emergency Plans. Due to the sensitivity of the information, any detailed information on reservoirs is not provided within this SFRA.

However, reservoir flood maps can be viewed online only and can be found on the EA's website[21]. The FWMA updated the Reservoirs Act and targeted a reduction in the capacity at which reservoirs should be regulated from 25,000m³ to 10,000m³. This reduction is, at the time of writing, yet to be confirmed meaning the requirements of the Reservoirs Act 1975 should still be adhered to.

The maps show the largest area that might be flooded if a reservoir were to fail and release the water it holds, including information about the depth and speed of the flood waters. In September 2016 the EA produced a RFM guide ' Explanatory Note on Reservoir Flood Maps for Local Resilience Forums – Version 5[22]' which provides information on how the maps were produced and what they contain. Table 5-4 illustrates the key sites which may be affected by reservoir flooding.

The RFM can be viewed nationally at:

https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?map=SurfaceWater#Reservoirs_3-ROFR

Table 5-4: Key sites potentially affected by reservoir flooding

Site Name	Proposed use	Area (ha)
Billingham Riverside	Employment	24.75
Former Tannery Site	Residential	1.43
Bowesfield A	Employment	2.00
Bowesfield B	Employment	0.52
Bowesfield C	Employment	0.81
Bowesfield E	Employment	7.15
Bowesfield Riverside Phase 2	Residential	22.24
Bowesfield Riverside Phase 1	Residential	5.53
Tees Golf Club	Residential	7.90
Teesdale A	Employment	0.79

21 https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?map=SurfaceWater

22 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/558441/LIT_6882.pdf

Chandlers Wharf	Residential	2.90

5.6 Historical Flooding

The Emergency Planning Unit of SBC provided a table listing various flooding incidents that have occurred which required a response from the Emergency Planning Unit. There are no dates associated with these incidents however it provides an indicator of where significant flooding incidents have occurred in the past. This information is presented in Table 5-5 and relate to specific incidents within a part of the settlement. The LFRMS and PFRA also summarise historical flood events that have occurred across the county.

Table 5-5: Known areas that have required a response from the Emergency Planning Unit

Area	Type of Flooding	Date
Yarm on Tees	Fluvial	1995
Lustrum Beck	Fluvial	Events occurring from 1771-2000 Severe flooding Sept 2012
Halidon Way, Billingham	Fluvial	1979 was the most notable, however the area has flooded numerous times. Most recently in 2013
Leven Bridge, Low Lane	Fluvial	2004
Fairfield, Stockton on Tees	Overflow of drainage systems	2010 was the most notable event, however has occurred in previous years to this.
Port Clarence	Culvert failure due to heavy rainfall	1990 main event, however also occurred in 2000, 2005 and 2006 Flooded the tidal surge event of Dec 2013

5.6.1 Cleveland Fire Brigade Flood Incident Data

Cleveland Fire Brigade (CFB) do not plot the extents of any flooding and the incident plot is centred on the flooding location. There are many different types of flooding incidents included, such as leaks in homes, to flooding of properties and subsequent pumping out of water. It was therefore decided not to include this data on the SFRA Maps. Since 2012 to 2016, CFB have attended 48 incidences in Stockton-On-Tees.

5.6.2 Historic Surface Water Flooding

NWL provided a copy of their existing DG5 Register which is used to record flood incidents at the individual property level attributable to water company controlled sewer networks, whether that be from foul and / or surface water sewers. Due to the sensitivity of this information, this data could not be mapped as part of this SFRA. The Register does however list a number of properties that have flooded in the past as a result of surface water / sewer system flooding.

5.6.3 EA Historic Flood Map

The Historic Flood Map (HFM) contains outlines of past fluvial, tidal and groundwater flooding though does not contain any information regarding flood source, return period or date of flood. These outlines can be viewed on the accompanying SFRA Maps in Appendix A.

The HFM outlines show that there has been historical tidal flooding in the area around

5.7 Flood Risk Management

The aim of this section of the SFRA is to identify existing Flood Risk Management (FRM) assets and previous / proposed FRM schemes in the borough. The location, condition and design standard of existing assets will have a significant impact on actual flood risk mechanisms. Whilst

future schemes in high flood risk areas carry the possibility of reducing the probability of flood events and reducing the overall level of risk. Both existing assets and future schemes will have a further impact on the type, form and location of new development or regeneration.

5.7.1 EA Assets

The EA provided an ArcGIS shapefile of its flood defence dataset which shows that there is a large network of flood defence infrastructure throughout the borough, the majority of which are owned and maintained by private owners though a number of other assets are managed by the EA, the local authority or relevant internal drainage board.

The main source of flooding in Stockton-On-Tees borough is tidal and fluvial from the river tees and other urban watercourses. Certain areas can also be prone to surface water flooding. There are extensive sections of fluvial flood defences on the River Tees in the Borough. These defences mainly protect agricultural land from flooding but they also protect the town of Yarm.

Additionally, there are formal defence on Lustrum Beck in Stockton that provide a standard of protection (SoP) up to the 1 in 10 year and on the Tees, that protect Yarm up to the 1 in 50 year event. Lustrum Beck is defended for almost its entire length in the Stockton urban area. The defences were constructed in 1960 to a perceived 1 in 50-year standard of protection of approximately 1 in 10 years, whereas the tidally influenced reaches have a standard of 1 in 150 years.

As well as the ownership and maintenance of a network of formal defence structures, the EA carries out a number of other flood risk management activities that help to reduce the probability of flooding, whilst also addressing the consequences of flooding. These include:

- Maintaining and improving the existing flood defences, structures and watercourses.
- Enforcement and maintenance where riparian owners unknowingly carry out work that may be detrimental to flood risk.
- Identifying and promoting new flood alleviation schemes (FAS) where appropriate.
- Working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is permitted relative to the scale of flood risk.
- Operation of Floodline Warnings Direct and warning services for areas within designated Flood Warning Areas (FWA) or Flood Alert Areas (FAA). EA FWAs are shown on the SFRA Maps in Appendix A.
- Promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are therefore sufficiently prepared in the event of flooding.
- Promoting resilience and resistance measures for existing properties that are currently at flood risk, or may be in the future as a result of climate change.

Tidal Defences:

There are 11km of defences on the estuary downstream of the Tees Barrage. Those on the Tees are primarily located at the confluence with Lustrum Beck and at Port Clarence, downstream of the Transporter Bridge. In addition, there is an earth embankment at Teesside Retail Park, which separates the retail development from the Old River Tees. The Environment Agency is responsible for maintaining all of these structures. Other third party assets include an embankment at the Tees confluence with Billingham Beck.

The Environment Agency has powers and responsibilities for flood risk management on the main river network and the sea. This includes providing a flood warning service.

As well as the ownership and maintenance of a network of formal defence structures, the EA carries out a number of other flood risk management activities that help to reduce the probability of flooding, whilst also addressing the consequences of flooding. These include:

- Maintaining and improving the existing flood defences, structures and watercourses.
- Enforcement and maintenance where riparian owners unknowingly carry out work that may be detrimental to flood risk.

- Identifying and promoting new flood alleviation schemes (FAS) where appropriate.
- Working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is permitted relative to the scale of flood risk.
- Operation of Flood Line Warnings Direct and warning services for areas within designated Flood Warning Areas (FWA) or Flood Alert Areas (FAA). EA FWAs are shown on the SFRA Maps in Appendix A.
- Promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are therefore sufficiently prepared in the event of flooding.
- Promoting resilience and resistance measures for existing properties that are currently at flood risk, or may be in the future as a result of climate change.

5.7.2 SBC Assets

SBC will own and maintain a number of assets throughout the Stockton-On-Tees borough which may include culverts, bridge structures, gullies, weirs and trash screens. The majority of these assets will lie along ordinary watercourses within smaller urban areas where watercourses may have been culverted or diverted, or within rural areas. All these assets can have flood risk management functions as well as an effect on flood risk if they become blocked or fail. In the majority of cases responsibility lies with the riparian/land owner.

As part of their FWMA duties as LLFA, SBC has a duty to maintain a register of structures or features, which are considered to have a significant effect on flood risk, including details on ownership and condition as a minimum.

The Asset Register should include those features relevant to flood risk management function including feature type, description of principal materials, location, measurements (height, length, width, diameter) and condition grade. The Act places no duty on the LLFA to maintain any third party features, only those for which the authority has responsibility as land / asset owner.

The SBC Asset Register has been produced by JBA and is available on the Stockton Council website. Further work on modelling of assets is continuing to advise the Council on potential risk areas.

5.7.3 Water Company Assets

The sewerage infrastructure within the borough of Stockton-On-Tees is likely to be based on Victorian sewers from which there is a risk of localised flooding associated with the existing drainage capacity and sewer system. The drainage system may be under capacity and / or subject to blockages resulting in localised flooding of roads and property. NWL is responsible for the management of the urban drainage system. This includes surface water and foul sewerage. There may however be some private surface water sewers in the borough as only those connected to the public sewer network transferred to the water companies under the Private Sewer Transfer in 2011. Surface water sewers discharging to watercourses did not transfer and would therefore not be under the ownership of NWL, unless adopted under a Section 104 adoption agreement.

Water company assets include Wastewater Treatment Works, Combined Sewer Overflows, pumping stations, detention tanks, sewer networks and manholes.

5.7.4 Future Flood Risk Management Work Programmes

Based on information provided by the EA, there are a number of ongoing and proposed flood risk management work programmes in the borough. In the Flood and Coastal Erosion Risk Management (FCERM) Development Programme, proposed works include Lustrum Beck Flood Alleviation Scheme including Browns Bridge (2017-2021) and Port Clarence and Greatham South Flood Alleviation Scheme (2017-2021).

6 Development and Flood Risk

6.1 Introduction

This section of the SFRA provides a strategic assessment of the suitability, relative to flood risk, of the potential development sites provided by SBC to be considered though the Local Plan.

The information and guidance provided in this chapter (supported by the SFRA mapping in Appendix A and the Development Site Assessment Spreadsheet in Appendix B) can be used by SBC to inform their Local Plan, and provide the basis from which to apply the Sequential Approach in the development allocation and development management process.

Modelled climate change outputs are unavailable for this study therefore a cautious approach to assessing future risk to sites at risk has been adopted. It is often the case that modelled 1 in 1000 year AEP event outlines are similar to modelled climate change scenarios for the 1 in 100 year AEP event. Therefore, Flood Zones 2 and 3 of the EA's Flood Map for Planning have been used as a climate change proxy to provide an indication of risk to sites in the future.

For this SFRA therefore, the assumption should be that the current day Flood Zone 2 will become Flood Zone 3a in 100 years' time and the current functional floodplain could become Flood Zone 3a. Predicting future expansion of the functional floodplain is however more difficult as the functional floodplain extent is based on a number of different criteria, as discussed in Section 5.2.2.

This approach to climate change is precautionary though is considered to be the most pragmatic methodology available. This approach is also consistent with other SFRAs and professional modelling experience. As such, for any sites within Flood Zone 2, the possibility of these sites being within Flood Zone 3a within 100 years' time should be considered.

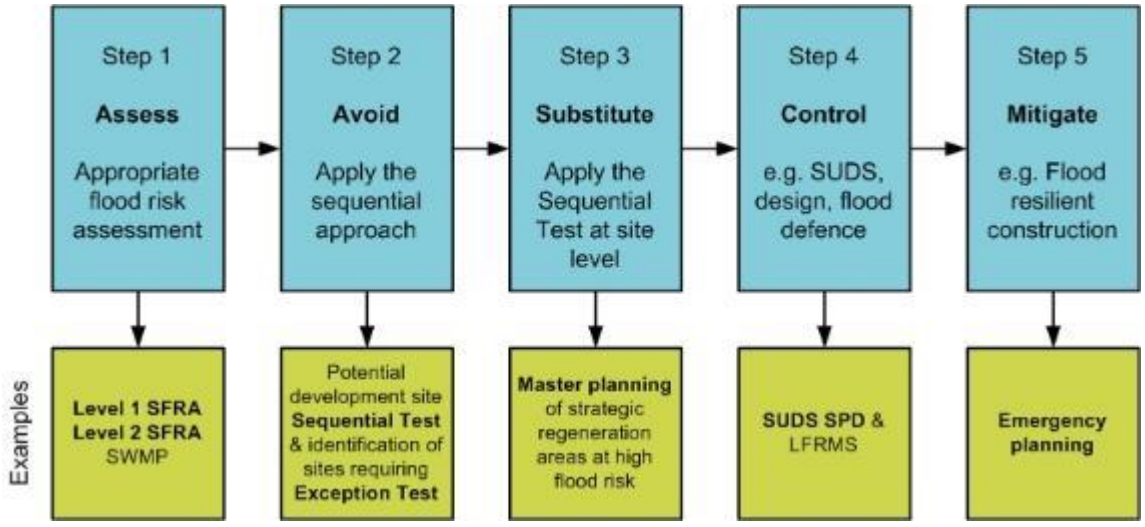
6.2 The Sequential Approach

The Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG) provides the basis for the Sequential Approach. It is this approach, integrated into all stages of the development planning process, which provides the opportunities to reduce flood risk to people, their property and the environment to acceptable levels.

The approach is based around the flood risk management hierarchy, in which actions to avoid, substitute, control and mitigate flood risk is central. For example, it is important to assess the level of risk to an appropriate scale during the decision making process, (starting with this Level 1 SFRA). Once this evidence has been provided, positive planning decisions can be made and effective flood risk management opportunities identified.

Figure 6-1 illustrates the flood risk management (FRM) hierarchy with an example of how these may translate into the council's management decisions and actions.

Figure 6-1: Flood Risk Management hierarchy



The overall aim of the Sequential Approach should be to steer new development to low risk Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, the flood risk vulnerability of land uses and reasonably available sites in Flood Zone 2 should be considered, applying the Exception Test if required.

Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in higher risk Flood Zone 3, be considered. This should take into account the flood risk vulnerability of land uses and the likelihood of meeting the requirements of the Exception Test if required.

There are two different aims in carrying out the Sequential Approach depending on what stage of the planning system is being carried out i.e. LPAs allocating land in Local Plans or determining planning applications for development. This SFRA does not remove the need for a site-specific Flood Risk Assessment at a development management stage.

The following sections provide a guided discussion on why and how the Sequential Approach should be applied, including the specific requirements for undertaking Sequential and Exception Testing.

6.3 Local Plan Sequential & Exception Test

SBC, as the LPA, should seek to avoid inappropriate development in areas at risk of flooding by directing development away from areas at highest risk and ensuring that all development does not increase risk and where possible can help reduce risk from flooding to existing communities and development.

(Guidance on the application of the Sequential and Exception tests through the development management process is provided at Section 6.7.1 of this report).

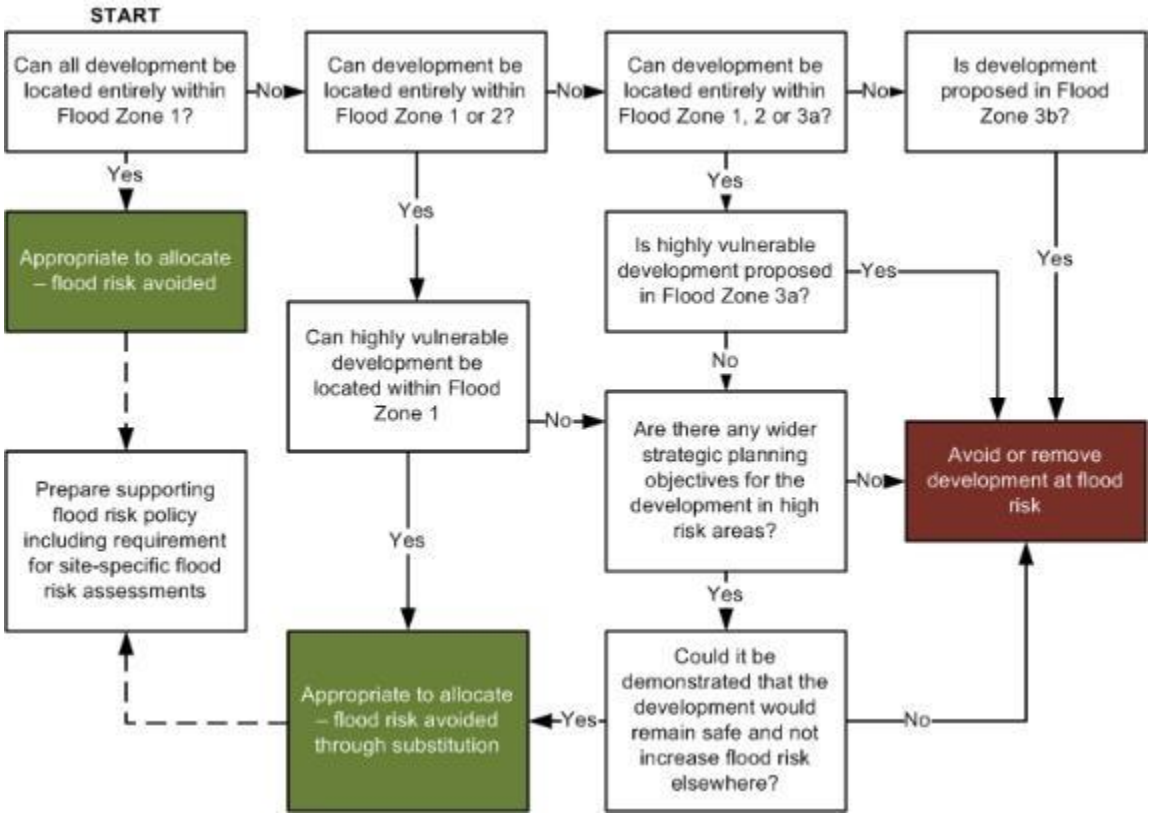
At a strategic level, this should be carried out as part of SBC's Local Plan. This should be done by:

1. Applying the Sequential Test and if the Sequential Test is passed, applying the Exception Test, if required;
2. Safeguarding land from development that is required for current and future flood management;
3. Using opportunities offered by new development to reduce the causes and impacts of flooding and where climate change is expected to increase flood risk so that existing development may not be sustainable in the long term;
4. Seeking opportunities to facilitate the relocation of development including housing to more sustainable locations.

Figure 6-2 illustrates the Sequential and Exception Tests as a process flow diagram using the information contained in this SFRA to assess potential development sites against the EA's Flood Map for Planning flood zones and development vulnerability compatibilities.

This is a stepwise process, but a challenging one, as a number of the criteria used are qualitative and based on experienced judgement. The process must be documented and evidence used to support decisions recorded.

Figure 6-2: Local Plan sequential approach to site allocation



This SFRA provides the main evidence required. This process also enables those sites that have passed the Sequential Test, and may require the Exception Test, to be identified.

For the Exception Test to be passed, the NPPF Paragraph 102 states:

a. *It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and*

b. *A site-specific Flood Risk Assessment (FRA) must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

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

Although actually passing the Exception Test will require the completion of a site-specific FRA, SBC should be able to assess the likelihood of passing the test at the Local Plan level by using the information contained in this SFRA to answer the following questions:

a. Can development within higher risk areas be avoided or substituted?
b. Is flood risk associated with possible development sites considered too high; and will this mean that the criteria for Exception Testing are unachievable?
c. Can risk be sustainably managed through appropriate development techniques (resilience and resistance) and incorporate Sustainable Drainage Systems without compromising the viability of the development?
d. Can the site, and any residual risks to the site, be safely managed to ensure that its occupiers remain safe during times of flood if developed?

In order to fully answer questions b to d, further, more detailed assessment may be required through a Level 2 SFRA.

Where it is unlikely that the Exception Test can be passed due to few wider sustainability benefits, the risk of flooding being too great, or the viability of the site being compromised by the level of flood risk management work required, then SBC should consider avoiding the site all together.

Once the process has been completed SBC should then be able to allocate appropriate development sites through the Local Plan as well as prepare flood risk policy including the requirement to prepare site-specific FRAs for all allocated sites that remain at risk of flooding.

6.3.1 Sustainability Appraisal and Flood Risk

The Sustainability Appraisal should help to ensure that flood risk is taken into account at all stages of the planning process with a view to directing development away from areas at flood risk, now and in the future, by following the sequential approach to site allocation, as shown in Figure 6-2.

By avoiding sites identified in this SFRA as being at significant risk, such as those listed in Section 6.5.1.1, or by considering how changes in site layout can avoid those parts of a site at flood risk, such as any site included within Recommendation C (Section 6.5.1.3), the Council would be demonstrating a sustainable approach to development.

In terms of surface water, the same approach should be followed whereby those sites at highest risk should be avoided or site layout should be tailored to ensure sustainable development. This should involve investigation into appropriate SuDS techniques (see Section 6.8).

Once the Council has decided on a final list of sites following application of the Sequential Test and, where required, the Exception Test following a site-specific FRA, a phased approach to development should be carried out to avoid any cumulative impacts that multiple developments may have on flood risk. For example, for any site where it is required to develop in Flood Zone 3, detailed modelling would be required to ascertain where water displaced by development may flow and to calculate subsequent increases in downstream flood volumes. The modelling should investigate scenarios based on compensatory storage techniques to ensure that downstream or nearby sites are not adversely affected by development on other sites.

Using a phased approach to development, based on modelling results of floodwater storage options, should ensure that any sites at risk of causing flooding to other sites are developed first in order to ensure flood storage measures are in place before other sites are developed, thus ensuring a sustainable approach to site development. Also, it may be possible that flood mitigation measures put in place at sites upstream could alleviate flooding at downstream or nearby sites.

6.4 Local Plan Sites Assessment

Strategic Housing Land Availability Assessment (SHLAA) and Employment Land Review

The SHLAA is an evidence base document that will inform the preparation of the council's Local Plan. LPAs have a requirement under the National Planning Policy Framework (NPPF) to demonstrate a sufficient supply of potential sites suitable for residential development to meet local housing requirements as well as sites for economic development uses.

Housing sites have been identified from a broad range of sources as suggested in PPG, and include sites promoted through an annual "call for sites" exercise; which was last undertaken as part of the consultation on the draft Local Plan. Employment sites included within this assessment are those identified within the Stockton-On-Tees Employment Land Review 2016. The assessments assess sites on their suitability for development, availability and the likelihood of development being financially viable. The assessments are used to inform the Local Plan, but it does not make policy decisions on future site allocations. The inclusion of a site in the assessment does not mean it will be developed, or that the LPA would view an application on the site favourably.

Sites included within the assessments have been considered by this SFRA update. 146 potential sites overall have been assessed and subdivided into several proposed uses including:

- Residential - 103 sites
- Employment - 41 sites
- Mixed use - 2 sites

In order to inform the first part of the Sequential Approach for allocation of development through the Local Plan (illustrated in Figure 6-2), this SFRA has carried out a high level GIS screening exercise which involved overlaying the potential sites against Flood Zones 1, 2, 3a and 3b.

Surface water risk to sites has also been assessed through the EA's updated Flood Map for Surface Water dataset to help identify those sites that may have critical drainage problems. The Development Site Assessment Excel spreadsheet, included in Appendix B, provides a breakdown of each site and the area (ha) and percentage coverage of each flood zone and each surface water flood zone.

Zones 3b, 3a and 2 are considered in isolation. Any area of a site within the higher risk Flood Zones 3b that is also within Flood Zone 3a is excluded from Flood Zone 3a and any area within Flood Zone 3a is excluded from Flood Zone 2. This allows the sequential assessment of risk at each site by addressing those sites at higher risk first.

Table 6-1 provides a count of the number of sites within each Flood Zone.

Table 6-1: Number of potential development sites at risk from Flood Map for Planning flood zones

Potential Development Site	Flood Zone 1*	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Residential	75	3	3	22
Employment	22	3	11	5
Mixed use	2	0	0	0
Total	**99**	**6**	**14**	**27**

*Sites with 100% area within Flood Zone 1

SBC should use the Development Site Assessment spreadsheet in Appendix B to identify which sites should be avoided during the Sequential Test. If this is not the case, or where wider strategic objectives require regeneration in areas already at risk of flooding, then SBC should

consider the compatibility of vulnerability classifications and Flood Zones (refer to FRCC-PPG) and whether or not the Exception Test will be required before finalising sites. The decision making process on site suitability should be transparent and information from this SFRA should be used to justify decisions to allocate land in areas at high risk of flooding.

6.5 Potential Development Sites Review

This section of the report assesses flood risk to potential sites. Section 6.5.1 provides high level broad-brush recommendations for those sites within the flood zones of the Flood Map for Planning. Section 6.5.2 reviews the surface water risk to the potential sites by way of the updated Flood Map for Surface Water.

It is important to note that each individual site will require further investigation, as local circumstances may dictate the outcome of the recommendation. Such local circumstances may include the following:

- Flood depths and hazards will differ locally to each at risk site therefore modelled depth, hazard and velocity data should be assessed for the relevant flood event outlines, including climate change (using the EA's February 2016 allowances), as part of a site-specific FRA.
- Current surface water drainage infrastructure and applicability of SuDS techniques are likely to differ at each site considered to be at risk from surface water flooding. Further investigation would therefore be required for any site at surface water flood risk.
- If sites have planning permission but construction has not started, the SFRA will only be able to influence the design of the development e.g. finished floor levels. New, more extensive flood extents (from new models) cannot be used to reject development where planning permission has already been granted.
- It may be possible at some sites to develop around the flood risk. Planners are best placed to make this judgement i.e. will the site still be deliverable if part of it needs to be retained to make space for flood water.
- Surrounding infrastructure may influence scope for layout redesign/removal of site footprints from risk.
- Current land use. A number of sites included in the assessment are likely to be brownfield, thus the existing development structure could be taken into account as further development may not lead to increased flood risk.
- Existing planning permissions may exist on some sites where the EA may have already passed comment and/or agreed to appropriate remedial works concerning flood risk. Previous flood risk investigations/FRAs may already have been carried out at some sites.

Development viability is assessed, based on the flood risk vulnerability classification in Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance23 (FRCC-PPG), and subsequent strategic recommendations were made and are discussed in this report.

The following strategic recommendations may apply to a site, following application of the Sequential Test by the LPA:

- Strategic Recommendation A - consider withdrawing the site based on significant level of fluvial or surface water flood risk;
- Strategic Recommendation B - Exception Test required if site passes Sequential Test;
- Strategic Recommendation C - consider site layout and design around the identified flood risk if site passes Sequential Test;
- Strategic Recommendation D - site-specific FRA required; and
- Strategic Recommendation E - site permitted on flood risk grounds due to little perceived risk, subject to consultation with the LPA / LLFA.

Table 6-2 Summarises the number of sites that each recommendation applies to.

23 http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/

Table 6-2 Number of sites per Strategic Recommendation (Following Council review of flood risk and development)

Site/Proposed use	Strategic Recommendation				
	A	B	C	D	E
Residential	1	1	1	93	7
Employment	0	0	4	36	1
Mixed use	0	0	0	2	0
Total	**1**	**1**	**5**	**131**	**8**

6.5.1 Flood Map for Planning Site Assessment

The following recommendations provide only a guide, based on the flood risk information made available for this Level 1 SFRA. Information regarding local, site specific information is beyond the scope of this SFRA. It is SBC's responsibility to carry out sequential testing of each site using the information provided in this SFRA and more specifically using their local, site specific knowledge and advice from the EA. These sections should be read alongside the Development Site Assessment spreadsheet in Appendix B.

6.5.1.1 Recommendation A – Consider withdrawal of site

This recommendation DOES NOT take account of local circumstances, only that part of a site area falls within a Flood Zone.

Recommendation A applies to any site within the functional floodplain where the following criteria is true:

- 10% or greater of the site area is within Flood Zone 3b (areas below this indicative threshold are more likely to be manageable through avoidance and development layout) . The FRCC-PPG flood risk vulnerability classification states that only water-compatible uses and essential infrastructure should be permitted in Flood Zone 3b, though any essential infrastructure must pass the Exception Test. Land allocated for housing falls in to the more vulnerable category and sites for employment; retail; recreation and leisure; and mineral and waste are in the less vulnerable category, though waste management sites for hazardous materials fall with the more vulnerable category. Gypsy and traveller sites fall within the highly vulnerable category. Mixed use sites should be placed into the higher of the relevant classes of flood risk sensitivity. Development should not be permitted for sites within the more vulnerable and less vulnerable categories that fall

The 10% threshold is not included within any policy, it is merely considered that it would likely prove difficult for developers to deliver a site where 10% or more of the site area is considered as undevelopable, based on the NPPF. This 10% threshold does not account for local circumstances therefore it may be possible to deliver some of the sites included with Recommendation A upon more detailed investigation. It may also be possible to deliver part of some of the larger sites, dependent upon further investigation, where a significant area is not within Flood Zone 3b. **Error! Reference source not found.**Strategic recommendation A applies to one of the potential development sites.

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within FZ3A	% Area within FZ3b
EPY14	Former Cable Ski Site, Bowesfield Farm	Residential	20.18	54.84	28.36

6.5.1.2 Recommendation B – Exception Test

Recommendation B applies to sites where it is likely the Exception Test would be required. This does not include any recommendation on the likelihood of a site passing the Exception Test. These sites may need to be examined as part of a more in-depth Level 2 SFRA. The developer / LPA should attempt to avoid the risk area where possible.

This recommendation DOES NOT take account of local circumstances, only that part of a site area falls within a Flood Zone.

Recommendation B applies to sites where the following criteria is true:

- 10% or greater of any residential site or essential infrastructure site that is within Flood Zone 3a. Water-compatible and less vulnerable uses of land do not require the Exception Test if in Flood Zone 3a.
- 10% or greater of any mixed use site that may entail residential use that is within Flood Zone 3a.

All development proposals in Flood Zone 3a must be accompanied by a FRA.

The 10% threshold is not included within any policy; it is merely considered that it would be very difficult for developers to avoid Flood Zone 3a when 10% or more of the site area is within it. This 10% threshold does not account for local circumstances therefore it may be possible to avoid Flood Zone 3a altogether for some of the sites included with Recommendation B. It may also be possible to deliver part of some of the larger sites, dependent upon further investigation, where a significant area is not within the FZ3b.

It should be considered that, based on climate change, the 1 in 20 and 1 in 25 year flood event outlines used to create the functional floodplain, may increase in extent in 100 years' time meaning a larger number of sites or a larger percentage area of these sites may be at risk from the 1 in 20 / 25 year flood events. Table 6-3 lists those sites where Recommendation B should apply based on the 10% threshold of site area within Flood Zone 3a. The Development Site Assessment spreadsheet in Appendix B illustrates that there are three sites where Recommendation B needs to be applied.

Table 6-3: Sites which require Exception test

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within FZ3A	% Area within FZ3b
S1	Boathouse Lane	Residential	7.18	37.54	3.35
BR1	Billingham Riverside	a range of Water Compatible, Less Vulnerable and Essential Infrastructure	24.75	46.66	0.00

6.5.1.3 Recommendation C – Consider site layout and design

This recommends a review of site layout and / or design at the development planning stage in order for development to proceed. A Level 2 SFRA may be required or a site-specific FRA would be required to inform on site layout and design.

This recommendation DOES NOT take account of local circumstances, only that part of a site area falls within a Flood Zone.

Recommendation C applies to sites where the following criteria is true:

- <10% of the area of any site type is within Flood Zone 3b.
- <10% of any residential site is within Flood Zone 3a.
- <10% of any mixed use site that may entail residential use is within Flood Zone 3a.
- <10% of any essential infrastructure site is within Flood Zone 3a.

The 10% threshold is not included within any policy, it is merely considered that it may be possible for developers to avoid Flood Zone 3b and Flood Zone 3a when less than 10% of the site area is at risk. This 10% threshold does not account for local circumstances.

The Development Site Assessment spreadsheet in Appendix B categorises those sites with <10% of their area within Flood Zone 3b where site layout should be examined with a view to removing the site footprint from Flood Zone 3b. Depending on local circumstances, if it is not possible to adjust the site boundary to remove the site footprint from Flood Zone 3b to a lower risk zone then development should not be permitted.

Also, listed within the spreadsheet are the residential use sites with <10% of their area within Flood Zone 3a and where site layout and / or design should be examined with a view to removing the site footprint from Flood Zone 3a or incorporating on-site storage of water into site design. Depending on local circumstances, if it is not possible to adjust the site boundary to remove the site footprint from Flood Zone 3a to a lower risk zone or to incorporate on-site storage of water within the site design, then the Exception Test should be undertaken and passed as part of a site-specific FRA.

Overall there are 4 sites to which Recommendation C applies, as listed in Table 6-4. Initially there were 39 sites with a Recommendation C, refer to the spreadsheet in Appendix B. However, the council have confirmed that the development sites can avoid Flood Zone 3.

As discussed in Section 6.1, a precautionary approach to accounting for climate change should be considered by assuming that Flood Zone 2 will become Flood Zone 3a in 100 years' time and Flood Zone 3a could become Flood Zone 3b, though depending on local circumstances.

Any site layout and design should take account of the 8 metre easement buffer along watercourses, from the top of the bank or the landward to of a defence on main rivers, where development is not permitted. This easement buffer is recommended by the EA to allow ease of access to watercourses for maintenance works. Any site redesign, where Flood Zone 3a is included within the site footprint, should allow water to flow naturally or be stored in times of flood through application of suitable SuDS.

The FRCC-PPG (Paragraph 050) states:

Local authorities and developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally

Table 6-4: Sites to consider layout and design to avoid risk areas

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within FZ3a	% Area within FZ3b
NTI2	North Tees Ind Est B	Employment	0.45	100	0.00
NTI3	North Tees Ind Est C	Employment	0.51	100	0.00
NTI1	North Tees Ind Est A	Employment	0.38	100	0.00
T1	Tees Marshalling Yard	Residential	34.49	0.83	0.00

6.5.1.4 Recommendation D – Development could be allocated subject to FRA

This recommends that development could be allocated, assuming a site-specific FRA shows the site can be safe and it is demonstrated that the site is sequentially preferable. A site within Flood Zone 2 could still be rejected if the conclusions of the FRA decide development is unsafe or inappropriate.

This recommendation DOES NOT take account of local circumstances, only that part of a site area falls within a Flood Zone.

Recommendation D applies to sites where the following criteria is true:

- Any site within Flood Zone 2 that does not have any part of its footprint within Flood Zone 3a, except for highly vulnerable developments (such as gypsy and traveller sites) which would be subject to, and have to pass, the Exception Test.
- Any site 100% within Flood Zone 1 where surface water flood risk is apparent on site and therefore recommended for investigation through a site-specific FRA.
- Any site 100% within Flood Zone 1 that is greater than or equal to 1 hectare in area.

Recommendation D applies to 131 potential sites overall.

As discussed previously for other recommendations, a precautionary approach to accounting for climate change should be considered by assuming that Flood Zone 2 will become Flood Zone 3a in 100 years' time.

All development proposals within Flood Zone 2 or Flood Zone 3a must be accompanied by a site-specific Flood Risk Assessment. Any sites 100% within Flood Zone 1 that are equal to or greater than 1 hectare in area must be accompanied by a site-specific Flood Risk Assessment to determine vulnerability to flooding from other sources as well as fluvial and tidal. The FRA should determine the potential of increased flood risk elsewhere as a result of the addition of hard surfaces on-site and the effect of new development on surface water runoff.

The FRCC-PPG states:

"Local authorities and developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally." (Paragraph 50).

6.5.1.5 Recommendation E - Should be allocated on flood risk grounds subject to consultation with the LPA / LLFA

This recommends that development should be allocated on flood risk grounds, based on the evidence provided within this SFRA. Further investigation may be required by the developer and an FRA is required to assess further or new information that may not have been included within this SFRA. Recommendation E applies to 8 sites which equates to around a quarter of the sites (25%) assessed.

As discussed previously for other recommendations, a precautionary approach to accounting for climate change should be considered. For these 8 sites, the SFRA Maps in Appendix A should be consulted to ascertain which sites are in close proximity to Flood Zones 2 and 3a and may therefore be at risk from either flood zone in 100 years' time.

Recommendation E applies to any site with its area 100% within Flood Zone 1 and with either no risk or minimal risk from surface water, based on the Risk of Flooding from Surface Water map.

6.5.2 Surface Water Risk to Potential Sites

This section assesses surface water risk to each site according to the RoFSW. The Development Site Assessment spreadsheet in Appendix B isolates each of the surface water outlines so that any area of a site within the higher risk 1 in 30 year outline is excluded from the medium risk 1 in 100 year outline and any area within the 1 in 100 year outline is excluded from the lower risk 1 in 1000 year outline. This allows a sequential assessment of risk at each site. Table 6-5 shows the number of sites at risk for each event. A number of these sites are also at fluvial and / or tidal flood risk.

NOTE: This assessment of surface water risk to sites DOES NOT take account of local circumstances, only that part of a site area falls within a surface water flood outline of the updated Flood Map for Surface Water.

Table 6-5: Number of sites at risk from surface water flooding

RoFSW event outline	Number of sites at risk	Number of sites with >10% for 30 & 100 yrs. >20% for 1000yrs area at risk
1 in 30 year	104	3
1 in 100 year	114	0
1 in 1000 year	128	6
In reality, sites within the 1 in 30 year outline will also be in the 1 in 100 year outline and those within the 1 in 100 year outline will also be in the 1000 year outline.		

Table 6-5 summarises the number of sites at risk from each surface water flood zone. Of the 152 sites at risk from the higher risk 1 in 30 year event, 3 sites have 10% or more of their site area at risk. No sites have 10% or more of their area at risk from the medium risk 1 in 100 year event and for the lower risk 1 in 1000 year extreme event, 6 sites have 20% or more of their area at risk.

As explained with the fluvial / tidal flood zones, the percentage thresholds are not included within any policy, it is merely considered that where a site has 10% or greater of its area at risk from the 1 in 30 or 1 in 100 year event outlines, or 20% or greater for the 1 in 1000 year event, then it could prove difficult to manage this surface water on-site. Therefore, a site-specific FRA should be carried out to investigate possible mitigation measures for flood storage or infiltration techniques through appropriate SuDS. The percentage thresholds do not consider local conditions. Table 6- lists the sites where surface water flood risk is considered to be significant enough that it may be difficult to develop these sites.

Table 6-6: Sites requiring further investigation based on surface water risk

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within 1 in 30 Year Outline (RoFSW)	% Area within 1 in 100 Year Outline (RoFSW)	% Area within 1 in 1000 Year Outline (RoFSW)
VE1	Land at rear of Elton Manor, Elton Village	Residential	1.17	17.70	12.68	11.20
B7	Land at Wolviston	Residential	7.41	10.55	1.69	3.90
VH1	Fir Tree Farm & Greenfields Farm	Residential	4.21	11.30	5.13	8.99
IB2	Land at corner of Blair Ave Ingleby Barwick	Residential	0.41	0.00	2.41	20.33
T6	Queens Avenue	Residential	0.42	0.93	5.22	74.94
OF	Oxbridge Foundry A	Employment	1.80	1.61	3.72	49.20
TD1	Teesdale C	Employment	0.51	2.91	3.54	34.74
VS2	Land West of Stillington	Residential	0.64	1.52	3.94	20.01

For sites at surface water flood risk the following should be considered:

- Possible withdrawal, redesign or relocation of the site, certainly for those sites at higher risk from the 1 in 30 year event and those with a large percentage area at risk. This applies to the sites listed in Table 6- where further investigation is recommended;
- A detailed site-specific Flood Risk Assessment incorporating surface water flood risk management;
- A FRA may want to consider detailed surface water modelling, particularly for the larger sites which may influence sites elsewhere;
- The size of development and the possibility of increased surface water flood risk caused by development on current Greenfield land, and cumulative impacts of this within specific areas;
- Management and re-use of surface water on-site, assuming the site is large enough to facilitate this and achieve effective mitigation;
- Larger sites could leave surface water flood prone areas as open greenspace, incorporating social and environmental benefits;
- Effective surface water management should ensure risks on and off site are controlled;
- SuDS should be used where possible. Appropriate SuDS may offer opportunities to control runoff to Greenfield rates. Developers should refer to the Tees Valley Authorities Local Standards for Sustainable Drainage[24]. Restrictions on surface water runoff from new development should be incorporated into the development planning stage. For brownfield sites, where current infrastructure may be staying in place, then runoff should attempt to mimic that of Greenfield rates, unless it can be demonstrated that this is unachievable or hydraulically impractical;
- Whether the delineation of areas of critical drainage may be appropriate for areas particularly prone to surface water flooding. Detailed analysis and consultation with the LLFA, NWL and the EA would be required. It may then be beneficial to carry out a Surface Water Management Plan (SWMP) or drainage strategy for targeted locations with any such areas of critical drainage. Investigation into the capacity of existing sewer systems would be required in order to identify critical parts of the system. Drainage model outputs could be obtained to confirm the critical parts of the drainage network and subsequent recommendations could then be made for future development i.e. strategic SuDS sites, parts of the drainage system where any new connections should be avoided, and parts of the system that may have any additional capacity and recommended runoff rates.

6.5.3 Strategic recommendation summary

Table 6-7 summaries the strategic recommendations made for the sites at fluvial and tidal flood risk. Table 6-8 lists the number of sites to which each strategic recommendation applies.

Table 6-7: Summary of strategic recommendations

Recommendation	Outcome	Reasons
A	Consider Withdrawal of Site	10% or greater of the site footprint is within Flood Zone 3b The scale of surface water risk on the site is considered large enough that possible mitigation of the risk on site is deemed unlikely to be achievable
B	Exception Test	10% or greater of the footprint of any residential site or essential infrastructure site is within Flood Zone 3a Greater than 10% of the footprint of any mixed use site that may entail residential use is within Flood Zone 3a

24 https://www.stockton.gov.uk/media/6235/flooding-webpage-update-jane-salisbury-25-02-2016-3msg.pdf

C	Consider site layout and design	Less than 10% of the footprint of the area of any site type is within Flood Zone 3b Less than 10% of the footprint of any residential site is within Flood Zone 3a Less than 10% of the footprint of any mixed use site that may entail residential use is within Flood Zone 3a Less than 10% of the footprint of any essential infrastructure site is within Flood Zone 3a
D	Development could be allocated subject to FRA	Any site within Flood Zone 2 that does not have any part of its footprint within Flood Zone 3a Employment sites within Flood Zone 3a assuming the site use falls within the less vulnerable or water-compatible category of the flood risk vulnerability classification of the FRCC-PPG. No part of the site can be within Flood Zone 3b Any site 100% within Flood Zone 1 where surface water flood risk is apparent on site and therefore recommended for investigation through a site-specific FRA. Any site 100% within Flood Zone 1 that is greater than or equal to 1 hectare in area
E	Should be allocated on flood risk grounds subject to consultation with the LLFA	Any site 100% within Flood Zone 1 that is less than or equal to 1 hectare in area and has no surface water flood risk issues.

Table 6-8: Number of sites per strategic recommendations

Site/Proposed use	Strategic Recommendation				
	A	B	C	D	E
Residential	1	1	1	93	7
Employment	0	0	4	36	1
Mixed use	0	0	0	2	0
Total	**1**	**1**	**5**	**131**	**8**

6.6 Summary of Assessment Options

6.6.1 Rejection of site

A site which fails to pass the Sequential Test and / or the Exception Test would be rejected. Rejection would also apply to any residential (including gypsy and traveller) or employment site, or mixed use schemes with an element of residential development, as this falls into the more vulnerable, less vulnerable or highly vulnerable categories within Flood Zone 3b for which development should not be permitted. The Flood Risk and Coastal Change PPG flood risk vulnerability classification states that only water-compatible uses and essential infrastructure should be permitted in Flood Zone 3b, though any essential infrastructure must pass the Exception Test and clearly demonstrate that it does not increase or exacerbate flood risk. If the developer is able to avoid 3b, part of the site could still be delivered.

In terms of surface water flood risk, if risk is considered significant or where the size of the site does not allow for on-site storage or application of appropriate SuDS then such sites could be rejected. There are six sites which require further investigation as they are at significant risk of surface water which can be seen in table 6-6, however if appropriate SuDS or on-site storage is acceptable these sites will not be rejected.

6.6.2 Exception Test required

For those sites that, according to the FRCC-PPG vulnerability tables, would require the Exception Test. Only water-compatible and less vulnerable uses of land would not require the Exception Test in Flood Zone 3a. More vulnerable uses, including residential, and essential infrastructure are only permitted if the Exception Test is passed and all development proposals in Flood Zone 3a must be accompanied by a Flood Risk Assessment. To avoid having to apply the Exception Test, the developer / LPA should attempt to avoid the risk area altogether.

6.6.3 Consideration of site layout and design

Site layout and site design is important at the site planning stage where flood risk exists. The site area would have to be large enough to enable any alteration of the developable area of the site to remove development from the functional floodplain, or to leave space for on-site storage of flood water within Flood Zone 3a. Careful layout and design at the site planning stage may apply to such sites where it is considered viable based on the level of risk. Surface water risk and opportunities for SuDS should also be assessed during the planning stage. Developers should refer to the Tees Valley Authorities Local Standards for Sustainable Drainage which provides details when and where SuDS are required:

https://www.stockton.gov.uk/media/6235/flooding-webpage-update-jane-salisbury-25-02-2016-3msg.pdf

Depending on local circumstances, if it is not possible to adjust the site boundary to remove the site footprint from Flood Zone 3b to a lower risk zone then development should not be permitted. If it is not possible to adjust the developable area of a site to remove the proposed development from Flood Zone 3a to a lower risk zone or to incorporate the on-site storage of water within site design, then the Exception Test would have to be passed as part of a site-specific Flood Risk Assessment.

Any site layout and design options should take account of the 8 metre easement buffer along watercourses, from the top of the bank or the landward toe of a defence on main rivers, where development is not permitted. This easement buffer is recommended by the EA to allow ease of access to watercourses for maintenance works. Any site redesign, where Flood Zone 3a is included within the site footprint, should allow water to flow naturally or be stored in times of flood through application of appropriate SuDS techniques, as per the Tees Valley Authorities Local Standards for Sustainable Drainage.

6.6.4 Site-Specific Flood Risk Assessment

According to the FRCC-PPG (Para 030), a site-specific FRA is:

"…*carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary (see footnote 20 in the National Planning Policy Framework), the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users (see Table 2 – Flood Risk Vulnerability of PPG).*"

The objectives of a site-specific FRA are to establish:

Whether a proposed development is likely to be affected by current or future flooding (including effects of climate change) from any source. This should include referencing this SFRA to establish sources of flooding. Further analysis should be performed to improve understanding of flood risk including agreement with the council on areas of functional floodplain that have not been specified within this SFRA. Key objectives:

- Whether the development will increase flood risk elsewhere;
- Whether the measures proposed to deal with these effects and risks are appropriate;
- The evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- Whether the development will be safe and pass the Exception Test, if applicable.

The FRCC-PPG doesn't contain any further detail on the minimum requirements for site-specific FRAs. It is therefore important that the EA's FRA guidance[25] is referred to and also the site-specific Flood Risk Assessment Checklist in paragraph 068 of the FRCC-PPG should be consulted. CIRIA's report 'C624 Development and Flood Risk' also provides useful guidance.

When is a Site-Specific FRA Required?

According to NPPF footnote 20, a site-specific FRA should be prepared when the application site is:

- Situated in Flood Zone 2 and 3; for all proposals for new development (including minor development and change of use)
- 1 hectare or greater in size and located in Flood Zone 1
- Located in Flood Zone 1 where there are critical drainage problems
- At risk of flooding from other sources of flooding, such as those identified in this SFRA
- Subject to a change of use to a higher vulnerability classification which may be subject to other sources of flooding

The LPA may also like to consider further options for stipulating FRA requirements, such as:

- Situated in an area currently benefitting from defences
- Situated within 20 metres of the bank top of a Main River
- Situated over a culverted watercourse or where development will require controlling the flow of any river or stream or the development could potentially change structures known to influence flood flow

These further options should be considered during the preparation and development of the Local Plan

25 https://www.gov.uk/flood-risk-assessment-local-planning-authorities

6.6.5 Sites passing the Sequential and Exception Tests

Development sites can be allocated or granted planning permission where the Sequential Test and the Exception Test (if required) are passed. In addition, a site is likely to be allocated without the need to assess flood risk where the proposed use is for open space. Assuming the site is not to include any development and is to be left open then the allocations is likely to be acceptable from a flood risk point of view. For such sites, opportunities for flood storage should be explored however as part of an FRA.

All development proposals within flood zones 2 or 3 must be accompanied by a Flood Risk Assessment. Any sites 100% within Flood Zone 1 that are 1 hectare or more in area must be accompanied by a Flood Risk Assessment to determine vulnerability to flooding from other sources as well as fluvial. The FRA should determine the potential of increased flood risk elsewhere as a result of the addition of hard surfaces on-site and the effect of new development on surface water runoff.

The Flood Risk and Coastal Change PPG states:

"Local authorities and developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally." (Paragraph 50).

6.7 Guidance for Developers

This SFRA provides the evidence base for developers to assess flood risk at a strategic level and to determine the requirements of an appropriate site-specific FRA.

The aim of this section is to provide guidance for developers on using this SFRA.

When initially considering the development options for a site, developers should use this SFRA, the NPPF and the Planning Practice Guidance to:

- ***Identify whether the site is***
    - *A windfall development, allocated development, within a regeneration area, single property or subject to a change of use to identify if the Sequential and Exception Tests are required.*
- ***Check whether the Sequential Test and / or the Exception Test have already been applied***
    - *Request information from the LPA on whether the Sequential Test, or the likelihood of the site passing the Exception Test, have been assessed;*
    - *If not, provide evidence to the LPA that the site passes the Sequential Test and will pass the Exception Test.*
- ***Consult with the LPA Development Control, the LLFA and the EA and the wider group of flood risk consultees, where appropriate, to scope an appropriate FRA if required***
    - *Guidance on FRAs provided in Section 6.6.4 of this SFRA;*
    - *Also refer to the EA Standing Advice, CIRIA Report C624, NYCC SuDS Design Guidance, the NPPF and the Planning Practice Guidance;*
    - *Consult LLFA.*
- ***Submit FRA to Development Control and the EA for approval, where necessary***

Table 6-9 identifies, for developers, when the Sequential and Exception Tests are required for certain types of development and who is responsible for providing the evidence and those who should apply the tests if required.

Table 6-9: Development types and application of Sequential and Exception Tests for developers

Development	Sequential Test Required	Who Applies the Sequential Test?	Exception Test Required?	Who Applies the Exception Test?
Allocated Sites	No (assuming the development type is the same as that submitted via the allocations process)	LPA should have already carried out the test during the allocation of development sites	Dependent on land use vulnerability	LPA to advise on the likelihood of test being passed. The developer must also provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Windfall Sites	Yes	Developer provides evidence, to the LPA that the test can be passed. An area of search will be defined by local circumstances relating to the catchment and for the type of development being proposed	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Regeneration Sites Identified Within Local Plan	No	-	Dependent on land use vulnerability	LPA to advise on the likelihood of test being passed. The developer must also provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Redevelopment of Existing Single Properties	No	-	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Changes of Use	No (except for any proposal involving changes of use to land involving a caravan, camping or chalet site	Developer provides evidence, to the LPA that the test can be passed	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA

6.7.1 Development Management Sequential & Exception Test

This section of the SFRA has been developed to provide a useful tool to inform the development management process regarding the potential risk of flooding associated with future planning applications and the basis for requiring site-specific FRAs.

According to the NPPF Paragraph 103:

"When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be 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; and*
- *Development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems."*

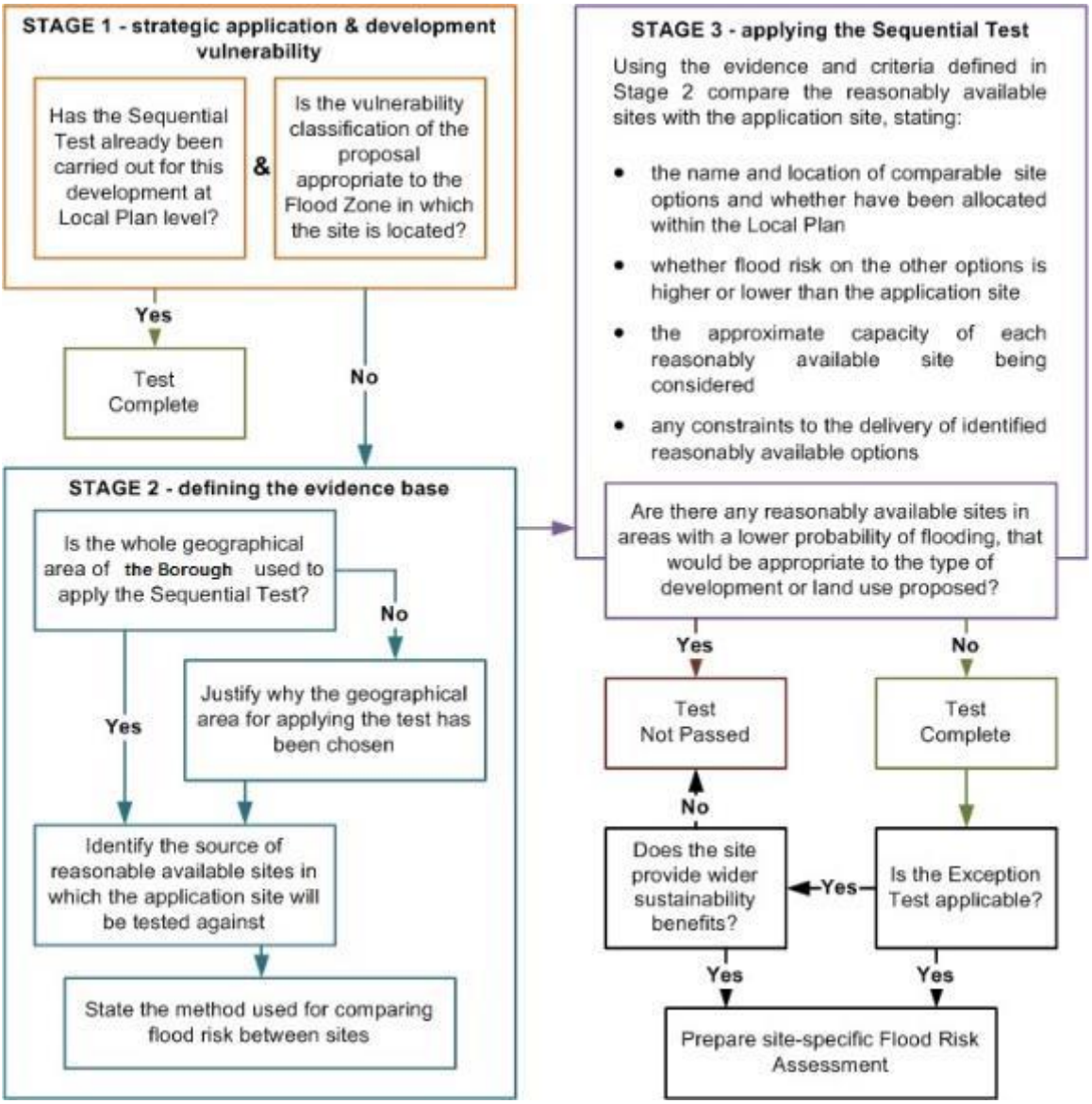
6.7.1.1 Demonstrating the Sequential Test for Planning Applications

The EA provides advice via:

https://www.gov.uk/guidance/flood-risk-assessment-the-sequential-test-for-applicants

This advice recommends the approach illustrated by Figure 6-3 is used by LPAs to apply the Sequential Test to planning applications located in flood zones 2 or 3.

Figure 6-3: Development management Sequential Test process



The approach provides an open demonstration of the Sequential Test being applied in line with the NPPF and the FRCC-PPG. The EA works with local authorities to agree locally specific approaches to the application of the Sequential Test and any local information or consultations with the Lead Local Flood Authority should be taken into account.

In accordance with the EA's advice, the following process should be followed:

- *First, check the Local Plan for sites that have already been allocated for development and could be suitable for the development you are proposing,*
- *Also look at sites that have not been allocated in the Local Plan, but that have been granted planning permission for a development that is the same or similar to the development you are proposing,*
- *Finally, check whether there are any 'windfall sites' in your search area. Windfall sites are sites that are not allocated in the Local Plan and do not have planning permission, but could be available for development. You can look for windfall sites yourself and also reference the Council's SHELAA.*

The Sequential Test does not apply to change of use applications unless it is for change of land use to a caravan, camping or chalet site, or to a mobile home site or park home site. The Sequential Test can also be considered adequately demonstrated if both of the following criteria are met:

- The Sequential Test has already been carried out for the site (for the same development type) at the strategic level (Local Plan); and
- The development vulnerability is appropriate to the Flood Zone (see Table 3 of the FRCC-PPG).

If both these criteria are met, reference should be provided for the site allocation of the Local Plan document and the vulnerability of the development should be clearly stated.

When applying the Sequential Test, the following should also be considered:

- **The geographic area in which the Test is to be applied. For SBC, this would be defined by the local circumstances relating to the catchment and for the type of development being proposed;**
- **The source of reasonable available sites in which the application site will be tested against; and**
- **The evidence and method used to compare flood risk between sites.**

Sites should be compared in relation to flood risk; Local Plan status; capacity; and constraints to delivery including availability, policy restrictions, physical problems or limitations, potential impacts of the development on the local area, and future environmental conditions that would be experienced by the inhabitants of the development.

The test should conclude if there are any reasonably available sites, in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.

The LPA should now have sufficient information to be able to assess whether or not the proposed site has passed the Sequential Test. If the Test has been passed, then the developer should apply the Exception Test in the circumstances set out by tables 1 and 3 of the FRCC-PPG.

In all circumstances, where the site is within areas at risk of flooding and where a site-specific FRA has not already been carried out, a site-specific FRA should be completed in line with the NPPF and the FRCC-PPG. More detailed guidance on site-specific FRAs is provided in Section 6.6.4.

In addition to the formal Sequential Test, the NPPF sets out the requirement for developers to apply the sequential approach to locating development within the site. As part of their application and masterplanning discussions with applicants, LPAs should seek whether or not:

- Flood risk can be avoided by substituting less vulnerable uses or by amending the site layout;
- Less vulnerable uses for the site have been considered; or
- Density can be varied to reduce the number or the vulnerability of units located in higher risk parts of the site.

6.7.2 Taking Climate Change into Account

Climate change will increase flood risk over the lifetime of a development. This SFRA has considered a precautionary approach to climate change, as discussed in Section 6.1. A more detailed assessment of the impacts of climate change on flooding from the land and rivers should be carried out as part of a Level 2 SFRA or FRA. This should be carried out using the sensitivity ranges presented in this section which will provide an appropriately robust response to the uncertainty about climate change impacts on rainfall intensities and river flow.

Considering the impacts of climate change within a FRA / Level 2 SFRA will have implications for both the type of development that is appropriate according to its vulnerability to flooding and

design standards for any SuDS or mitigation schemes proposed. For example, through very flat floodplains, using the +30 per cent from 2070 to 2115 allowance for peak river flows, could see an area currently within lower risk zones (Flood Zone 2), in future be re-classified as lying within a higher risk zone (Flood Zone 3a). Therefore, residential development may not be appropriate without suitable flood mitigation measures or flood resilient or resistant houses. In well-defined floodplains the same climate change allowance could have significant impacts on flood depths influencing building type and design (e.g. finished floor levels).

The EA revised the climate change allowances, in February 2016, for use in FRAs and SFRAs and will use these revised allowances when providing advice:

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

The revised climate change allowances are predictions of anticipated change for:

- Peak river flow by River Basin District;
- Peak rainfall intensity;
- Sea level rise; and
- Offshore wind speed and extreme wave height.

Deciding on which of the peak river flow allowances to use is based on the flood zone the development is within and the associated vulnerability classification (see Table 2 of the FRCC-PPG). Table 6-10 shows the peak river flow allowances for the Northumbria River Basin District.

Table 6-10: Recommended Peak River Flow Allowances for the Northumbria River Basin District

Allowance Category	Total Potential Change Anticipated for…		
	2020s (2015 2039)	2050s (2040 2069)	2080s (2070 2115)
Upper end	+20%	+30%	+50%
Higher central	+15%	+20%	+25%
Central	+10%	+15%	+20%

The peak rainfall intensity allowance applies to the whole of England. SFRAs and FRAs should assess both the central and upper end allowances to gauge the range of impacts. Table 6-11 shows these allowances.

Table 6-11: Peak Rainfall Intensity Allowance in Small and Urban Catchments for England

Allowance Category	Total Potential Change Anticipated for…		
	2015 2039	2040 2069	2070 2115
Upper end	+10%	+20%	+40%
Central	+5%	+10%	+20%

Allowances for sea level rise are based on different regions of England. The allowances for the North East of England are shown in Table 6-12. The number in brackets is the cumulative sea level rise for each year within each range.

Table 6-12: Sea Level Allowance for North East England

1990 2025	2026 2055	2056 2085	2086 2115	Cumulative Rise 1990 2115 (metres)
2.5 mm (87.5 mm)	7 mm (210 mm)	10 mm (300 mm)	13 mm (390 mm)	0.99 m

The EA will also require consideration, if appropriate, of the 'high++ allowances' for peak river flows and mean sea level rise where a development is considered to be very sensitive to flood risk and with lifetimes beyond the end of the century. This could include infrastructure projects or developments that significantly change existing settlement patterns. The high++ allowances

can be found in the EA's *Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities*[26], which uses science from UKCP09. This guidance is based on Government's policy for climate change adaptation, and is specifically intended for projects or strategies seeking Government Flood Defence Grant in Aid (FDGiA) funding. However, RMAs in England may also find it useful in developing plans and making Flood and Coastal Erosion Risk Management (FCERM) investment decisions even if there is no intention of applying for central government funding. This is important for any future large scale infrastructure used to support the delivery of strategic sites such as flood defence schemes.

Although, it is anticipated that increases in river flows will lie somewhere within the range of the central to upper end estimates of the February 2016 allowances, more extreme change cannot be discounted. The high++ allowances can be used to represent more severe climate change impacts and help to identify the options that would be required. The UKCP09 high++ allowances for peak river flows are presented in Table 6-13.

Table 6-13: UKCP09 High++ Allowances for Peak River Flow for the Northumbria River Basin District

River Basin District	Total Potential Change Anticipated for…		
	2020s (2015 39)	2050s (2040 69	2080s (2070 2115
Northumbria	+20%	+35%	+65%

Table 6-14: UKCP09 High++ Mean Sea Level Allowance (compared to 1990 baseline, includes land movements)

Sea Level Rise mm/yr up to 2025	Sea Level Rise mm/yr 2026 to 2050	Sea Level Rise mm/yr 2051 to 2080	Sea Level Rise mm/yr 2081 to 2115
6	12.5	24	33

Modelled climate change outputs, using the February 2016 allowances, are not available at the time of writing for this Level 1 SFRA. However, any Level 2 assessment, following on from this Level 1, could involve the modelling of appropriate climate change events, where fully functioning EA hydraulic models are available.

6.8 Sustainable Drainage Systems (SuDS)

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and consequently a potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure. Managing surface water discharges from new development is therefore crucial in managing and reducing flood risk to new and existing development downstream. Carefully planned development can also play a role in reducing the amount of properties that are directly at risk from surface water flooding.

As previously noted, the Tees Valley Authorities have produced a Local Standards for Sustainable Drainage document (see Section **Error! Reference source not found.**) for developers which should be referred to alongside this SFRA.

The FWMA, 2010, originally transferred the adoption and maintenance of SuDS to Sustainable Drainage Systems Approval Bodies (SABs) that were supposed to be established by local authorities, or LLFA's, under Schedule 3 of the Act. However, the designation of a SAB has since been removed following lengthy consultation, with the announcement from the Department for Communities and Local Government (DCLG) in December 2014 that local planners will be responsible for delivering SuDS[27]. Changes to planning legislation give provisions for major applications of ten or more residential units or equivalent commercial development to require

26 Environment Agency Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities

27 http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/

sustainable drainage within the development proposals in accordance with the non-statutory technical standards for sustainable drainage systems[28], published in March 2015. This builds on the existing planning system, the NPPF, which developers and local authorities are already using. Policy changes to the planning system can also be introduced relatively quickly ensuring that flood risk benefits from sustainable drainage systems can be brought forward as part of planning application proposals.

The NPPF continues to reinforce how planning applications that fail to deliver SuDS above conventional drainage techniques could be rejected and sustainable drainage should form part of integrated design secured by detailed planning conditions so that the SuDS to be constructed must be maintained to a minimum level of effectiveness.

Maintenance options must clearly identify who will be responsible for SuDS maintenance and funding for maintenance should be fair for householders and premises occupiers; and, set out a minimum standard to which the sustainable drainage systems must be maintained.

The runoff destination should always be the first consideration when considering design criteria for SuDS including the following possible destinations in order of preference:

1. To ground;
2. To surface water body;
3. To surface water sewer;
4. To combined sewer.

Effects on water quality should also be investigated when considering runoff destination in terms of the potential hazards arising from development and the sensitivity of the runoff destination. Developers should also establish that proposed outfalls are hydraulically capable of accepting the runoff from SuDS through consultation with the LLFA, EA, and NWL.

The non-statutory technical standards for sustainable drainage systems (March 2015) set out appropriate design criteria based on the following:

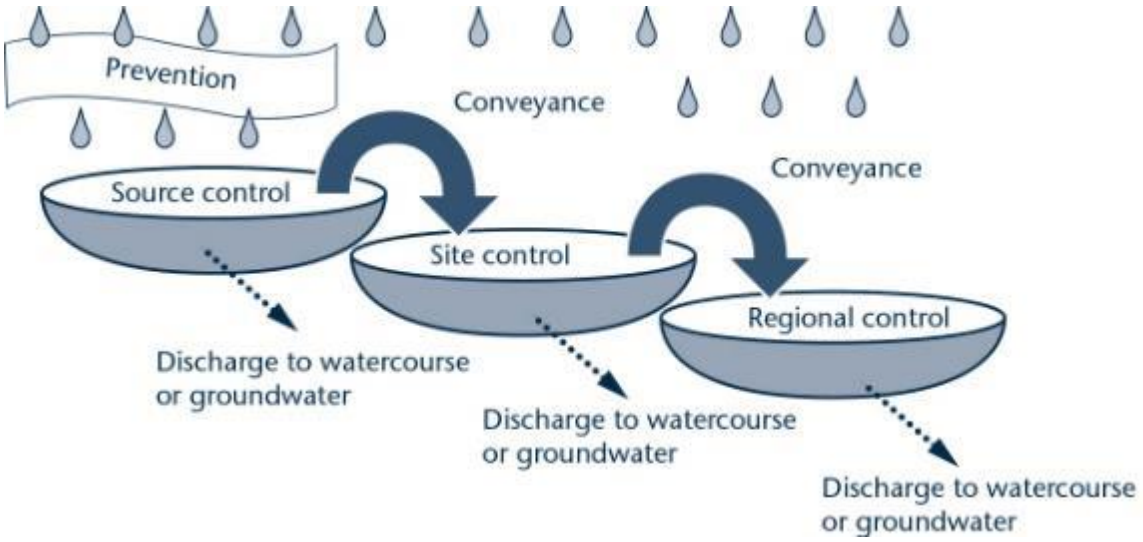
1. Flood risk outside the development;
2. Peak flow control;
3. Volume control;
4. Flood risk within the development;
5. Structural integrity;
6. Designing for maintenance considerations;
7. Construction.

In addition, the Local Planning Authority may set local requirements for planning permission that include more rigorous obligations than these non-statutory technical standards. More stringent requirements should be considered where current Greenfield sites lie upstream of high risk areas. This could include improvements on Greenfield runoff rates. CIRIA has also produced a number of guidance documents relating to SuDS that should be consulted by the LPA and developers.

Many different SuDS techniques can be implemented. As a result, there is no one standard correct drainage solution for a site. In most cases, a combination of techniques, using the Management Train principle (see Figure 6-4), will be required, where source control is the primary aim.

28 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

Figure 6-4: SuDS Management Train Principle[29]



The effectiveness of a flow management scheme within a single site is heavily limited by land use and site characteristics including (but not limited to) topography; geology and soil (permeability); and available area. Potential ground contamination associated with urban and former industrial sites should be investigated with concern being placed on the depth of the local water table and potential contamination risks that will affect water quality. The design, construction and ongoing maintenance regime of any SuDS scheme must be carefully defined as part of a site-specific FRA. A clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential for successful SuDS implementation.

6.8.1 Tees Valley Authorities Local Standards for Sustainable Drainage (2015)

This document was jointly produced by the Tees Valley Authorities and forms the local standards for SuDs requirements in Stockton-On-Tees. As LLFA, SBC is a statutory consultee to the planning authority and is responsible for approving surface water drainage systems for new developments. The guidance applies to all major developments (10 dwellings or more), decisions regarding SuDS and non-major development is a decision for SBC. It provides direction to the relevant design guidance for the successful implementation of SuDS and is the basis on which planning consultations from Local Planning Authorities will be assessed. The document includes checklists of items required for planning applications at the pre-development stage, for outlining drainage proposals and for at the detailed design stage (see Appendix 1 of the document).

29 CIRIA (2008) Sustainable Drainage Systems: promoting good practice – a CIRIA initiative

7 Emergency Planning

The provisions for emergency planning for local authorities as Category 1 responders are set out by the Civil Contingencies Act, 2004 and the National Flood Emergency Framework for England, December 2014[30]. This framework is a resource for all involved in emergency planning and response to flooding from the sea, rivers, surface water, groundwater and reservoirs. The Framework sets out the Government's strategic approach to:

- Ensuring all delivery bodies understand their respective roles and responsibilities when planning for and responding to flood related emergencies,
- Give all players in an emergency flooding situation a common point of reference which includes key information, guidance and key policies,
- Establish clear thresholds for emergency response arrangements,
- Place proper emphasis on the multi-agency approach to managing flooding events,
- Provide clarity on the means of improving resilience and minimising the impact of flooding events,
- Provide a basis for individual responders to develop and review their own plans, and
- Being a long-term asset that will provide the basis for continuous improvement in flood emergency management.

Along with the EA flood warning systems, there are a range of flood plans at a sub-regional and local level, outlining the major risk of flooding and the strategic and tactical response framework for key responders.

This SFRA contains useful data to allow emergency planning processes to be tailored to the needs of the area and be specific to the flood risks faced. The SFRA Maps in Appendix A and accompanying GIS layers should be made available for consultation by emergency planners during an event and throughout the planning process.

7.1 Civil Contingencies Act

Under the Civil Contingencies Act (CCA, 2004)[31], SBC is classified as a Category 1 responder and has duties to assess the risk of emergencies occurring, and uses this to:

- inform contingency planning;
- put in place emergency plans;
- put in place Business continuity management arrangements;
- put in place arrangements to make information available to the public about civil protection matters;
- maintain arrangements to warn, inform and advise the public in the event of an emergency;
- share information with other local responders to enhance coordination;
- cooperate with other local responders to enhance coordination and efficiency and to provide advice and assistance to businesses and voluntary organisations about business continuity management.

During an emergency such as a flood event, the local authority must also co-operate with other Category 1 responders (such as the emergency services and the EA) to provide the core response.

7.1.1 Cleveland Local Resilience Forum

SBC is a partner of the Cleveland Local Resilience Forum (CLRF)[32]. The role of the Resilience Forum is to ensure an appropriate level of preparedness to enable an effective multi-agency

30 https://www.gov.uk/government/publications/the-national-flood-emergency-framework-for-england

31 https://www.gov.uk/preparation-and-planning-for-emergencies-responsibilities-of-responder-agencies-and-others#the-civil-contingencies-act

32 http://www.clevelandemergencyplanning.info/cleveland-lrf/

response to emergency incidents that may have a significant impact on the communities of Stockton-On-Tees Borough Council and other boroughs in the Tees Valley. CLRF consists of representatives from the Emergency Services, all four of the Tees Valley local authorities (SBC, Middlesbrough Borough Council, Redcar and Cleveland Borough Council and Stockton-On-Tees Borough Council), Cleveland Police, NHS England, the EA, Public Health England and the Maritime and Coastguard Agency.

7.1.1.1 Community Risk Register

As a strategic decision-making organisation, the CLRF prepared a Community Risk Register (CRR)[33], last updated in 2013, which considers the likelihood and consequences of the most significant risks and hazards the area faces, including fluvial and urban flooding. This SFRA can help to inform this. The CRR is considered as the first step in the emergency planning process and is designed to reassure the local community that measures and plans are in place to respond to the potential hazards listed within the CRR.

7.1.1.2 Community Emergency Plan

Communities may need to rely on their own resources to minimise the impact of an emergency, including a flood, before the emergency services arrive. Many communities already help each other in times of need, but experience shows that those who are prepared cope better during an emergency. Communities with local knowledge, enthusiasm and information are a great asset and a Community Emergency Plan can help. CLRF has produced a template on how to produce a Community Emergency Plan.

7.1.2 Local Flood Plans

This SFRA provides a number of flood risk data sources that should be used when producing or updating flood plans. SBC will be unable to write specific flood plans for new developments at flood risk. Developers should write their own. Guidance can be found on the EA web site[34]. Generally, owners with individual properties at risk should write their own individual flood plans, however larger developments or regeneration areas, such as retail parks, hotels and leisure complexes, should consider writing one collective plan for the assets within an area.

This SFRA can help to:

- Update these flood plans if appropriate;
- Inform emergency planners in understanding the possibility, likelihood and spatial distribution of all sources of flooding (emergency planners may however have access to more detailed information, such as for Reservoir Inundation Maps, which have not been made available for this SFRA);
- Identify safe evacuation routes and access routes for emergency services;
- Identify key strategic locations to be protected in flooding emergencies, and the locations of refuge areas which are capable of remaining operational during flood events;
- Provide information on risks in relation to key infrastructure, and any risk management activities, plans or business continuity arrangements;
- Raise awareness and engage local communities;
- Support emergency responders in planning for and delivering a proportionate, scalable and flexible response to the level of risk;
- Provide flood risk evidence for further studies.

7.2 Flood Warning and Evacuation Plans

Developments that include areas that are designed to flood (e.g. ground floor car parking and amenity areas) or have a residual risk associated with them, will need to provide appropriate flood warning and instructions so users and residents are safe in a flood. This will include both

33 http://www.clevelandemergencyplanning.info/information-for-residents/

34 https://www.gov.uk/prepare-for-a-flood/make-a-flood-plan

physical warning signs and written flood warning and evacuation plans. Those using the new development should be made aware of any evacuation plans.

Whilst there is no statutory requirement on the EA or the emergency services to approve evacuation plans, SBC is accountable under its Civil Contingencies duties, via planning condition or agreement, to ensure that plans are suitable. This should be done in consultation with Development Management Officers. Given the cross cutting nature of flooding, it is recommended that further discussions are held internally to SBC between emergency planners and policy planners / development management officers, the LLFA, drainage engineers and also to external stakeholders such as the emergency services, the EA, NWL, and Canal & River Trust.

It may be useful for both the LLFA and spatial planners to consider whether, as a condition of planning approval, flood evacuation plans should be provided by the developer which aim to safely evacuate people out of flood risk areas, using as few emergency service resources as possible. The application of such a condition is likely to require policy support in the Local Plan, and discussions within the Cleveland Local Resilience Forum are essential to establish the feasibility / effectiveness of such an approach, prior to it being progressed. It may also be useful to consider how key parts of agreed flood evacuation plans could be incorporated within local development documents, including in terms of protecting evacuation routes and assembly areas from inappropriate development.

Once the development goes ahead, it will be the requirement of the plan owner (developer) to make sure the plan is put in place, and to liaise with SBC regarding maintenance and updating of the plan.

7.2.1 What should the Plan Include?

Flood warning and evacuation plans should include the information stated in Table 7-1. Advice and guidance on plans is accessible from the EA website and there are templates available for businesses and local communities

Table 7-1: Flood warning and evacuation plans

Consideration	Purpose
Availability of existing flood warning system	The EA offers a flood warning service that currently covers designated Flood Warning Areas in England and Wales. In these areas they are able to provide a full Flood Warning Service.
Rate of onset of flooding	The rate of onset is how quickly the water arrives and the speed at which it rises which, in turn, will govern the opportunity for people to effectively prepare for and respond to a flood. This is an important factor within Emergency Planning in assessing the response time available to the emergency services.
How flood warning is given and occupants awareness of the likely frequency and duration of flood events	Everyone eligible to receive flood warnings should be signed up to the EA flood warning service. Where applicable, the display of flood warning signs should be considered. In particular sites that will be visited by members of the public on a daily basis such as sports complexes, car parks, retail stores. It is envisaged that the responsibility should fall upon the developers and should be a condition of the planning permission. Information should be provided to new occupants of houses concerning the level of risk and subsequent procedures if a flood occurs.
The availability of staff / occupants / users to respond to a flood warning and the time taken to respond to a flood warning	The plan should identify roles and responsibilities of all responders. The use of community flood wardens should also be considered.
Designing and locating safe access routes, preparing evacuation routes and the identification of safe locations for evacuees	Dry routes will be critical for people to evacuate as well as emergency services entering the site. The extent, depth and flood hazard rating, including allowance for climate change, should be considered when identifying these routes.

Consideration	Purpose
Vulnerability of occupants	Vulnerability classifications associated with development as outlined in the FRCC-PPG. This is closely linked to its occupiers.
How easily damaged items will be relocated and the expected time taken to re-establish normal use following an event	The impact of flooding can be long lasting well after the event has taken place affecting both the property which has been flooded and the lives that have been disrupted. The resilience of the community to get back to normal will be important including time taken to repair / replace damages.

7.3 Flood Awareness

Emergency planners may also use the outputs from this SFRA to raise awareness within local communities. This should include raising awareness of flood risks, roles and responsibilities and measures that people can take to make their homes more resilient to flooding from all sources whilst also encouraging all those at fluvial flood risk to sign up to the EA's Flood Warning System[35] service.

It is also recommended that Category 1 responders are provided with appropriate flood response training to help prepare them for the possibility of a major flood with an increased number of people living within flood risk areas, to ensure that adequate pre-planning, response and recovery arrangements are in place.

7.4 Environmental Permitting Regulations

Under the Environmental Permitting Regulations certain works within (8m/16m) of a (non-tidal/tidal) main river, or within [8m/16m] of any flood defence structure on a [non-tidal/tidal] main river, require a Flood Risk Activity Permit from the Environment Agency. You can find more information on permit requirements using the following link: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits. If a permit is required, it must be obtained prior to beginning the works.

For minor ordinary watercourses, there should be a minimum easement as advised by the relevant Lead Local Flood Authority or Internal Drainage Board. They may also need to be consulted if any alterations to the watercourse are proposed.

35 https://www.fws.environment-agency.gov.uk/app/olr/home

8 Conclusions and Recommendations

8.1 Conclusions

This SFRA provides a single repository planning tool relating to flood risk and development in Stockton-On-Tees. Key flood risk stakeholders namely the EA, Northumbrian Water, Lead Local Flood Authority and Canal & River Trust were consulted to collate all available and relevant flood risk information on all sources into one comprehensive assessment. Together with this report, this SFRA also provides a suite of interactive GeoPDF flood risk maps (Appendix A) and a Development Site Assessment spreadsheet (Appendix B) illustrating the level of risk to sites identified in the SHELAA, with subsequent recommendations.

The flood risk information, assessment, guidance and recommendations of the SFRA will provide the Borough Council with the evidence base required to apply the Sequential and Exception Tests, as required under the NPPF, and demonstrate that a risk based, sequential approach has been applied in the preparation of its new Local Plan.

Whilst the aim of the sequential approach is the avoidance of high flood risk areas, in locations such as Stockton-On-Tees, Stillington, Billingham, Ingleby Barwick, Castlelevington and Yarm, where the council is looking for continued growth, this will not always be possible. This SFRA therefore provides the necessary links between spatial development, wider flood risk management policies, local strategies / plans and on the ground works by combining all available flood risk information together into one single repository. As this is a strategic study, detailed local information on flood risk is not fully accounted for. For a more detailed assessment of specific areas or sites, a Level 2 SFRA may be carried out following on from the completion of a Level 1 assessment, if required.

8.2 Planning Policy and Flood Risk Recommendations

The following planning policy recommendations relating to flood risk are designed to enable the Council to translate the information provided in this Level 1 SFRA into meaningful Local Plan policy for flood risk and water management:

Policy Recommendation 1: No development within Flood Zone 3b…

…as per the NPPF and FRCC-PPG, unless in exceptional circumstances such as for essential infrastructure or where development is water compatible.

Development must not impede the flow of water within Flood Zone 3b nor should it reduce the volume available for storage of flood water.

Refer to tables 1 to 3 of the FRCC-PPG.

Policy Recommendation 2: Consider surface water flood risk…

…alongside fluvial risk, including possible withdrawal, redesign or relocation for sites at significant surface water risk.

Flood Risk Assessments should always consider surface water flood risk management and options for on site flood storage.

Policy Recommendation 3: Sequential approach to site allocation and site layout…

…must be followed by the LPA to ensure sustainable development when either allocating land in Local Plans or determining planning applications for development.

The overall aim of the Sequential Approach should be to steer new development to low risk Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, the flood risk vulnerability of land uses and reasonably available sites in Flood Zone 2 should be considered, applying the Exception Test if required.

Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in higher risk Flood Zone 3, be considered. This should take into account the flood risk vulnerability of land uses and the likelihood of meeting the requirements of the Exception Test, if required.

This SFRA, the NPPF and FRCC-PPG should be consulted throughout this process.

Policy Recommendation 4: Requirement for a site specific Flood Risk Assessment…

…from a developer when a site is:

- Within Flood Zone 3a or Flood Zone 2
- Within Flood Zone 1 and 1 hectare or greater in size
- At risk from surface water flooding
- Situated in an area currently benefitting from defences
- Situated within 20 metres of the bank top of a Main River
- Situated over a culverted watercourse or where development will be required to control or influence the flow of any watercourse

Before deciding on the scope of the FRA, this SFRA should be consulted along with the LPA, LLFA and EA. The FRA should be submitted to and approved by the LPA including suitable consultation with the LLFA and the EA.

Policy Recommendation 5: Use of appropriately sourced of SuDS…

…required for all major developments of 10 or more residential units or equivalent commercial development. This is in accordance with the interim national standards published in March 2015.

SuDS scoping and design, as part of a site-specific FRA, must be included within the early stages of the site design in order to incorporate appropriate SuDS within the development.

The LPA, LLFA, Northumbrian Water and IDB (if appropriate) must be consulted during the site design stage and the FRA must be submitted to and approved by the LPA, considering all consultation with key stakeholders.

The EA should be consulted with regards to surface water if surface water is being discharged from the site to a Main River (See section 7.4)

Policy Recommendation 6: Phasing of development…

…should be carried out by the LPA to avoid any cumulative impacts of flood risk.

Using a phased approach to development, should ensure that any sites at risk of causing flooding to other sites are developed first in order to ensure flood storage measures are in place before other sites are developed, thus contributing to a sustainable approach to site development.

It may be possible that flood mitigation measures put in place at sites upstream could alleviate flooding at downstream or nearby sites.

Policy Recommendation 7: Planning permission for at risk sites…

…can only be granted by the LPA where a site-specific FRA shows that:

- The NPPF and FRCC-PPG have been referenced together with appropriate consultation with the LLFA, the EA, Northumbrian Water and the IDB, where applicable
- The effects of climate change have been taken into account using the February 2016 allowances developed by the EA, though modelled climate change outputs are not available and have not been used in this Update
- There is no loss in floodplain storage resulting from the development
- The development will not increase flood risk elsewhere
- There is no adverse effect on the operational functions of any existing flood defence infrastructure
- Proposed resistance / resilience measures designed to deal with current and future risks are appropriate
- Appropriate SuDS techniques have been considered and are to be incorporated into the design of the site, where applicable
- Whether the development will be safe and has passed the Exception Test, if applicable.

8.3 Recommendations for Further Work

The SFRA process has developed into more than just a planning tool. Sitting alongside the SBC LFRMS and PFRA, it can be used to provide a much broader and inclusive vehicle for integrated, strategic and local flood risk management and delivery.

There are a number of plans and assessments listed in Table 8-1 that would be of benefit to SBC as the LLFA, in developing their flood risk evidence base to support the delivery of their Local Plan or to help fill critical gaps in flood risk information.

8.3.1 Level 2 SFRA

The Council should review the sites where they expect the main housing numbers and employment sites to be delivered, using Section 6.5 of this report, the SFRA Maps in Appendix A and the Development Site Assessment spreadsheet in Appendix B. A Level 2 SFRA will be required if a large site, or group of sites, are within Flood Zone 3 and have strategic planning objectives, which means they cannot be relocated or avoided. A Level 2 SFRA may also be required if the majority of the sites are within Flood Zone 2 or are at significant risk of surface water flooding. Residual flood risk should also be taken account of when considering options for future work. Additionally, although updated flood zone 3b modelling has been used for this report, if a level 2 SFRA was to be carried out the implications of Flood Zone 2 and 3 (if any) would need to be assessed.

As discussed in Section 6.7.2, a Level 2 assessment can be used to model the February 2016 climate change allowances, where current EA models are available.

A Level 2 SFRA should build on the source information provided in this Level 1 assessment and should show that a site will not increase risk to others and will be safe, once developed, and will pass the Exception Test, if required. A Level 2 study may also assess locations and options for the implementation of open space, or Green Infrastructure, to help manage flood risk in key areas.

The LPA will need to provide evidence in their Local Plan to show that the housing numbers (and other sites) can be delivered. The Local Plan may be rejected if a large number of sites require the Exception Test to be passed but with no evidence that this will be possible.

Once all sites within this Level 1 assessment have been reviewed by the LPA then further advice or guidance should be sought to discuss possible next steps.

Table 8-1: Recommended further work for SBC

Type	Study	Explanation	Timeframe
Understanding of local flood risk	EA Flood Risk Mapping updates	EA modelling updates of older models. Updates of Flood Map for Planning upon completion	Medium term
	Level 2 SFRA	Further, more detailed assessment of flood risk to high risk sites, as notified by this Level 1 SFRA	Short term
	SWMP / drainage strategy	For those high surface water risk sites / areas as notified by this Level 1 SFRA	Short term
Climate change (February 2016 allowances)	Level 2 SFRA	Modelling of climate change for available EA models, where applicable	Short term
CDA designation	Level 2 SFRA	Exploration of the possibility of designating official CDAs as notified to the LPA by the EA or identification of areas of critical drainage for use in SBC's Local Plan	Short term
Flood storage	Community Infrastructure Levy (CIL)	For new developments, GI assets can be secured from a landowner's 'land value uplift' and as part of development agreements. The LPA could include capital for the purchase, design, planning and maintenance of GI within its CIL programme.	Short term
Data Collection	Flood Incident Data	SBC, has a duty to investigate and record details of locally significant flood events within the county. General data collected for each incident, should include date, location, weather, flood source (if apparent without an investigation), impacts (properties flooded or number of people affected) and response by any RMA.	Short Term / Ongoing
	FRM Asset Register	SBC should continue to update and maintain their flood risk management register of structures and features, which are considered to have an effect on flood risk.	Ongoing
Risk assessment	Asset Register Risk Assessment	SBC should carry out a strategic assessment of structures and features on the FRM Asset Register to inform capital programme and prioritise maintenance programme.	Short Term
Capacity	SuDS review / guidance	SBC should identify internal capacity required to deal with SuDS applications, set local specification and set policy for adoption and	Specification adopted

Type	Study	Explanation	Timeframe
		maintenance of SuDS.	
Partnership	Northumbrian Water	SBC should continue to work with NW on sewer and surface water projects.	Ongoing
	EA	SBC should continue to work with the EA on fluvial and tidal flood risk management projects. SBC should also identify potential opportunities for joint schemes to tackle flooding from all sources.	Ongoing
	Canal & River Trust	SBC should continue to work with the Canal & River Trust to understand the residual risks associated with the Tees Canal Navigation and also asset owners of reservoirs.	Ongoing
	Community	Continued involvement with the community through SBC's existing flood risk partnerships.	Ongoing

Appendices

A SFRA Maps

Interactive GeoPDF Maps

Open the Overview Map in Adobe Acrobat. The Overview Map contains a set of four index squares covering four quarters of the borough. Clicking on one of the four index squares will open up an Index Map for that area, by way of a hyperlink.

Each of the four Index Maps contain a further set of index squares covering different areas of the borough at a scale of 1:10,000. Clicking on one of these index squares will open up a more detailed map of that area (scale = 1:10,000) by way of a hyperlink.

Within the detailed maps, use the zoom tools and the hand tool to zoom in/out and pan around the open detailed map. In the legend on the right-hand side of the detailed maps, layers can be switched on and off when required by way of a dropdown arrow. The potential development site reference labels can also be switched on and off if, for example, smaller sites are obscured by the labels.

B Development Site Assessment Spreadsheet

Excel spreadsheet containing an assessment of flood risk to the potential development sites based on Flood Zones 2, 3a and 3b as delineated through this SFRA, and also the updated Flood Map for Surface Water (RoFSW).

C Functional Floodplain and Flood Zone 3b Delineation

Technical note explaining the methodology behind the delineation of the functional floodplain (Flood Zone 3b) for this SFRA.

JBA consulting

Offices at
Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
South Barn
Broughton Hall
SKIPTON
North Yorkshire
BD23 3AE
United Kingdom

t:+44(0)1756 799919
e:info@jbaconsulting.com

Jeremy Benn Associates Ltd
Registered in England
3246693

Visit our website
www.jbaconsulting.com