Chichester District Council Level 1 Strategic Flood Risk Assessment

Final Report

December 2023

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Chichester District Council

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This report describes work initially commissioned by George Whalley of Chichester District Council, by an email dated 12 October 2021 and subsequently instructed by Andrew Rushmer. Abigail Betts, Melody Burgess, Harriet Freestone, Ffion Wilson and Alastair Dale of JBA Consulting carried out this work.

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Purpose

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- West Sussex County Council
- The Environment Agency
- Southern Water
- Planners at the neighbouring authorities
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- Hunston Parish Council
- Southbourne Parish Council
- West Wittering Parish Council
- Manhood Peninsula Partnership
- Manhope local interest group

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Executive summary

Introduction

This Strategic Flood Risk Assessment (SFRA) 2023 document is an update of the previous Level 1 SFRA (2018) and the Interim SFRA issued in December 2022. The SFRA study area is the Chichester District Council area, excluding the South Downs National Park.

The **Chichester Local Plan: Key Policies 2014-2029** was adopted in July 2015, and the Local Plan Review will revisit the adopted Local Plan so that sufficient housing is planned to meet the needs of the area.

There have been updates to flood modelling climate change guidance, the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG) since the 2018 SFRA was prepared. This version of the SFRA addresses the matters arising from the updated Planning Practice Guidance issued in August 2022 and so updates the Interim SFRA issued in December 2022. This report can be used to support the application of the Sequential and Exception Tests.

This Level 1 SFRA provides the flood risk evidence and long-term strategy to support the management and planning of development, protect the environment, deliver infrastructure and promote sustainable communities within in the Local Plan area. It also supports the selection of site allocations in the Local Plan Review and provides information and guidance to be used in the preparation of Flood Risk Assessments (FRAs) in support of site-specific planning applications. The evidence in this SFRA shall also be used to formulate Neighbourhood Plans.

SFRA Objectives

The key objectives of the 2023 SFRA update are:

- To provide updated surface water, coastal and fluvial climate change modelling in line with the Environment Agency's updated guidance and the updated PPG requirements (August 2022).
- Assess the cumulative impact of proposed development as required in the 2021 NPPF update.
- To provide the information for Chichester District Council to perform the Sequential Test. The NPPF 2021 update and PPG 2022 update include a requirement to assess all sources of flooding both now and in the future.
- Update the report in line with Chichester District Council's accessibility guidance.
- Run the Level 1 site screening tool (Appendix K) with the updated information and prepare updated mapping to inform the preparation of the Sequential Test.

SFRA outputs

The Planning Practice Guidance advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

- **Level One:** where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient detail to enable application of the Sequential Test. The Level 1 should be used to attempt to allocate sites in areas of lowest overall flood risk (including other sources of flood risk).

- **Level 2**: where allocations are proposed in flood risk areas (i.e. from any source now and in the future), or where future windfall pressures in flood risk areas are expected. The L2 SFRA should be detailed enough to identify which development sites have the least risk of flooding and the application of the Exception Test, if relevant. The above text suggests that the Level 2 SFRA will only be used to assess whether the Exception Test can be passed, and not the Sequential Test.

This report fulfils the Level One SFRA requirements.

To meet the objectives, the following outputs have been prepared:

- Assessment of all potential sources of flooding
- Assessment of the potential impact of climate change on flood risk
- An assessment of surface water management issues and the application of Sustainable Drainage Systems (SuDS)
- A review and update of new and amended data sources (e.g. Catchment Flood Management Plans, Preliminary Flood Risk Assessment, Updated Flood Maps and modelling, etc)
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk
- Guidance for developers including requirements for site-specific flood risk assessments
- Mapping of location and extent of functional floodplain
- Mapping areas at risk from other sources including surface water, sewer, ground water, reservoir inundation
- Mapping areas covered by an existing flood alert / warning
- Identify opportunities to reduce flood risk
- High-level screening of proposed development sites against flood risk information
- Flood defence infrastructure.
- Cumulative impact assessment

Summary of Assessment

Flood risk

- There have been several substantive recorded flood incidents across the study area, from a combination of sources. The prominent source of flooding is fluvial with a significant influence from groundwater, surface water and tidal conditions. These sources of flooding can also occur in combination. More recent surface water flooding at locations across the Local Plan area has caused damage and disruption.
- More recent events have highlighted that flooding has often been associated with exceedance of the capacity of the sewer network and drainage systems.
- The most notable flooding incidents occurred in 1974, 1993/1994, 2000, 2012 and 2013/2014.
- There are several watercourses in the study area which contribute to fluvial flood risk. Fluvial flooding from the River Lavant poses a risk to Chichester and the characteristics of flooding are influenced by contributions from groundwater. The River Lavant, River Ems and Bosham Stream are particularly sensitive to groundwater levels and have high winter baseflows as

their headwaters are fed by the chalk springs to the south of the South Downs. Elsewhere in the study area, settlements are at fluvial flood risk from other watercourses.

- As well as this, the study area is bounded to the south by the English Channel and as such there is a tidal flood risk along the coastline. Additionally, the combination of high tides and high river levels can result in tidal locking, particularly in the Rifes, as the rivers are unable to discharge effectively.
- The Risk of Flooding from Surface Water (RoFSW) dataset shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys, with some isolated ponding located in low lying areas.
- The JBA Groundwater Flood Map shows that a large proportion of the study area is at risk of groundwater emergence. The south of the Local Plan area is at particularly high risk due to the chalk valleys feeding from the South Downs. Rain can infiltrate the chalk through large fissures into the underlying aquifers and is released slowly though springs further downstream in the Local Plan area.
- Historical incidents of sewer flooding are detailed by Southern Water. A total of 272 recorded flood incidents have been identified in the study area.
- There are no records of flooding from reservoirs impacting properties inside the study area.
- There are two canals located in the study area, the Chichester Canal and the Wey and Arun Canal. There are no recorded incidents of breach or overtopping of canals within the study area
- There are currently 12 Flood Alert Areas and 16 Flood Warning Areas in the study area.

Flood defences

There are several Environment Agency and Council owned fluvial and coastal flood defences located within the study area. The standard of protection provided by these assets varies, as does the condition. There are also tidal flood defences and coastal protection measures.

Development and flood risk

The Sequential and Exception Test procedures for both Local Plans and Flood Risk Assessments (FRAs) have been documented in Appendix L, along with guidance for planners and developers. Links have been provided for various guidance documents and policies published by other Risk Management Authorities such as the LLFA and the Environment Agency (EA).

Relevant studies

There are many relevant regional and local key studies which complement the SFRA and have been considered, such as the Shoreline Management Plans for Beachy Head to Selsey and North Solent, the Arun and Western Streams Catchment Flood Management Plan, River Basin Management Plan, the Preliminary Flood Risk Assessment, the South-East River Basin District Flood Risk Management Plan and the West Sussex Local Flood Risk Management Strategy. Other policy considerations have also been incorporated, such as sustainable development principles, climate change and flood risk management.

Policy Recommendations

The following policy recommendations are to be considered by Chichester District Council in the development of the Local Plan Review. Reference should also be made to the content of the Level 2 SFRA as this identifies particular requirements for proposed allocation sites where flood risk considerations must be addressed.

Development and planning considerations

Sequential approach to development

It is recommended that a sequential approach is adopted for all future developments within the study area where there is a flood risk.

New development and re-development of land should wherever possible seek opportunities to reduce overall level of flood risk at the site**.**

Sequential and Exception tests

Where possible the SFRA has identified areas that are at high risk of flooding. Therefore, proposed development sites at such locations will be required to satisfy the Sequential and, where necessary, Exception Tests in accordance with the updated 2021 NPPF. Chichester District Council will use the information in this SFRA when deciding which development sites to take forward in the Local Plan Review. The high- level Sequential Test Methodology has been documented in Appendix L.

Site-specific Flood Risk Assessments

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent, to inform development zoning and flood risk areas within the site and demonstrate, if required, whether the Sequential and Exception Tests are satisfied (for windfall sites not included in the plan, evidence on the Sequential Test must be submitted in FRAs). Where a site-specific FRA has produced modelling outlines which differ from the Flood Map for Planning then a full evidence-based review would be required. Where the watercourses are embanked, the effect of overtopping and breach must be considered and appropriately assessed. All sources of flood risk must be addressed.

All new development within the 1% AEP (Annual Exceedance Probability) flood extent including an allowance for climate change (for the lifetime of the development) must not normally result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage. Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment. Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain should normally be provided so the total volume of the floodplain storage is not reduced.

A revised **NPPF** was published on 20 July 2021 and this sets out Government's planning policies for England and how these are expected to be applied. This revised Framework replaces the previous NPPFs published in 2012, 2018 and 2019. The associated **PPG** on flood risk and coastal change was updated in August 2022.

There are also several guidance documents which provide information on the requirements for site-specific FRAs:

- **Standing Advice on Flood Risk (Environment Agency)**
- **Flood Risk Assessment for Planning Applications (Environment Agency)**
- **Site-specific Flood Risk Assessment: CHECKLIST (NPPG, Defra)**

Developers should consult with Chichester District Council, West Sussex County Council, the Environment Agency and Southern Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

Surface water management and SuDS

- Planners should be aware of the conditions and local requirements set by West Sussex County Council for surface water management for major and minor developments and ensure development proposals and applications are compliant with the LLFAs policy.
- West Sussex County Council worked with our partner authorities to produce **design guidance for developers** which highlights the need to consider SuDS at an early planning stage.
- Chichester District published a document on **Surface Water and Drainage: Supplementary Planning Document** and expands on various policies in the adopted Local Plan relating to surface water and drainage, and how to address these.

Review of planning applications

Chichester District Council should consult the Environment Agency's '**Flood Risk Assessment: Local Planning Authorities**', last updated 8 February 2022, when reviewing planning applications for proposed developments at risk of flooding. The Council will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases, also contact non-statutory consultees (e.g. Southern Water) that have an interest in the planning application.

Infrastructure and safe access

According to the government's guidance on **'Preparing a flood risk assessment: standing advice'** minimum finished floor levels for vulnerable development should normally be above whichever is higher of the following:

- a minimum of 300mm above average ground level of the site.
- a minimum of 300mm above the adjacent road level to the building.
- 300mm above estimated river or sea flood level.

Construction materials that have low permeability up to at least the same height as finished floor levels should be used. If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency will be required to determine alternative approaches. This includes replacement dwellings.

Safe access and egress will need to be demonstrated at all development sites. Emergency vehicular access should be possible during times of flood.

Where development is located behind, or in an area benefitting from, defences, consideration should be given to the potential safety of the development, finished floor levels and the potential for safe access and egress in the event of rapid inundation of water due to a defence breach with little warning.

Resilience measures will be required if buildings are situated in the flood risk area, and opportunities to enhance green and blue infrastructure and reduce flood risk by making space for water should be sought.

Residual risk

Residual risk is the risk that remains after mitigation measures are considered. The residual risk includes the consideration of flood events that exceed the design thresholds of the flood

defences or circumstances where there is a failure of the defences, e.g. flood banks collapse. Residual risks should be considered as part of site-specific Flood Risk Assessments.

Further, any developments located within an area protected by flood risk management measures, where the condition of those defences is 'fair' or 'poor', where the standard of protection is not of the required standard, where the failure of the intended level of service gives rise to unsafe conditions or where the future commitment to maintaining a safe standard is not in place should be identified.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage. They should seek to contact the reservoir owner to obtain information and should apply the sequential approach to locating development within the site. Developers should also consult with relevant authorities regarding emergency plans in case of reservoir breach.

Any development within the vicinity of either of the canals flowing through the borough should consider the residual risk from the canal, including the possibility of breach. Consideration should be given to the potential for safe access and egress in the event of rapid inundation of water due to a breach with little warning.

Future flood management

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. These are often waterside areas or areas along known flow routes. Development that may adversely affect green infrastructure assets should not be permitted.

The information provided in the SFRA should be used as a basis for investigating potential strategic flood risk solutions within the study area. Opportunities could consist of the following:

- Catchment and floodplain restoration;
- Flood storage areas;
- Opening up culverts, weir removal, and river restoration;
- The Environment Agency's Regional Habitat Creation Programme; and
- Green infrastructure

The Environment Agency has developed **Working with natural processes to reduce flood risk** mapping which displays opportunities for NFM.

It is recommended that local planning authorities continue with their catchment partnership working approach in tackling flood risk and environmental management.

Use of Strategic Flood Risk Assessment data

SFRAs are high level strategic documents and, as such, do not go into detail on an individual site-specific basis. This SFRA has been developed using the best available information, supplied at the time of preparation. This relates both to the current risk of flooding all sources, and the potential impacts of future climate change.

The Environment Agency regularly reviews its hydrology, hydraulic modelling and flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA. It should be noted that the Environment Agency's Flood Zones, on their Flood Map for Planning website, may differ to the maps in the SFRA for a short period of time, whilst new modelling is incorporated into the Environment Agency's flood maps. When using the SFRA to prepare FRAs it is important to check that the most up to date information is used, as is described in amendments to the flood mapping prepared and issued by the Environment Agency at regular intervals.

Other datasets used to inform this SFRA may also be periodically updated and following the publication of this SFRA, new information on flood risk may be provided by Risk Management Authorities.

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Abbreviations

	Definition
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
CDC	Chichester District Council
CFMP	Catchment Flood Management Plan
CLPHP	Chichester Local Plan: key policies 2014-2029
DEFRA	Department of the Environment, Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
FCRMGiA	Flood and Coastal Risk Management Grant in Aid
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act
FWA	Flood Warning Area
FWS	Flood Warning Service
FZ	Flood Zone
GIS	Geographic Information Service
JBA	Jeremy Benn Associates
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
PFR	Property Flood Resilience
PPG	Planning Practice Guidance
RBMP	River Basin Management Plan
RMA	Risk Management Authority
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
WFD	Water Framework Directive
WSCC	West Sussex County Council

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

> "Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards."
>
> (National Planning Policy Framework (July 2021), paragraph 160)

This Strategic Flood Risk Assessment (SFRA) 2023 document supersedes the previous Level 1 SFRA (2018) and the Interim SFRA issued in December 2022. The SFRA study area is shown in Figure 1-1 and excludes the South Downs National Park (SDNP) authoritative area. As the SDNP occupies a large area of the Chichester District, the mapping in this report has been divided into areas north and south of the SDNP. The mapping in the appendices provides both a district wide view and a 5km grid view. **Interactive maps** are also available the Chichester District Council's website. This report only considers Chichester District Council's Local Plan Area.

The main purpose of the SFRA update was to prepare a document that provides comprehensive and supporting evidence for the emerging Local Plan Review. The **Chichester Local Plan: Key Policies (CLPKP) 2014-2029** was adopted in July 2015, and the Local Plan Review will revisit the adopted Local Plan to make sure that sufficient housing will be planned to meet the needs of the area.

The SFRA update was also required to be compliant with the latest guidance described in the 2021 update to the National Planning Policy Framework (NPPF), the August 2022 update to the Planning Practice Guidance (PPG), support the selection of site allocations in the Local Plan Review and to provide information and guidance to be used in the preparation of Flood Risk Assessments (FRAs) in support of site specific planning applications. The evidence in this SFRA is also be used to support the formulation of Neighbourhood Plans.

A **revised NPPF** was published on 20 July 2021 and sets out Government's planning policies for England and how these are expected to be applied. This revised Framework replaces the previous NPPF published in July 2018.

The key objectives of the 2023 SFRA are:

- To provide up to date information and guidance on flood risk for Chichester District Council, taking into account the latest flood risk information (including the probable impacts of climate change), the current state of national planning policy and legislation and relevant studies
- To provide the basis for applying the flood risk Sequential Test, and if necessary the Exception Test
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as part of the evidence base for the Local Plan Review and to support the preparation of Neighbourhood Plans.
- Identify the requirements for site-specific flood risk assessments and the application of Sustainable Drainage Systems

An **Updated Planning Practice Guidance for Flood Risk and Coastal Change** was published in August 2022; Annex 1 provides more information on the recent changes to the PPG.

1.2 Levels of SFRA

The Planning Practice Guidance advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

1 Level One: where flooding from all sources is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test.

2 Level Two: where allocations are proposed in flood risk areas (i.e. from any source now and in the future), or where future windfall pressures in flood risk areas are expected. The L2 SFRA should be detailed enough to identify which development sites have the least risk of flooding and the application of the Exception Test, if relevant. This statement suggests that the Level 2 SFRA will be used to assess whether the Exception Test can be satisfied and will also provide more detailed assessment where the necessary level of information on flood risk is not readily available from existing mapping.

1.3 SFRA outputs

To meet the objectives, the following outputs have been prepared:

- Assessment of all potential sources of flooding
- Assessment of the potential impact of climate change on flood risk
- An assessment of surface water management issues and the application of Sustainable Drainage Systems (SuDS)
- A review and update of new and amended data sources (e.g. Catchment Flood Management Plans, Preliminary Flood Risk Assessment, Updated Flood Maps and modelling, etc)
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk
- Guidance for developers including requirements for site-specific flood risk assessments
- Mapping of location and extent of functional floodplain
- Mapping areas at risk from other sources including surface water, sewer, ground water, reservoir inundation
- Mapping areas covered by an existing flood alert / warning
- Identify opportunities to reduce flood risk
- High-level screening of proposed development sites against flood risk information
- Flood defence infrastructure.

1.4 SFRA user guide

Table 1-1: SFRA report contents

Section	Contents
1. Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultation performed.
2. The Planning Framework and Flood Risk Policy	Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study.
3. How is flood risk assessed	Outlines the definitions of flood risk, flood zones, residual risk and possible responses to flooding
4. Planning Policy for Flood Risk Management	Describes the Sequential Approach and application of Sequential and Exception Tests. Outlines cross-boundary issues and considerations.
5. Climate change	Outlines climate change guidance and the implications for Chichester.
6. Sources of information used in preparing the SFRA	Outlines what information has been used in the preparation of the SFRA.
7. Understanding flood risk in Chichester	Introduces the assessment of flood risk and provides an overview of the characteristics of flooding affecting the district. Provides a summary of responses that can be made to flood risk, together with policy and institutional issues that should be considered. Outlines the flood warning service in Chichester and provides advice for emergency planning, evacuation plans and safe access and egress.
8. Fluvial and coastal defences	Assessment of flood defences
9. FRA requirements and flood risk management guidance	Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Provides guidance for developers and outlines conditions set by the LLFA that should be followed.
10. Surface water management and SuDS	Advice on managing surface water run-off and flooding and the application of SuDS.
11. Flood warning and emergency planning	Outlines the flood warning service in the joint SFRA area and provides advice for emergency planning, evacuation plans and safe access and egress.
12. Strategic flood risk solutions	Overview of possible strategies to reduce flood risk
13. Level 1 summary assessment of potential development locations	A summary of the information presents in the site screening table

Section	Contents
14. Summary	Review of the Level 1 SFRA.
15. Recommendations	Identifies recommendations for the council to consider as part of Flood Risk Management policy.
Annex	Summary of August 2022 PPG changes

1.5 Consultation

The following parties have been consulted during the preparation of this Level 1 SFRA:

- Chichester District Council
- Environment Agency
- West Sussex County Council
- Southern Water
- Neighbouring authorities: East Hampshire District, Havant District, Arun District, Horsham District, Waverley District and South Downs National Park
- The Chichester Harbour Conservancy
- Portsmouth Water
- Natural England

1.6 Use of SFRA data

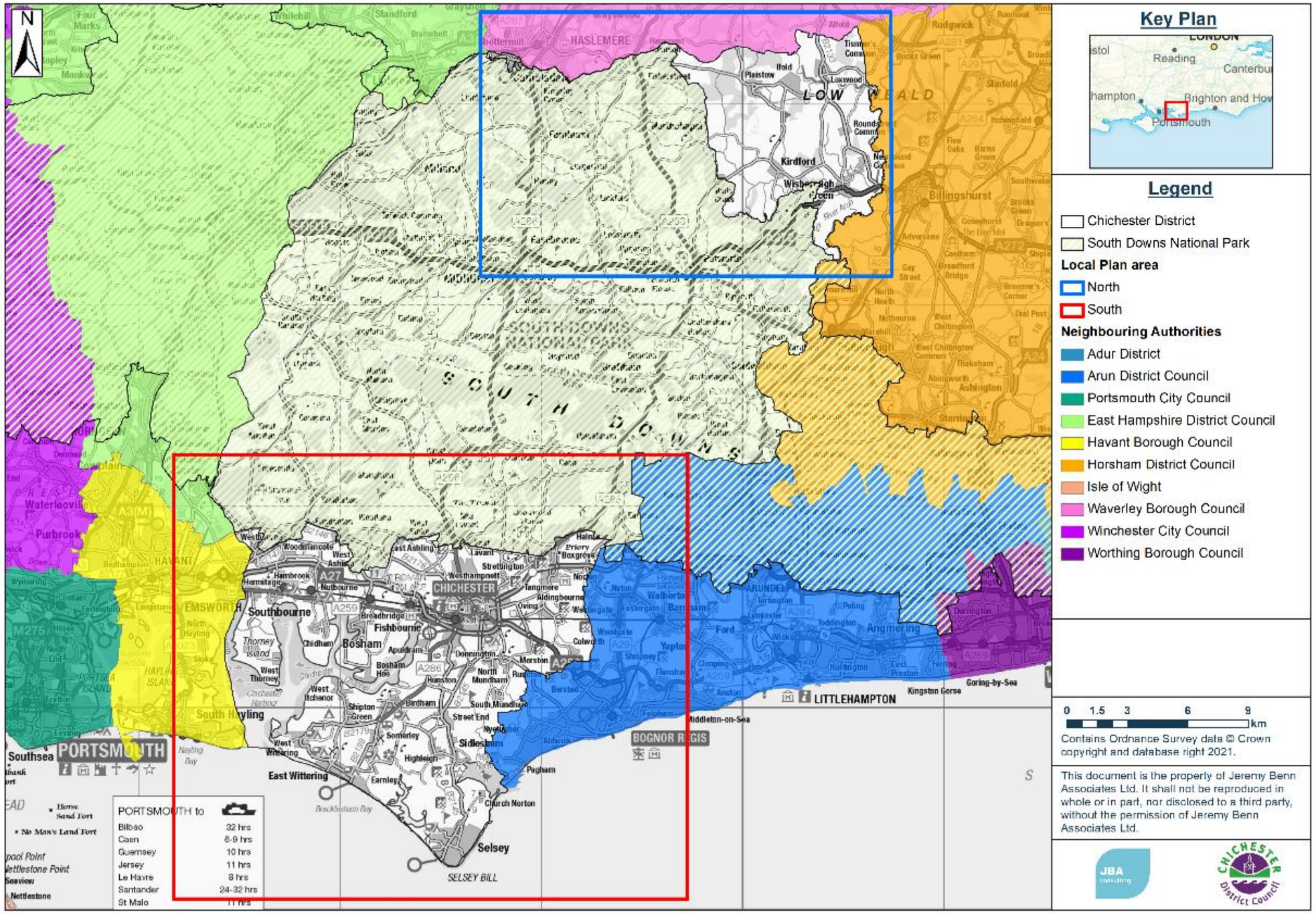
It is important to recognise that SFRAs are high level strategic documents and, as such, do not go into detail on an individual site-specific basis. The SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

SFRAs should be a **'living document'**, and as a result should be updated when new information on flood risk, new planning guidance or legislation becomes available. New information on flood risk may be provided by Chichester District Council, West Sussex County Council, the Environment Agency, Southern Water and the Harbour Conservancy. Such information may be in the form of:

- New hydraulic modelling results
- Flood event information following a flood event
- Policy/ legislation updates
- Environment Agency flood map updates
- New flood defence schemes etc.

The Environment Agency regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed Flood Risk Assessment. It is recommended that the SFRA is reviewed internally, in line with the Environment Agency's Flood Zone map updates to ensure latest data is still represented in the SFRA, allowing a cycle of review and a review of any updated data by checking with the above bodies for any new information.

Figure 1-1: Chichester District Council's Local Plan area and neighbouring authorities



2 The Planning Framework and Flood Risk Policy

2.1 Introduction

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is taken into account at every stage of the planning process. This section of the SFRA provides an overview of the planning framework, flood risk policy and flood risk responsibilities.

2.2 Flood Risk Regulations (2009) and Flood and Water Management Act (2010)

2.2.1 Flood Risk Regulations (2009)

The Flood Risk Regulations (2009) translate the current EU Floods Directive into UK law and place responsibility upon all Lead Local Flood Authorities (LLFAs) to manage localised flood risk. Under the Regulations, the responsibility for flooding from rivers, the sea and reservoirs lies with the Environment Agency; however, responsibility for local and all other sources of flooding rests with LLFAs. In the instance of this SFRA, the LLFA is West Sussex County Council. Detail on the responsibilities of LLFAs is provided in Section 2.2.6.

Figure 2-1 illustrates the steps that have / are being taken to implement the requirements of the EU Directive in the UK via the Flood Risk Regulations. The Regulations require that the process described in Figure 2-1 is repeated on a 6-year cycle and thus the PFRA was updated last year (2017).

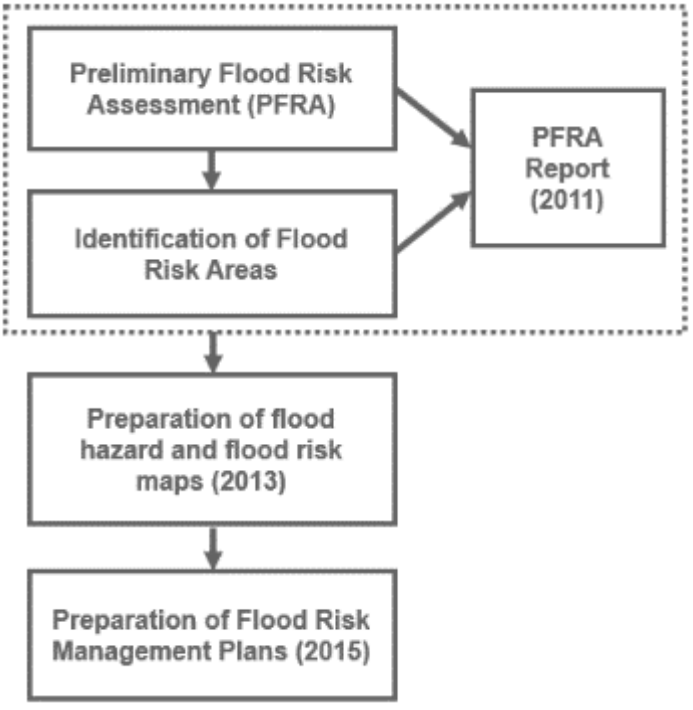


Figure 2-1: Flood Risk Regulation Requirements

2.2.2 Preliminary Flood Risk Assessments

Under this action plan and in accordance with the Flood Risk Regulations, LLFAs have the task of preparing a Preliminary Flood Risk Assessment (PFRA) report for local flood risk every 6 years. The **PFRA document** that covers the study area was first published by West Sussex County Council in 2011. In 2017, West Sussex

County Council prepared an **addendum** to the PFRA which updated the 2011 report.

The PFRA reports on significant past and future flooding from all sources except from Main Rivers and reservoirs, which are covered by the Environment Agency, and the performance of the adopted sewer network (in this instance, under the remit of Southern Water). PFRAs are a high-level screening exercise and consider floods which have significant harmful consequences for human health, economic activity, the environment and cultural heritage. The Regulations require the LLFA to identify significant Flood Risk Areas. The threshold for designating significant Flood Risk Areas is defined by DEFRA and the PRFA is the process by which these locations can be identified.

In 2011 ten indicative Flood Risk Areas were identified nationally by DEFRA / the Environment Agency, none encroached on the Chichester District Council's Local Plan area.

The exercise was repeated in 2017 and a further national study prepared to identify potential areas of significant flood risk ("Flood Risk Areas") – **'Review of preliminary flood risk assessments (Flood Risk Regulations 2009): guidance for lead local flood authorities in England – 25th Jan 2017'.** No additional Flood Risk Areas for local flood risk were identified within the Local Plan area.

It is observed that the Flood Risk Regulations, 2009 will cease to have effect from the end of December 2023. As the assessment and management of flood risk is primarily performed under the Flood and Water Management Act, 2010 it is understood that the "sunsetting" of the regulations is unlikely to have a material effect.

2.2.3 Flood Risk Management Plans

Under the Regulations, the Environment Agency exercised an 'Exception' and did not initially prepare a PFRA for risk from rivers, reservoirs and the sea. This then made it a requirement for the Environment Agency to prepare and publish a Flood Risk Management Plan (FRMP). The FRMP process adopts the same catchments as used in the preparation of River Basin Management Plans, in accordance with the Water Framework Directive.

Accordingly, more detailed strategic information on proposed strategic measures and approaches can be found in the **South East River Basin District Flood Risk Management Plan** (FRMP) (2016) – Parts A, B and C. The FRMP draws on previous policies and actions identified in the Catchment Flood Management Plans and also incorporates information from Local Flood Risk Management Strategies.

There are ten catchments covered by the South East River Basin, and the Local Plan Area lies within the East Hampshire and Arun and Western Streams Catchment areas. The FRMP summarises the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations.

2.2.4 Flood and Water Management Act (FWMA), 2010

The **Flood and Water Management Act (2010)** aims to create a simpler and more effective means of managing both flood risk and coastal erosion and implements some of Sir Michael Pitt's recommendations following his review of the 2007 floods.

The FWMA established Lead Local Flood Authorities (LLFAs). West Sussex County Council is the LLFA for the study area. Further information on the LLFA role and responsibilities are provided in Section 2.15.2.

DEFRA has announced a proposed update to Schedule 3 of the FWMA 2010 that will mandate sustainable drainage (SuDS) in new developments in England. This update follows discussions in April 2015 in which the government addressed increasing the use of SuDS through planning policy. Current policy requires that SuDS are included in all new major developments (over 10 homes), unless there is clear evidence that this would be inappropriate. It is understood that this update will come into effect in 2024 following a further consultation.

2.2.5 West Sussex Local Flood Risk Management Strategy (2013)

Under the F&WMA West Sussex County Council is responsible for developing, maintaining, applying and monitoring a LFRMS for West Sussex, which covers the Local Plan area. The **West Sussex Local Flood Risk Management Strategy** (2013) is used as a means by which the LLFA co-ordinates flood risk management on a day to day basis. The LFRMS also sets measures to manage local flood risk i.e. from surface water, groundwater and ordinary watercourses.

At the time of preparation of this SFRA West Sussex County Council are updating the LFRMS.

2.2.6 LLFAs, surface water and SuDS

On 18 December 2014 a **Written Ministerial Statement** laid by the Secretary of State for Communities and Local Government set out changes to the planning process that would apply for major development from 6 April 2015.

Major developments are defined as:

- Residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known; and
- Non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of 1 hectare or more.

When considering planning applications, Local Planning Authorities should consult the LLFA on the management of surface water so that:

- the proposed minimum standards of operation are appropriate
- there are clear arrangements for on-going maintenance over the development's lifetime, through the use of planning conditions or planning obligations.

As LLFA, WSCC is responsible for local flood risk, which involves flooding from surface water, groundwater and ordinary watercourses. The **West Sussex LLFA Policy for the Management of Surface Water** outlines the requirements that WSCC has for drainage strategies and surface water management provisions, relating to development applications.

2.2.7 Surface Water and Foul Drainage

Chichester District Council's **Surface Water and Foul Drainage – Supplementary Planning Document** (2016) expands on the objectives and policies of the Chichester Local Plan: Key Policies 2014-2029, and provides information on what is required by developers and planners in terms of new developments.

2.3 Water Quality

2.3.1 Water Quality and Strategic Growth for Chichester District Background Paper

The **Water Quality and Strategic Growth for Chichester District Background Paper** (2012) highlights problems with water quality in Chichester District and the subsequent impact on development. The two main aspects of the issue are the insufficient capacity in environmental permits to accommodate future development needs, and the high level of groundwater infiltration into the sewer network. This has led to the ongoing operation of storm overflow at Chichester (Apuldram) Wastewater Treatment Works. Key stakeholders, Chichester District Council, Southern Water, Environment Agency, Natural England and Chichester Harbour Conservancy, are looking at ways to solve these problems, which are summarised in this policy statement.

The Chichester District Council's Water Quality Assessment (2018) provides the evidence base for the Local Plan review by highlighting potential options for future wastewater treatment which would enable growth in the Local Plan area and support the council in their Habitats Regulations Assessment (HRA).

The Local Plan identifies a number of growth areas which are served by nine Wastewater Treatment Works. The assessment describes the outcomes of a water quality assessment and modelling work to estimate the potential impact of increased discharge volumes from these Wastewater Treatment Works on water quality and receiving waterbodies.

The assessments indicated that consideration might need to be given to upgrading all the Wastewater Treatment Works to provide increased capacity. The sewer networks for Chichester and Loxwood Wastewater Treatment Works will need upgrading and the further investigation is required at other locations so provision is made for sufficient capacity in the networks where necessary to reduce the volume and frequency of any storm related spills.

End of pipe solutions (e.g. improved treatment in the Wastewater Treatment Works) along with water efficiency measures and catchment solutions have also be recommended for consideration.

2.4 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments.

Surface Water Management Plans (SWMPs) applicable to the Local Plan area are summarised below. The outcomes and actions from these SWMPs should be considered in the context of proposed developments within the study area. The following plans have been prepared in the Chichester District Council area.

2.4.1 Manhood Peninsula Surface Water Management Plan

The **Manhood Peninsula** SWMP was developed as part of a commission by the WSCC, which involved producing SWMPs for five areas with a significant history of flooding in West Sussex. The plan was completed in 2015. It identifies the importance of short-term and long-term mitigation strategies in reducing flooding in the Manhood Peninsula. After identifying twelve priority locations (including

those at high and moderate risk of flooding), the plan outlines short-term actions needed to reduce flooding. Ongoing and long-term mitigation measures are discussed and based around four key themes: the importance of land drainage consents; controlling runoff from new developments; maintenance of watercourses, culverts and highway drainage on a cyclical basis; controlling runoff from glass houses.

2.4.2 West Chichester Surface Water Management Plan

Similar to the Manhood Peninsula, the West Chichester SWMP was published in Autumn 2018 due to significant flooding in the past. The plan assesses flood risk within the area, which has been divided into three primary surface water flow catchments: Fishbourne Catchment, Fishbourne Road East Catchment and Parklands Estate Catchment. Following detailed analysis of the drainage systems, the SWMP discusses various options to mitigate flooding within each catchment. This includes localised mitigation measures, which are considered as small scale but high priority, and strategic measures, which address broader problems of capacity and exceedance flow of the drainage network.

2.5 Drainage and Wastewater Management Plans (DWMPs)

Water companies were required to publish Drainage Water Management Plans (DWMPs) for river basin catchments across England as part of the Environment Act. Southern Water has recently published their **DWMP**.

This is a risk-based catchment screening where existing data is used to identify where there is a current and/or potential risk or vulnerability in the sewer catchment to future changes. This will enable Southern Water's detailed assessment of risk for high priority areas for investment.

This provides a wider geographical extent of information on sewer flood risk than has previously been available. In doing this, the DWMP's include risk assessment and mapping which could potentially be used in the proposed land use planning prioritisation process and could potentially be perceived as being appropriate for consideration in the Sequential and Exception Tests.

JBA reviewed the information within the DWMP (Appendix N) and convened a meeting with Southern Water to discuss the findings. It was confirmed by Southern Water that the mapping provided within the DWMP is not suitable for use in the Sequential Test as the data and mapping is prepared to prioritise investment priorities and the resolution of the data does not enable comparative risk at different sites to be evaluated appropriately.

It was noted that Southern Water carry out capacity assessments as a matter of course when consulted on the Local Plan. Therefore, the information within the DWMP would not need to be considered with the Level 2 SFRA.

2.6 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are a high-level strategic plan providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management.

There are six pre-defined national policies provided in the CFMP guidance and these are applied to specific locations through the identification of 'Policy Units'. These policies are intended to cover the full range of long-term flood risk management options that can be applied to different locations in the catchment.

2.6.1 Arun and Western Streams CFMP (2009)

The Local Plan area is partially covered by the **Arun and Western Streams CFMP**. Due to the age of this document, some key flood events that have impacted the Local Plan area are not included, notable flood events excluded are 2012 and Winter 2013/14. The primary policy units for the area are:

- **Policy 3 - Manhood Peninsula and Rural Chichester Harbour/Upper Chalk Stream**. Areas of low to moderate flood risk with generally effective flood risk management
- **Policy 4 - Coastal Plains and East Wittering/Chichester & Lower Chalk Streams.** Areas of low to moderate flood risk where further action is required to sustain the current level of flood risk (responding to the potential increases in risk from urban development, land use change and climate change)
- **Policy 6 – Rother Valley/Middle Arun/Weald**. Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

The follow issues have been raised in each area.

Manhood Peninsula and Rural Chichester Harbour/ Upper Chalk Streams

This area is low lying and artificially drained by an old drainage network. High tides can prevent flood waters from entering the sea causing tide locking. There have been problems in this area where saturated ground fills septic tanks resulting in foul water discharge into streams and the local sewerage system has been overwhelmed.

The Chichester flood alleviation scheme drains into the Pagham Rife which runs through the area and there is an extensive network of drainage ditched which typically provides protection up to a 3% AEP event.

The CFMP states that the flood risk is being managed at an appropriate level. The emphasis to manage the flood risk in the area is on adaptation rather than prevention.

Coastal Plains and East Wittering

In these areas there is a risk of surface water flooding when groundwater is high, and surface water drains can be prevented from draining when tides are high causing tide locking. The Environment Agency are managing the flood risk in these areas, but further action is needed to keep pace with climate change. Sea level rise will cause an increase in tide locking and increases in rainfall will cause further flooding. It is proposed that methods to reduce run-off and SuDS are used where possible in these areas.

Chichester and Lower Chalk Streams

The rivers in this area are chalk fed streams and the River Lavant flows intermittently. High flows have caused flooding in the past however the Lavant Alleviation Scheme has been in place since 2003 and diverts excess flows into the Pagham Rife.

Groundwater flooding is also an issue in this area and can last for several weeks. High tides can cause tide locking in drainage channels and run-off from the A27 can exacerbate flooding.

Rother Valley/Middle Arun/The Weald

This area has opportunities for changing land use and possible flood storage. The policy in this area supports increased flooding, or at least keeping water on the land for longer. There are large areas of existing wet woodlands which would benefit or be increased in area through increased flooding.

2.7 River Basin Management Plans

River Basin Management Plans (RBMPs) are prepared under the Water Framework Directive (WFD) and assess the pressure facing the water environment in River Basin Districts. The Local Plan area falls within the **South East RBMP**.

The plan provides a summary of programmes of measures that help prevent deterioration to protect and improve the beneficial use of the water environment in the river basin district. An assessment of whether deterioration has occurred from the 2015 classification baseline is understood to have been carried out in 2021.

Measures are presented for each significant water management issue in the river basin district which are:

- Physical modifications
- Managing pollution from waste water
- Managing pollution from towns, cities and transport
- Changes to natural flow and levels of water
- Managing invasive non-native species
- Managing pollution from rural areas

The plan provides an example of how Portsmouth Water are working towards making improvements to the operation of the River Ems augmentation scheme and restoration. The improvements will mitigate the low flows which are exacerbated by its abstractions for public water supply. The measures are understood to have had the aim of achieving good ecological potential of the overall water body by 2021.

2.8 Shoreline Management Plan

The Shoreline Management Plan (SMP) forms part of Defra's strategy for flood and coastal defence. It provides a large-scale assessment of risks associated with coastal evolution and presents the policy framework to address these risks in a sustainable manner. The SMP policies defined by DEFRA are:

- **Hold the line** – maintain or upgrade the level of protection provided by defences.
- **Advance the line** – build new defences seaward of the existing defence line.
- **Managed realignment** – allowing retreat of the shoreline, with management to control or limit the movement.
- **No active intervention** – a decision not to invest in providing or maintaining defences.

Not all policies are guaranteed funding and over time the Environment Agency along with other partners will identify the cost. The SMPs are currently undergoing a refresh.

2.8.1 Beachy Head to Selsey Bill Shoreline Management Plan (2006)

The **Beachy Head to Selsey Bill Shoreline Management Plan** (2006) covers part of the Local Plan coastline. Between Pagham Harbour and Selsey Bill, the long-term policy is Managed Realignment of the shoreline. At Selsey Bill the Policy is Hold the line.

2.8.2 North Solent Shoreline Management Plan (2010)

The **North Solent Shoreline Management Plan** covers the study area from Selsey West Beach to Emsworth Yacht Harbour. The majority of the coastline within this area requires 'Hold the Line' management, both in the short and long term. However, this is on the proviso that there is "No Public Funding Available." Although most of this section of coastline is 'Hold the Line,' areas are intersected by sections of managed realignment and no active intervention.

2.9 Coastal Defence Strategies

Coastal defence strategies provide recommendations for managing flood and erosion risks along the coastline.

2.9.1 Pagham to East Head Coastal Defence Strategy (2009)

The Environment Agency, Chichester District Council and Arun District Council worked together to produce the **Pagham to East Head Coastal Defence Strategy.** The strategy identifies ways to manage the risk of flooding and erosion at the main population centres around Pagham, Selsey and the Witterings. The Environment Agency has now begun to implement the recommended options.

2.9.2 Arun to Pagham Risk Management Strategy (2015)

The **Arun to Pagham Flood and Coastal Erosion Risk Management Strategy** outlines recommendations for managing flood and erosion risk along the coastline between the River Arun and Pagham over the next 100 years. The area is divided into a number of strategy units. Part of the SFRA study area, in the south east of the district, is located in the Bognor Regis and Felpham strategy unit.

2.10 Medmerry coastal flood defence scheme

New sea defences have been built between Selsey and Bracklesham as part of the **Medmerry management realignment scheme**. The Environment Agency has worked with the local council and community groups to improve the standard of protection for 300 homes.

2.11 Integrated coastal zone management for the Manhood Peninsula

The Manhood Peninsula Partnership prepared a document titled **'Towards Integrated Coastal Zone Management (ICZM) on the Manhood Peninsula'** in 2011. This document has been integrated into Policy 22 of the Adopted Chichester Local Plan: Key Policies 2014-2029.

2.12 Local Plan policies on flood risk and drainage

The **Chichester Local Plan: Key Policies 2014-2029** provides the policy framework and long-term strategy manage development, protect the environment, deliver infrastructure and promote sustainable communities within in the Local Plan area. The policies relating to flood risk and drainage are:

- **Policy 40** – Sustainable Design and Construction
- **Policy 42** - Flood Risk and Water Management

2.13 Natural Flood Management (NFM) Plans

The Environment Agency has developed **Working with natural processes to reduce flood risk** mapping which displays opportunities for NFM. These maps are to be used as a guide and supplemented with local knowledge to provide a starting point for discussions about NFM. NFM aims to protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast. NFM should be used on a catchment wide scale and is the linking of blue and green infrastructure.

The maps identify NFM opportunities on different catchment scales:

- National River Basin Districts
- River Basin Districts showing Management Catchments
- Management Catchments showing Water Body Catchments
- Water Body Catchments

These catchments in the Local Plan area cross boundaries with the South Downs National Park Authority and other neighbouring authorities. Discussions about NFM should be had with catchment stakeholders in combination with local knowledge. West Sussex County Council as the LLFA have an NFM lead officer and it is recommended that they are contacted to promote collaborative working.

2.14 Risk Areas for Local Planning Authorities in England

The Association of British Insurers (ABI) and the National Flood Forum have published **guidance for Local Authorities** with regards to planning in flood risk areas. The guidance aims to assist Local Authorities in England in producing local plans and dealing with planning applications in flood risk areas. The guidance complements the National Planning Policy Framework. The key recommendations from the guidance are:

- Ensure strong relationships with technical experts on flood risk.
- Consider flooding from all sources, taking account of climate change.
- Take potential impacts on drainage infrastructure seriously.
- Ensure that flood risk is mitigated to acceptable levels for proposed developments.
- Make sure Local Plans take account of all relevant costs and are regularly reviewed.

2.15 Roles and responsibilities of Risk Management Authorities in the Chichester District Council's Local Plan area

The roles and responsibilities of Risk Management Authorities (RMAs) in the Chichester District are summarised below.

2.15.1 Chichester District Council

As a Local Planning Authority, Chichester District Council assess, consult on and determine whether development proposals are acceptable, ensuring that flooding and other, similar, risks are effectively managed.

The council will consult relevant statutory consultees as part of planning application assessments and may, in some cases, also contact non-statutory consultees, such as Southern Water, that have an interest in the planning application.

Chichester District Council are also the Coast Protection Authority, primarily managing coastal erosion through defences. These defences are dual purpose and often serve to manage the coastal flood risk.

2.15.2 West Sussex County Council

As the Lead Local Flood Authority (LLFA) for the area, West Sussex County Council's duties include:

- Local Flood Risk Management Strategy (LFRMS): LLFAs must develop, maintain, apply and monitor a LFRMS to outline how they will manage flood risk, identify areas vulnerable to flooding and target resources where they are needed most.
- Flood Investigations: When appropriate and necessary LLFAs must investigate and report on flooding incidents (Section 19 investigations).
- Register of Flood Risk Features: LLFAs must establish and maintain a register of structures or features which, in their opinion, are likely to have a significant effect on flood risk in the LLFA area.
- Designation of Features: LLFAs may exercise powers to designate structures and features that affect flood risk, requiring the owner to seek consent from the authority to alter, remove or replace it.
- Consenting: When appropriate LLFAs will perform consenting of works on ordinary watercourses.
- Enforcement: The LLFA has enforcement powers under the Land Drainage Act 1991 and FWMA 2010.

West Sussex County Council is also the Local Highway Authority and manages highway drainage, carrying out maintenance and improvement works on an on-going basis, as necessary, to maintain existing standards of flood protection for highways, making appropriate allowances for climate change. It also has the responsibility so road projects appropriately address flood risk.

2.15.3 Environment Agency

The Environment Agency is responsible for protecting and enhancing the environment and contributing to the government's aim of achieving sustainable development in England and Wales. The Environment Agency has powers to work on Main Rivers to manage flood risk. These powers are permissive, which means they are not a duty, and they allow the Environment Agency to carry out flood and coastal risk management work and to regulate the actions of other flood risk management authorities on main rivers and the coast.

The Environment Agency also has powers to regulate and consent works to Main Rivers. Prior written consent is required from the Environment Agency for any work in, under, over or within nine metres of a Main River or between the high water line and the secondary line of defence e.g. earth embankment. The Environment Agency also has a strategic overview role across all types of flooding as well as other types of water management matters.

2.15.4 Water and wastewater providers

Southern Water is the sewerage undertaker for the Local Plan area and maintains three types of sewer across its wastewater networks; foul, combined and surface water. Foul sewers should take only wastewater (ie no rainwater) from domestic and commercial kitchens, bathrooms, washing machines, etc. Combined sewers take all of the aforementioned wastewater plus rainwater connected via roof guttering and patios, etc. Both foul and combined sewers convey wastewater to Water Treatment Works for treatment before being returned to a watercourse. Surface water sewers take only rainwater and will discharge directly to watercourses without treatment. Southern Water provides the following information on sewers:

- Foul sewers are designed to accommodate peak flows arising from the population served along any particular segment of the network (peaks are usually mornings and evenings). Surface water and combined sewers are designed to a statistical flood risk in order to accommodate rainfall, and it is not possible to design a combined or surface water sewer that will never flood.
- Sewer systems are dynamic, and capacity is variable depending not only on physical pipe diameter, but also pipe gradient and liquid properties (ie fast flowing or viscid). Build-up of fats and non-degradable items such as wet wipes will gradually reduce pipe capacity until it culminates in a blockage, at which point flooding will occur. Once the blockage is located and the pipe is jetted to clear debris, the pipe's original capacity will be restored. Blockages in the sewer network are a concern in Chichester District, with approximately 73% of internal property flooding caused by blockages in the sewer network.
- Pipe capacity can also be reduced by cracks in pipes caused by ground movement or tree root ingress allowing groundwater to enter. This may occur not only in the adopted network but also in private laterals that connect to the public system. This type of reduction in capacity is generally seasonal and is more likely to occur in areas affected by high groundwater.
- In addition, misconnections or illegal connections of surface water into a foul sewer can reduce the sewer's capacity in wet weather as foul sewers are not designed to convey rainwater, and consequently could result in flooding from manholes/sewers backing up. Misconnections of foul wastewater into surface water sewers, typically arising from unregulated residential extensions, causes pollution of rivers and bathing waters.
- Urban creep can also exacerbate capacity issues. Water UK's 21st Century Drainage Programme explains, "The country's built environment is constantly changing and "urban creep" – home extensions, conservatories and paving over front gardens for parking – can all add to the amount of water going into our sewers and drains. Green spaces that would absorb rainwater are covered over by concrete and tarmac that will not. In fact, studies show that "urban creep" results in a larger increase in predicted flooding than new housing, because it adds more rainwater to these systems'.

Southern Water is understood to be working with stakeholders to reduce the impacts that heavy rainfall, along with urban creep, misconnected drainage and climate change, all have on the sewerage network – for more detailed information see Storm Overflow Task Force (southernwater.co.uk).

It is understood from Southern Water that network upgrades to increase pipe/pumping station capacity or increase the rate at which flows are pumped through the network (also increasing capacity) will normally be carried out to accommodate new developments. However, these are also subject to the above influences and therefore capacity can be reduced, sometimes temporarily as outlined above, over time.

Southern Water advise that Flood risk from sewers is strongly associated with heavy rainfall and may therefore be linked with areas of low gradient and low points in topography, as well as areas affected by seasonally high groundwater. The performance of the network is therefore often influenced by temporal, seasonal and geographical conditions that should be factored into the risk assessment.

It is understood that Southern Water estimate that in Chichester District about 73% of water in the sewer network during a storm is rainwater. This significant increase in water entering the network can cause flooding from the sewer affecting homes and businesses. There is also a significant flow in the sewers from groundwater in the Chichester District. Groundwater levels in the chalk and alluvial geology are sufficiently high to infiltrate into the sewer network. This reduces the capacity of the sewers for wastewater.

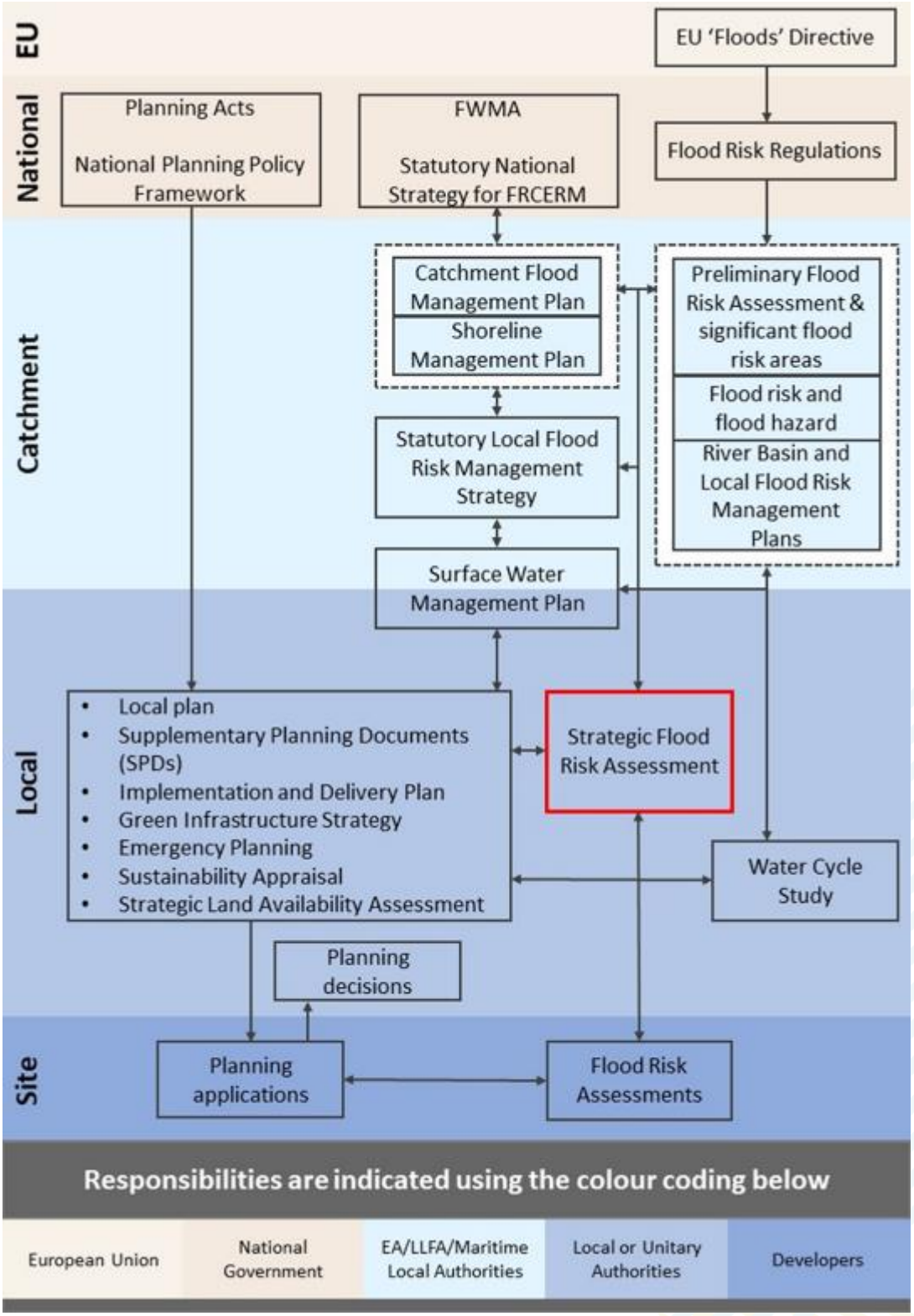
When flows (foul or surface water) are proposed to enter public sewers, Southern Water will assess whether the public system has the capacity to accept these flows as part of their pre-application service. If there is not available capacity, they will provide a solution that identifies the necessary mitigation. Southern Water also comments on the available capacity of foul and surface water sewers as part of the planning application process. Further information can be found on their **website**.

Portsmouth Water and Southern Water provide potable water to the Local Plan area. Consent, prior to commencing work, is required from the relevant provider if installing water systems, or altering existing systems, is intended.

2.16 Key strategic planning links

Figure 2-2 outlines the key strategic planning links for flood risk management and associated documents. It shows how the Flood Risk Regulations and Flood and Water Management Act, have introduced a wider requirement for the mutual exchange of information and the preparation of strategies and management plans. There is a duty to cooperate which is a legal requirement between local planning authorities and other public bodies which serves to maximise the effectiveness of policies for strategic matters in Local Plans.

Figure 2-2: Strategic planning links and key documents for flood risk



3 How Flood Risk is Assessed

3.1 Definitions

3.1.1 Flood

Section 1 (subsection 1) of the Flood and Water Management Act (FWMA) (2010)1 defines a flood as:

> **'any case where land not normally covered by water becomes covered by water'**

Section 1 (subsection 2) states that 'it does not matter for the purposes of subsection (1)' whether a flood is caused by

a) heavy rainfall;
b) a river overflowing or its banks being breached;
c) a dam overflowing or being breached;
d) tidal waters;
e) groundwater; or
f) anything else (including any combination of factors).

Note: Sources of flooding under this definition do not include excess surface water from any part of a sewerage system, unless caused by an increase in the volume of rainwater entering or affecting the system, or a flood caused by a burst water main.

3.1.2 Flood risk

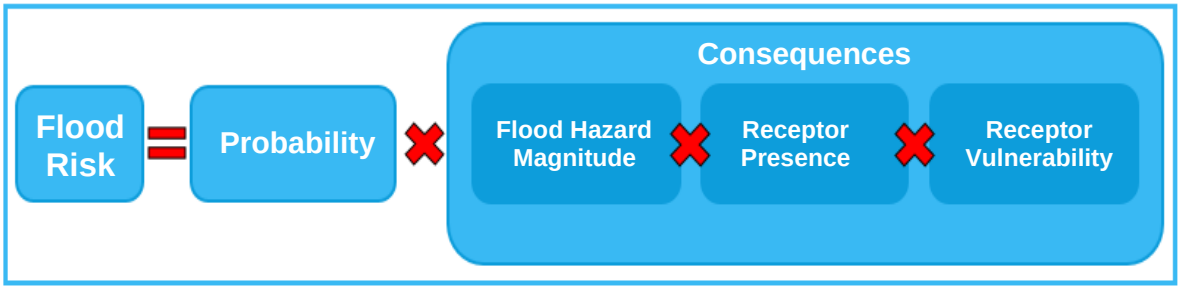
Section 3 (subsection 1) of the FWMA defines the risk of a potentially harmful event (such as flooding) as:

> **'a risk in respect of an occurrence is assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences.'**

Thus, it is possible to summarise flood risk as:

Flood Risk = (Probability of a flood) x (Scale of the consequences)

On that basis it is useful to express the definition as follows:



Using this definition it can be seen that:

Increasing the probability or chance of a flood being experienced increases the flood risk: In situations where the probability of a flood being

1 Flood and Water Management Act (2010): http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf

experienced increases gradually over time, for example due to the effects of climate change, then the severity of the flood risk will increase (flooding becomes more frequent or has increased effect).

The potential scale of the consequences in a given location can increase the flood risk:

- Flood Hazard Magnitude: If the direct hazard posed by the depth of flooding, velocity of flow, the speed of onset, rate of risk in flood water or duration of inundation is increased, then the consequences of flooding, and therefore risk, is increased.
- Receptor Presence: The consequences of a flood will be increased if there are more receptors affected, for example with an increase in extent or frequency of flooding. Additionally, if there is new development that increases the probability of flooding (for example, increase in volume of runoff due to increased impermeable surfaces) or increased density of infrastructure then consequences will also be increased.
- Receptor Vulnerability: If the vulnerability of the people, property or infrastructure is increased then the consequences are increased. For example, old or young people are potentially more vulnerable in the event of a flood.

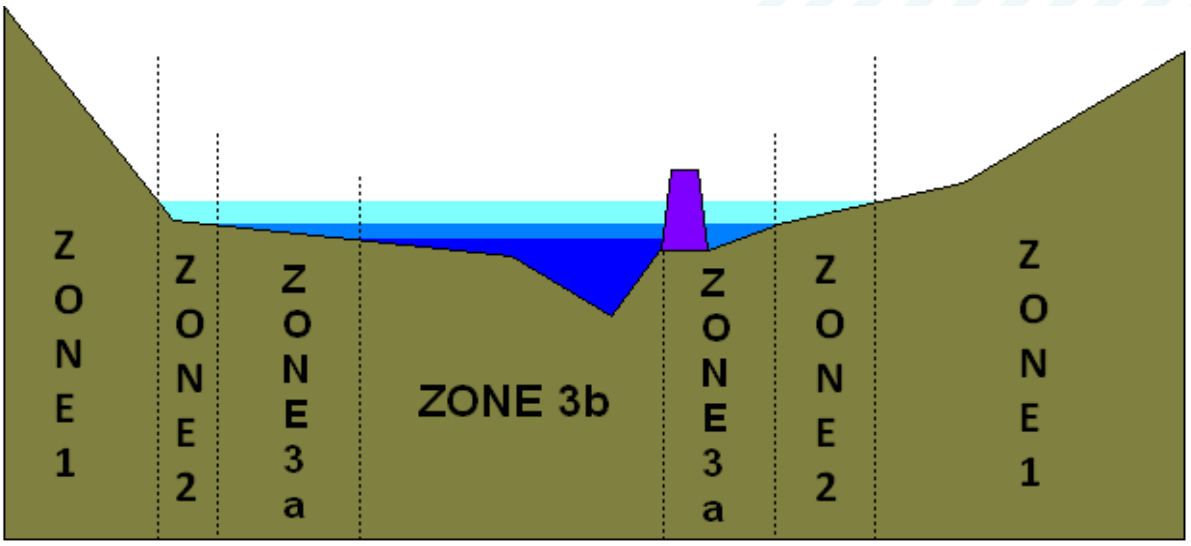
3.2 Flood Zones and areas affected by Flood Risk

3.2.1 Fluvial and tidal

The SFRA includes maps that show the Flood Zones. These zones describe the land that would flood if there were no defences present. A concept diagram showing the classification of Flood Zones graphically is included in Figure 3-1. These apply to both Main River and Ordinary Watercourses.

The preference when allocating land is, whenever possible, to place all new development on land in Zone 1. Since the Flood Zones identify locations that are not reliant on flood defences, placing development on Zone 1 land means there is no future commitment to spending money on flood banks or flood alleviation measures. It also does not commit future generations to costly long-term expenditure that would become increasingly unsustainable as the effects of climate change increase.

Figure 3-1: Concept of flood zones



The Flood Zones are:

- Flood Zone 1: Low probability - less than a 0.1% chance of river and sea flooding in any given year
- Flood Zone 2: Medium probability - between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year
- Flood Zone 3a: High probability - greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. Excludes Flood Zone 3b.
- Flood Zone 3b: Functional Floodplain - land where water has to flow or be stored in times of flood. SFRAs identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. The updated August 2022 PPG recommends the 3.3% AEP flood extent is the starting point.

Excluding Flood Zone 3b, the Flood Zones do not take into account defences. This is important for planning long term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

However, it should be noted that where the Arun to East Head tidal model has been used to delineate tidal Flood Zone 2 and 3a, the Environment Agency have confirmed that both the defended and undefended outputs should be used. This is because the removal of the defences can allow flood water to flow back into the sea and suggest that the extent of flooding would be less than would in practice be experienced. In the defended scenarios, the presence of the defences prevents the floodwater from flowing back to sea and as the volume of water increases behind the defences, this results in more extensive inland inundation. A full understanding of all the areas at flood risk is obtained by combining the defended and undefended results.

Where the 3.3% AEP flood extents did not exist, Flood Zone 3a has been used as a precautionary approach to delineate Flood Zone 3b.

The Level 1 SFRA assesses all sources of flood risk, however, the Flood Zones do not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure or climate change. Hence there could still be a risk of flooding from other sources and the level of flood risk will change over time during the lifetime of a development.

3.2.2 Actual flood risk

If it has not been possible for all future development to be situated in Zone 1 then a more detailed assessment is needed to understand the implications of locating proposed development in Zones 2 or 3. This is accomplished by considering information on the "actual risk" of flooding. The assessment of actual risk takes account of the presence of flood defences and provides a picture of the safety of existing and proposed development. It should be understood that the standard of protection afforded by flood defences is not constant and it is presumed that the required minimum standards for new development are:

- residential development should be protected against flooding with an annual probability of river flooding of 1% (1 in 100-year chance of flooding) in any year; and

- residential development should be protected against flooding with an annual probability of tidal (sea) flooding of 0.5% (1 in 200-year chance of flooding) in any year.

The assessment of the actual risk should take the following issues into account:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for the Flood Risk Management Strategy to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development (assumed to be 100 years for residential development). Over time the effects of climate change will erode the present day standard of protection afforded by defences and so commitment is needed to invest in the maintenance and upgrade of defences if the present day levels of protection are to be maintained and where necessary land secured that is required for affordable future flood risk management measures.
- The assessment of actual risk can include consideration of the magnitude of the hazard posed by flooding. By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources. This assessment will be needed in circumstances where consideration is given to the mitigation of the consequences of flooding or where it is proposed to place lower vulnerability development in areas that are at risk from inundation.

For information on defences reference should be made to the Environment Agency's Asset Information Management System (AIMS) which contains details on the standard of protection of defences.

3.2.3 Residual risk

The residual risk refers to the risks that remain in circumstances after measures have been taken to alleviate flooding (such as flood defences). It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

- The effects of a flood with a magnitude greater than that for which the defences or management measures have been designed to alleviate (the 'design flood'). This can result in overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming discharges.
- Failure of the defences or flood risk management measures to perform their intended duty. This could be breach failure of flood embankments, failure of flood gates to operate in the intended manner or failure of pumping stations.

The assessment of residual risk demands that attention be given to the vulnerability of the receptors and the response to managing the resultant flood emergency. In this instance, attention should be paid to the characteristics of flood emergencies and the roles and responsibilities during such events. Additionally, in the cases of breach or overtopping events, consideration should be given to the structural safety of the dwellings or structures that could be adversely affected by significant high flows or flood depths.

3.2.4 Surface Water

Paragraph 162 of the NPPF states that the Sequential Test must now "steer new development to areas with the lowest risk of flooding from **any source**. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the information that can be used to support the test. The sequential approach (as described in Para 161) should be used in areas known to be at risk now or in the future from any form of flooding."

To address the requirement to address flood risk from any source in the Sequential Test a Sequential Test Methodology has been prepared in consultation with West Sussex County Council and the Environment Agency. This is described in Appendix L.

In summary, the Environment Agency's 0.1% AEP Risk of Flooding from Surface Water flood extent mapping has been used to define a simple zoning scheme that identifies a high risk and low risk zone. It should be noted that the Risk of Flooding from Surface Water includes an allowance for drainage (a flood risk management feature), so this is not strictly the same conceptual risk zone as defined for river and sea flooding (even though it is associated with the same probability). However, it does create a product that can accommodate sequential testing, as it facilitates strategic decisions that direct development to land in a "low risk surface water flood zone".

3.2.5 Reservoirs

The Sequential Test Methodology (Appendix L) also outlines how reservoir flooding should be included in the Sequential Test. The latest available Environment Agency Risk of Flood from Reservoirs mapping now shows "wet day" and "dry day" reservoir inundation extents. The "wet day" being a reservoir breach at the same time as a 1 in 1000 river flood (as this is a likely time when a reservoir might fail) and the dry day shows the failure just from the water retained by the dam.

Neither set of mapping describes a risk-based scenario as they do not provide the probability of a dam failure but are intended to describe a "worst credible case". The Risk of Flooding from Reservoir dataset is is not conceptually similar to the risks pertaining to river and sea flooding or surface water.

However, a high risk zone has been prepared for reservoir flood risk which identifies where reservoir flooding is predicted to make fluvial flooding worse and where the placement of new development could result in properties being in a location where hazards from flow depth and velocity were potentially severe. If sites selected through a comparative process of assessing the river, sea and surface water flood risk are located in such zones then the implications are addressed in the Level 2 SFRA and further consideration given to the identification of alternative locations at lower potential risk at this stage.

3.2.6 Other sources of flooding

Groundwater

Flood Zones have not been prepared for groundwater flooding. The readily available datasets for groundwater flooding do not provide the confidence or certainty required to undertake the Sequential Test. The available mapping provides an indication of where the risk of groundwater emergence might be higher, but competent sequential decisions cannot be appropriately made based on the available mapping. Given the historic groundwater events in Chichester

District, it is assumed that all sites are potential susceptible to groundwater flood risk in the Sequential Test as a precautionary approach.

All sites selected for allocation sites are then subject to a further detailed assessment of groundwater flood risk in the assessment prepared for the Level 2 SFRA. This more detailed assessment considers local conditions on a site-by-site basis using borehole, geological and LIDAR data. If necessary further consideration is given to the identification of alternative site locations at lower potential risk at this stage.

Sewer flooding

Historic sewer flood data is only available at a postcode level and does not define spatial extent or location of sewer flooding. It is understood from Southern Water that sewer flooding is often caused by blockages and hence it can happen at any point in the sewer network. There have been significant problems surrounding wastewater and drainage throughout the district; there is a lack of capacity in the overall network that is understood to be the consequence of groundwater infiltration. High groundwater levels 2and surface water flooding caused by intense rainfall is understood to reduce the hydraulic capacity of the sewers.

Southern Water's DWMP will provide more detailed information on the performance of the sewerage network but is not available at the moment. There is no mapping available to enable execution of a risk-based sequence. On this basis, Flood Zones for sewer flooding have not been prepared and the available information is not appropriate for use in the Sequential Test.

Further information can be found in Appendix L.

3.3 Possible responses to flooding

3.3.1 Assess

The first response to flooding must be to understand the nature and frequency of the risk. The assessment of risk is not just performed as a "one off" during the process, but rather the assessment of risk should be performed during all subsequent stages of responding to flooding.

3.3.2 Avoid

The sequential approach requires that the first requirement is to avoid the hazard. If it is possible to place all new growth in areas at a low probability of flooding, then the flood risk management considerations will include provisions so that proposed development does not increase the probability of flooding to others. This can be achieved by implementing Sustainable Drainage Systems (SuDS) and other measures to control and manage run-off.

In some circumstances it might be possible to include measures within proposed growth areas that reduce the probability of flooding to others and assist existing communities to adapt to the effects of climate change. In such circumstances the growth proposals should include features that can deliver the necessary levels of mitigation so that the standards of protection and probability of flooding are not reduced by the effects of climate change. In Chichester District, consideration should be given not only to the peak flows generated by new development but also to the volumes generated during longer duration storm events.

3.3.3 Substitute control and mitigate

These responses all involve management of the flood risk and thus require an understanding of the consequences (the magnitude of the flood hazard and the vulnerability of the receptor).

There are opportunities to reduce the flood risk by lowering the vulnerability of the proposed development. For instance, changing existing residential land to commercial uses will reduce the risk provided that the residential land can then be located on land in a lower risk flood zone.

Flood risk management responses in circumstances where there is a need to consider growth or regeneration in areas that are affected by a medium or high probability will include:

- Strategic measures to maintain or improve the standard of flood protection so that the growth can be implemented safely for the lifetime of the development (this must include firm commitments to invest in infrastructure that can adapt to the increased chance and severity of flooding presented by climate change).
- Design and implement measures so that the proposed development includes features that enables the infrastructure to adapt to the increased probability and severity of flooding so that new communities are safe and the risk to others is not increased (preferably reduced).

Flood resilient measures that reduce the consequences of flooding to infrastructure so that the magnitude of the consequences is reduced. Such measures would need to be considered alongside improved flood warning, evacuation and welfare procedures so that occupants affected by flooding could be safe for the duration of a flood event and rapidly return to properties after an event had been experienced

3.4 Cumulative impacts

When allocating land for development, consideration must be given to the potential cumulative impact of development on flood risk. The loss of the natural storage and infiltration capacity of undeveloped land, potential loss of surface water storage capacity, the increase in impermeable surfaces and resulting rise in runoff increases the chances of surface water flooding if suitable mitigation measures, such as SuDS, are not put in place. Additionally, the increase in runoff may result in more flow entering watercourses, increasing the risk of fluvial flooding at locations further downstream that are potentially sensitive to increases in the volume or flow of flood water.

Consideration must also be given to the potential cumulative impact of the loss of floodplain as a result of development. The effect of the loss of floodplain storage should be assessed, at both the development and elsewhere within the catchment and, if required, the scale and scope of appropriate mitigation should be identified.

Whilst the increase in runoff, or loss in floodplain storage, from individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe without appropriate mitigation measures.

For windfall sites which have not yet been allocated, the NPPF requires that the cumulative impact of development should be considered at the application stage and the appropriate mitigation measures undertaken to ensure flood risk is not exacerbated, and in many cases the development should be used to improve the flood risk.

4 Planning Policy for Flood Risk Management

4.1 National Planning Policy Framework

The **National Planning Policy Framework** (NPPF) was updated in July 2021, replacing the previous versions as first published in March 2012. The NPPF sets out Government's planning policies for England. It must be taken into account in the preparation of local plans and is a material consideration in planning decisions. The NPPF defines Flood Zones and how flood risk from any source should be used to allocate land and requirements for the preparation of flood risk assessments. Key changes in the revised 2021 NPPF compared to the 2018 NPPF include:

- Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards (para 160).
- It is encouraged to use opportunities provided by improvements in green infrastructure, and to make as much use as possible of natural flood management techniques (para 161c).
- The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source (para 162).

Planning Practice Guidance (PPG) on flood risk was updated in August 2022 and sets out how the policy should be implemented. **Diagram 1 in the PPG** sets out how flood risk should be considered in the preparation of Local Plans. Key changes in the revised 2022 PPG include:

- Changes to the definition of Flood Zone 3b. The definition of a functional floodplain (Flood Zone 3b) has changed from a 5% AEP event to a 3.3% AEP event.
- Changes to the lifetime of non-residential development. The PPG now states that the lifetime of non-residential development is a minimum of 75 years.
- There is now guidance for the Sequential Test to assess high, medium, and low flood risk both now and in the future. As such, future Flood Zone 2 (0.1% AEP – medium risk) and Flood Zone 3b (3.3% AEP – the functional floodplain) should be assessed.
- Paragraph 162 of the NPPF has been changed such that the Sequential Test must now "steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach (as described in Para 161) should be used in areas known to be at risk now or in the future from any form of flooding."
- 'Design flood' includes Climate Change and surface water risk

4.1.1 The sequential risk-based approach

This SFRA has considered the July 2021 NPPF changes to the Sequential Test requiring a sequential approach for of all sources of flood risk. The 2022 updated Planning Practice Guidance indicates that low, medium and high flood risk areas are assessed for both now and in the future. To address that requirement further climate change modelling has been undertaken for fluvial and tidal sources. The Level 2 SFRA will provide more detail on the nature of the flood risks and will provide information to support consideration of the Exception Test (if required) and

to demonstrate whether the development can be made safe throughout its lifetime, without increasing the flood risk elsewhere.

The Sequential Test will be based on the following:

- The test will continue to be based on the use of the Zones describing river and sea flood risk.
- Surface Water flood Zones will be prepared based on the available surface water flood mapping (two Zones will be described, namely "a high risk zone" and a "low risk zone").
- As there is no available competent risk mapping for other sources of risk that is comparable with that for the sea, rivers and surface water it is not appropriate to use such mapping in a strict process that involves comparison of differing levels of flood risk. However, in addressing the Sequential Test it is important that the potential implications of such risk is assessed and so reservoir, groundwater and sewer flood risk are addressed during the process of finalising the selection of allocation sites. This process is described in the Level 2 SFRA and involves a more detailed assessment of the implications of reservoir, sewer and groundwater flood risk. Thus consideration is given to all sources of flood risk using the available data as part of completion of the Sequential Test so decisions on the selection of preferred sites for allocation address the potential implications of groundwater, reservoir and sewer flooding and where necessary identify sites where consideration should be given to the Exception Test.

Diagrams 2 and 3 in the PPG demonstrate how the Sequential Test (Figure 4-1) and Exception Test (Figure 4-2) should be performed.

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 4-1: Application of the Sequential Test for plan preparation

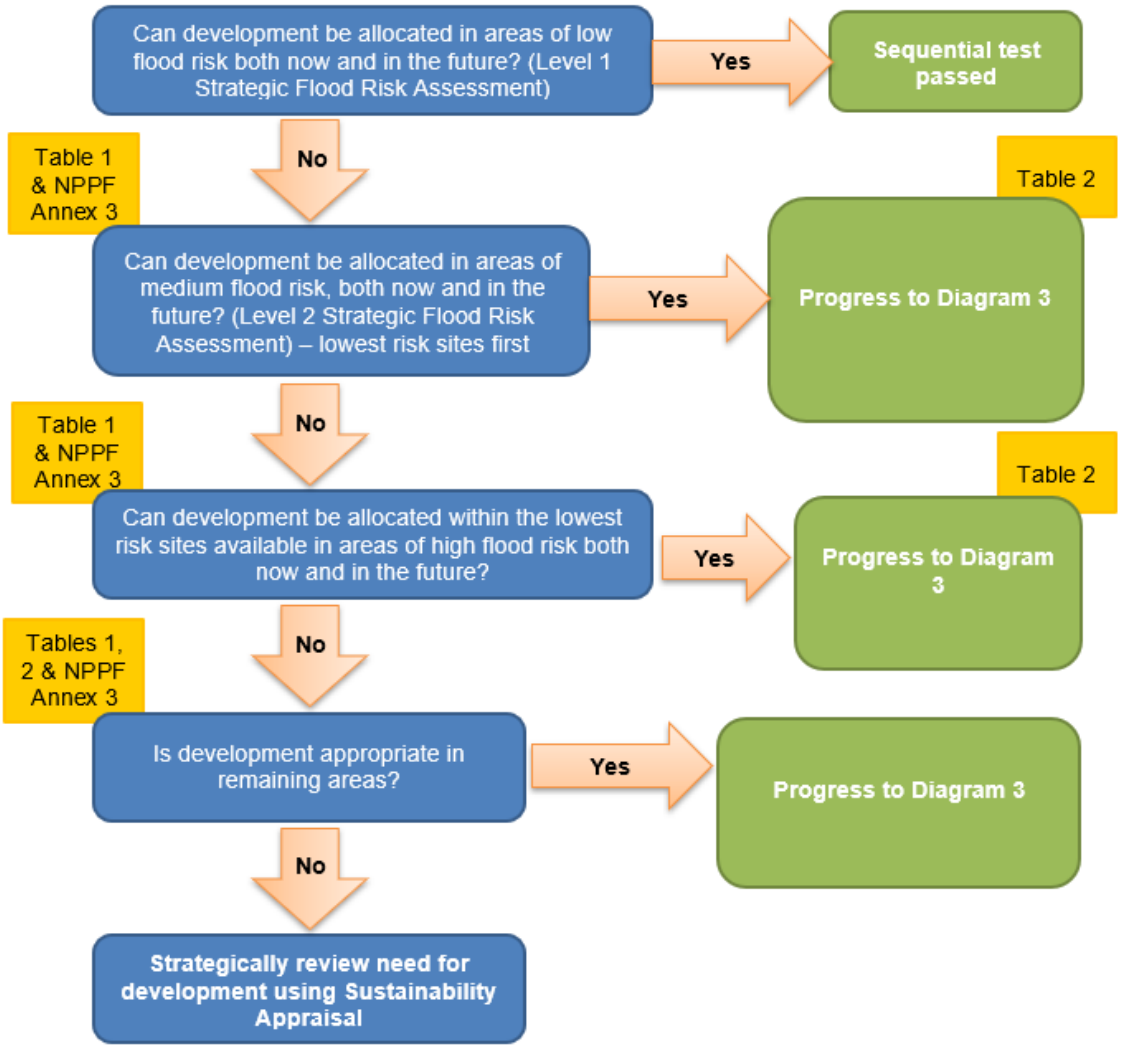
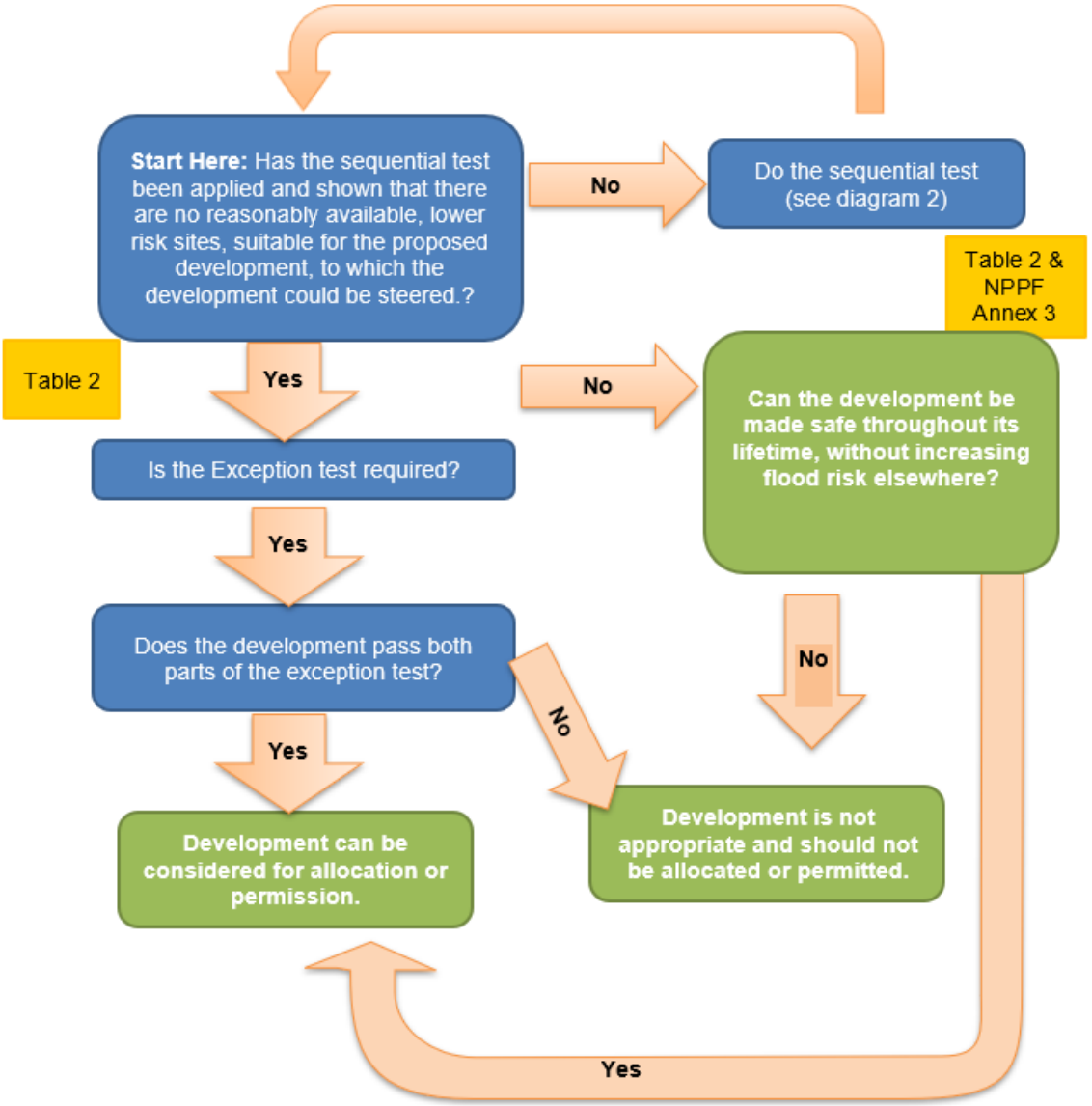


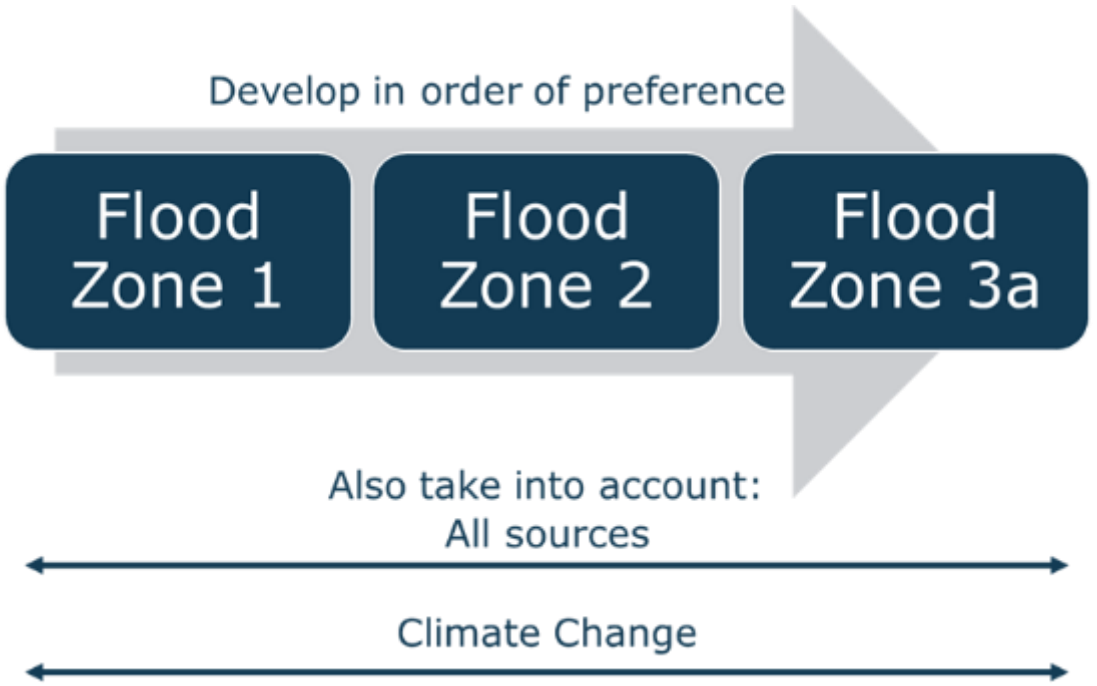
Figure 4-2: Application of the Exception Test to plan preparation



Fluvial/tidal flooding

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone (Section 3.2.1). **Annex 3 of the NPPF** defines the vulnerability of different development types to flooding. **Table 2 of the NPPG** shows whether, having applied the Sequential Test first, the vulnerability of development is incompatible for that Flood Zone and where further work is needed.

Figure 4-3: the Sequential Test for fluvial/tidal flood zones



Surface water flooding

The 0.1% AEP surface water flood extent mapping has been used to define a simple zoning scheme that identifies a 'high' risk and 'low' risk zone.

This is not strictly the same conceptual risk zone as defined for river and sea flooding (even though it is uses the same probability thresholds) as the mapping is based on different assumptions. However, it does create a product that can accommodate a form of sequential testing, as it can facilitate strategic decisions that directed development to land in a "low risk surface water flood zone".

The decision has been made to use the 0.1% AEP surface water extent as the high risk zone rather than the 1% AEP plus climate change extent as the 0.1% AEP is only marginally larger. This is a potentially a slightly more conservative approach but as the predicted 0.1% AEP surface water extents include assumptions that a proportion of the predicted flow is conveyed in pipe or channel systems the outlines could potentially underpredict the flood extents where such watercourse and drainage systems don't in fact exist. The approach will direct development to areas at low risk in a similar way to the fluvial/tidal Flood Zone 1 and will not preclude development in the surface water high risk zone provided that an FRA is performed to demonstrate that the risks in the 'high' risk zone can be appropriately managed.

Using such mapping it is not anticipated that the Sequential Test for surface water would normally require the consideration of alternative sites at lower risk, as the widespread and dendritic nature of surface water flood risk is conceptually very different to river and sea flood risk, but in some circumstances for relatively small sites that are potentially substantially affected it is possible that alternatives should be considered (as these could potentially not satisfy the flood risk requirements of the Exception Test).

The application of the test would require a preference that all proposed development on sites identified for allocation would be placed in the "low risk surface water flood zone". In circumstances where it is not possible to place all

proposed development in the "low risk surface water flood zone" or circumstances arose where encroachment could not be avoided then it would be necessary to provide supplementary evidence that the Exception Test could be satisfied. This supplementary exercise is set out in the Level 2 SFRA.

Groundwater flooding

The JBA groundwater flood map and West Sussex County Council's historical known events dataset do not provide the confidence or certainty required to undertake the Sequential Test as they describe the risk of groundwater emergence rather than the risk of flooding above the ground surface. On this basis, it is recommended that all sites are considered to be susceptible to groundwater flood risk as generally a substantive risk of emergence in the Chichester study area.

All sites selected for allocation on the basis of river, sea and surface water flood risk should undergo a further detailed assessment of groundwater flood risk which is described in the Level 2 SFRA. The Level 2 SFRA investigates local conditions on a site-by-site basis and will include using borehole, geological and LIDAR data.

Sewer flooding

The available data and information on sewer flooding does not make it possible to perform a comparative assessment of risk at alternative allocation sites. It is recommended that the sewer flood risk is not considered alongside river, sea and surface water flooding in the Sequential Test on the basis that the available information is not of appropriate resolution or format. Sewer flooding will be considered in more detail in the Level 2 SFRA for all sites selected on the basis of river, sea and surface water flood risk.

Reservoir flooding

It is recommended that reservoir flooding is included in the Sequential Test. The latest available mapping now shows "wet day" and "dry day" reservoir inundation extents. The "wet day" being a reservoir breach at the same time as a 0.1% river flood (as this is a likely time when a reservoir might fail) and the dry day shows the failure just from the water retained by the dam. Neither set of mapping describes a risk-based scenario as it does not provide the probability of a dam failure but are intended to describe a "worst credible case".

Two zones will be defined:

- Where reservoir flooding is predicted to make fluvial flooding worse.
- Where reservoir flooding is not predicted to make fluvial flooding worse.

This will also identify locations where proposed development could result in a change to the risk designation of a reservoir (locations where the velocities and depths would be severe if there was a dam failure). If proposed sites are located in a zone at reservoir risk it will be necessary to include a more detailed assessment in a Level 2 SFRA to understand the extent to which the flooding could be made worse and to report on the implications with respect to allocating the land for development.

4.1.2 The Exception Test

It will not always be possible for all new development to be allocated on land that is not at risk from flooding. To further inform whether land should be allocated, or Planning Permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required.

The Exception Test should only be applied following the application of the Sequential Test.

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

There are two parts to demonstrating a development passes the Exception Test:

1 *Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.*

Local planning authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

2 *Demonstrating 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.*

A Level 2 SFRA is likely to be needed to inform the Exception Test in these circumstances for strategic allocations. At Planning Application stage, a site-specific Flood Risk assessment will be needed. Both would need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

4.1.3 Making a development safe from flood risk over its lifetime

Local Planning Authorities will need to consider the actual and residual risk of flooding and how this will be managed over the lifetime of the development:

- The actual risk is the risk to the site considering existing flood mitigation measures. The 1% annual probability of fluvial flooding event should be used as a design standard when assessing the suitability of development and any mitigation measures.
- Safe access and egress should be available during the design flood event. Firstly, this should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.
- Residual risk is the risk that remains after the effects of flood defences have been taken into account and / or from a more severe flood event than the design event. The residual risk can be:
    - The effects of an extreme 0.1% chance flood in any year event. Where there are defences this could cause them to overtop, which may lead to failure if this causes them to erode; and/or
    - Structural failure of any flood defences, such as breaches in embankments or walls.

Flood resistance and resilience measures should be considered to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage it does, should water enter a property. Emergency plans should also account for residual risk, e.g. through the provision of flood warnings and a flood evacuation plan where appropriate.

In line with the NPPF, the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk.

4.2 Applying the Sequential Test and Exception Test to individual planning applications

4.2.1 The Sequential Test

Chichester District Council, taking account of views from other relevant parties, is responsible for considering whether the Sequential Test has been passed. The Environment Agency have been invited by Chichester District Council to provide comment in respect of the accuracy of the data the test is based on.

Developers are required to apply the Sequential Test to all development sites, unless the site is either:

- a strategic allocation and the test has already been carried out by the LPA
- a change of use (except to a caravan, camping or chalet site, or to a mobile home or park home site)
- a minor development (householder development, small non-residential extensions with a footprint of less than 250m2); or
- a development in flood zone 1 unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).

The SFRA contains information on all sources of flooding and taking into account the impact of climate change. This should be considered when a developer undertakes the Sequential Test, including the consideration of reasonably available sites at lower flood risk.

Local circumstances must be used to define the area of application of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). The criteria used to determine the appropriate search area relate to the catchment area for the type of development being proposed. For some sites this may be clear e.g. school catchments, in other cases it may be identified by other Local Plan policies. For some sites e.g. regional distribution sites, it may be suitable to widen the search area beyond LPA administrative boundaries.

The sources of information on reasonably available sites may include:

- Site allocations in Local Plans
- Site with Planning Permission but not yet built out
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/ five-year land supply/ annual monitoring reports
- Locally listed sites for sale.

It may be that a number of smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood risk.

Ownership or landowner agreement in itself is not acceptable as a reason not to consider alternatives.

The Sequential Test Methodology in Appendix L provides a guide to using the technical data and performing the Sequential Test for the purposes of the SFRA.

It should also be noted that for "small catchments" (typically less than 3 square kilometres) or the upper extremity of larger catchments the nationally available flood mapping might not have been prepared. This potentially gives the incorrect impression that a site is in Zone 1, when in fact it might be affected by flood risk from an adjacent watercourse. In such circumstances an initial assessment should

be performed to identify the extent of the flood zones to understand the implications with respect to applying the Sequential Test.

4.2.2 The Exception Test

If, following application of the Sequential Test, it is not possible for the development to be located in areas with a lower probability of flooding the Exception Test must then be applied if required. Developers are required to apply the Exception Test to all applicable sites (including strategic allocations).

The applicant will need to provide information that the application can pass both parts of the Exception test:

- *Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk*

Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

Applicants should detail the sustainability issues the development will address and how these will outweigh the flood risk concerns for the site e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

- *Demonstrating 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.*

The site-specific Flood Risk Assessment should demonstrate that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:

- the design of any flood defence infrastructure;
- access and egress;
- operation and maintenance;
- design of the development to manage and reduce flood risk wherever possible;
- resident awareness;
- flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event; and
- any funding arrangements required for implementing measures

4.3 Cumulative impacts

When allocating land for development, consideration must be given to the potential cumulative impact of development on flood risk. The increase in impermeable surfaces and resulting rise in runoff increases the chances of surface water flooding if suitable mitigation measures, such as SuDS, are not put in place. Additionally, the increase in runoff may result in more flow entering watercourses, increasing the risk of fluvial flooding at locations further downstream that are potentially sensitive to increases in the volume or flow of flood water.

Consideration must also be given to the potential cumulative impact of the loss of floodplain as a result of development. The effect of the loss of floodplain storage should be assessed, at both the development and elsewhere within the catchment and, if required, the scale and scope of appropriate mitigation should be identified.

Whilst the increase in runoff, or loss in floodplain storage, from individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe without appropriate mitigation measures.

For windfall sites which have not yet been allocated, the NPPF requires that the cumulative impact of development should be considered at the application stage and the appropriate mitigation measures undertaken to ensure flood risk is not exacerbated, and in many cases the development should be used to improve the flood risk.

4.4 Cross boundary considerations

Situations may occur where a development site is situated across Local Authority boundaries, or where the development in one district or borough may impact flood risk elsewhere. Chichester District Council should consider the impacts of development on flood risk elsewhere even if the impact of this is not within their area. In situations where cross-boundary developments are proposed, Chichester District Council should work closely with other Local Planning Authorities to satisfy the requirements of policies in their respective Local Plans, in consultation with statutory consultees such as the Environment Agency and Lead Local Flood Authority.

5 Climate change

5.1 Climate change, the NPPF and PPG

The updated NPPF (published July 2021) sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. NPPF and PPG describe how FRAs should demonstrate how flood risk will be managed over the lifetime of the development, taking climate change into account.

The updated 2021 NPPF also states that the 'All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change' (para 161).

The Environment Agency published **updated climate change guidance**[2] on 19 February 2016 (further updated in February 2019, December 2019, 2021 and 27 May 2022), which supports the NPPF and must now be considered in all new developments and planning applications. The document contains guidance on how climate change should be accounted for when considering development, specifically how allowances for climate change should be included with FRAs. The Environment Agency can give a free preliminary opinion to applicants on their proposals at pre-application stage. There is a charge for more detailed pre-application planning advice.

The PPG has been updated alongside the NPPF so when assessing flood risk there is a greater emphasis on all sources of flooding and the impacts of climate change. The sequential test seeks to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account both now and in the future (as set out in **diagram 2 of the PPG**). The guidance goes on to state that 'Where it is not possible to locate development in low-risk areas, the Sequential Test should go on to compare reasonably available sites:

- Within medium risk areas; and
- Only where there are no reasonably available sites in low and medium risk areas, within high-risk areas.'

It should be noted that the proposed approach can only be practically implemented if appropriate supporting risk mapping is available.

5.2 Climate change allowances

Making an allowance for climate change helps reduce the vulnerability of the development and provides resilience to flooding in the future.

The Environment Agency's climate change guidance includes climate change predictions of anticipated change for peak river flow, peak rainfall intensity and sea levels. These allowances are based on climate change projections and different scenarios of carbon dioxide emissions to the atmosphere.

Due to the complexity of projecting the effects of climate change, there are uncertainties attributed to climate change allowances. As a result, the guidance presents a range of possibilities to reflect the potential variation in the impact of climate change over three periods.

The **UK Climate Predictions 2018** (UKCP18) were published on 26 November 2018. The UKCP18 projections replace the UKCP09 projections and is the official source of information on how the climate of the UK may change over the rest of

2 Flood Risk Assessments: climate change allowances. Environment Agency (2016, last updated 2020) https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

this century. The Environment Agency has updated their climate change allowances to take account of the UKCP18 projections.

5.3 Peak river flows

Climate change is expected to increase the frequency, extent and impact of flooding, reflected in peak river flows. Wetter winters and more intense rainfall may increase fluvial flooding and surface water runoff and there may be increased storm intensity in summer. Rising river levels may also increase flood risk.

The **peak river flow allowances** provided in the guidance show the anticipated changes to peak flow for the river basin district within which a watercourse is located.

For each management catchment, guidance on uplift in peak flows are provided for three allowance categories, Central, Higher Central and Upper End which are based on the 50th, 70th and 95th percentiles respectively. The allowance category to be used is based on the vulnerability classification of the development and the Flood Zones within which it is located.

These allowances (increases) are provided, in the form of figures for the total potential change anticipated, for three climate change periods:

- The '2020s' (2015 to 2039)
- The '2050s' (2040 to 2069)
- The '2080s' (2070 to 2115)

The time period used in the assessment depends upon the expected lifetime of the proposed development. Residential development should be considered for a minimum of 100 years. For non-residential uses a starting point of 75 years should be considered unless there are specific reasons for a different development lifetime to be used. Further information on what is considered to be the lifetime of development is provided in the **PPG**.

The allowances for the Arun and Western Streams management catchment are provided in Table 5-1.

Table 5-1: Peak river flow allowances for the Arun and Western Streams management catchment

Allowance category	Central	Higher central	Upper end
Total potential change anticipated for '2020s' (2015 to 39)	11%	16%	27%
Total potential change anticipated for '2050s' (2040 to 2069)	13%	19%	36%
Total potential change anticipated for '2080s' (2070 to 2115)	25%	36%	64%

Developers will also need to use these allowances to assess off-site impacts and calculate floodplain storage compensation depends on land uses in affected areas. The central allowance should be used in most cases, with the higher central allowance used when the affected area contains essential infrastructure. This guidance also applies with consideration to safe access, escape route and places of refuge.

Developers should also consider likely future land uses shown by local plan allocations or unimplemented extant planning permissions. The Environment Agency will want to see evidence from the developer to prove they have done this.

5.3.1 River climate change guidance for Nationally Significant Infrastructure Projects, new settlements and significant urban extensions

Current guidance published in May 2022, is that Strategic Flood Risk Assessments should use the Central and Higher Central allowances to assess the impacts of climate change on river flood risk. The updates for peak river flows place increased emphasis on the Central and Higher Central scenarios. The guidance states that the Upper End allowances for peak river flows should be used to assess the following:

- Nationally Significant Infrastructure Projects;
- New settlements;
- Significant urban extensions.

5.4 Sea level rise allowance

Climate change is predicted to result in higher sea levels caused by melting ice sheets and more extreme storm events which will create higher storm surges. The

Environment Agency's sea level allowances[3] have been used in the preparation of this report as confirmed by the Environment Agency (Table 5-2). The allowances outline the range of possible increases in sea level based on the 70th (higher central) and 95th (upper end) percentiles.

Different allowances are provided for different coastal regions, Chichester is within the South East region.

Given the vulnerability of the coastal part of the plan area in relation to tidal flooding and erosion, it is considered most appropriate to use the Upper End Sea level rise allowance when applying the sequential and exception tests so that a precautionary approach is taken.

Table 5-2: Peak sea level allowances for South East region

Allowance category	Annual sea level rise allowance 2000 to 2035	Annual sea level rise allowance 2036 to 2065	Annual sea level rise allowance 2066 to 2095	Annual sea level rise allowance 2096 to 2125	Cumulative rise 2000 to 2125
Higher central	200mm	261mm	348mm	393mm	1.20m
Upper end	242mm	339mm	474mm	546mm	1.60m

5.4.1 Sea level rise guidance for Nationally Significant Infrastructure Projects, new settlements and significant urban extensions

The Environment Agency guidance states that the H++ allowance for sea level rise to 2100 should be used to assess the following:

- Nationally Significant Infrastructure Projects;
- New settlements;
- Significant urban extensions.

The H++ allowance represents an increase in sea level of 1.9m.

5.5 Peak rainfall intensity allowance

Climate change is predicted to result in wetter winters and increased summer storm intensity in the future. This increased rainfall intensity will affect land and urban drainage systems, resulting in surface water flooding, due to the increased volume of water entering the systems.

The Environment Agency climate change guidance provides peak rainfall intensity allowances based on management catchments. Table 5-3 and

show anticipated changes in extreme rainfall intensity for the Arun and Western Streams catchment which is located within the Local Plan study area. These values are higher than those for the Wey and Tributaries catchment which is also located in the Local Plan study area.

The Arun and Western Streams catchment allowances have been used within the SFRA surface water climate change modelling as this is a conservative approach.

3 Flood risk assessments: climate change allowances – sea level allowances. Environment Agency. (2016, updated 2022) https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#sea-level-allowances

The Upper End Arun and Western Streams catchment allowance has been run for the 1% AEP and 3.3% AEP surface water events for the 2070s epoch.

These allowances should be used for small catchments and urban drainage sites. For catchments, larger than 5km^2, the guidance suggests the peak river flow allowances should be used.

Table 5-3: Peak rainfall intensity allowance in small and urban catchments 3.3% AEP event

Arun and Western Streams Management Catchment	3.3% annual exceedance rainfall event	
	Central allowance	Upper end allowance
2050s epoch	20%	35%
2070s epoch	25%	40%

Table 5-4: Peak rainfall intensity allowance in small and urban catchments 1% AEP event

Arun and Western Streams Management Catchment	1% annual exceedance rainfall event	
	Central allowance	Upper end allowance
2050s epoch	20%	45%
2070s epoch	25%	45%

5.6 Groundwater

Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months.

There is substantial uncertainty over the potential effects of climate change on the magnitude of groundwater flows generated by rainfall making it difficult to identify competent evidence that can be used to inform a strategic assessment. As a general rule the order of magnitude of such change is likely to be much less than for other sources of flood risk and thus it is likely that that predicted changes in fluvial and surface water flood risk will be the most influential consideration when evaluating the safety of development over the intended life.

it is possible that long term changes in mean sea level could result in increased groundwater levels and reduce drainage system emptying times and so affect the performance of local watercourse systems. Consideration will need to be given to the arrangements for water level management as affects local watercourses and water features where these are predicted to be material effects.

The effect of climate change on groundwater levels for sites in areas where groundwater is known to be an issue should be considered at the planning application stage as part of a detailed Flood Risk Assessment. It might be necessary to consider water level management for the site or at a strategic level.

5.7 Using climate change allowances in Flood Risk Assessments

To help decide which allowances should be selected to inform the flood levels in flood risk assessments and management strategies for a development, the following should be considered:

- likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s)
- vulnerability of the proposed development types or land use allocations to flooding
- 'built in' resilience measures used, for example, raised floor levels
- capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach
- The resilience capacity of the measures in place so that development is safe and how this is affected by the increased hazard magnitudes associated with climate change conditions.

The climate change allowances which should be used in the Sequential Test are outlined in Appendix L.

5.8 The impact of climate change in the Local Plan area

5.8.1 Previous studies

The **UK Climate Projections (UKCP18)** provides a number of future projections for different variables across the UK.

South East England

- Increased mean summer temperature of between 2° - 7°C by 2099.
- Increased mean winter temperatures of up to 2ºC or a decrease of up to -1ºC by 2099.
- Summer rainfall could decrease by over 80% or it could increase up to 10% by 2099.
- Winter rainfall could decrease by up to 10% or it could increase over 30% by 2099.

Whilst changes in trends and mean values is important, the more influential effect of climate change with respect to flood risk and drought is to increase the chance of occurrence and severity of more extreme wet and dry events.

5.8.2 Adapting to climate change

The **PPG Climate Change guidance** contains information for how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future

adaptation if needed, such as setting new development back from watercourses

Chichester District Council have produced a **Climate Change Action Plan**. This outlines numerous projects and initiatives being undertaken across its services to reduce carbon emissions and assist the District in adapting to the effects of climate change.

West Sussex County Council has adopted a **Sustainability Strategy** for the period 2020 to 2030. The strategy aligns with the Council's aim to be carbon neutral by 2030 and prioritises corporate and environmental sustainability, valuing and protecting West Sussex, resource efficiency and collaborating with and influencing others in order to achieve maximum sustainability benefits.

West Sussex Life is a report published annually by WSCC and provides a range of statistics and information about West Sussex. A chapter in the report focuses on **the Environment**, including carbon emissions, energy consumption, waste, flood risk, natural environment and geology.

5.8.3 SFRA climate change modelling

Fluvial modelling

As part of the Level 1 SFRA, climate change scenarios have been run for the 3.3%, 1%, and 0.1% AEP events in order for Chichester District Council to assess the high, medium and low risk areas both now and in the future in line with the updated PPG guidance as part of the Sequential Test. The fluvial climate change allowances run as part of the SFRA are outlined in Table 5-5.

The Sequential Test methodology in Appendix L outlines the climate change allowances that should be assessed as part of the Sequential Test. If a site is located within the 0.1% AEP + climate change extent, the site will be considered at flood risk as part of the Sequential Test.

Table 5-5: Fluvial climate change allowances run as part of the SFRA

Model name	Model runs as part of the Level 1 SFRA
East Wittering	3.3% AEP + 25% climate change allowance
	3.3% AEP + 36% climate change allowance
	3.3% AEP + 64% climate change allowance
	1% AEP + 25% climate change allowance
	1% AEP + 36% climate change allowance
	1% AEP + 64% climate change allowance
	0.1% AEP + 25% climate change allowance
	0.1% AEP + 36% climate change allowance
	0.1% AEP + 64% climate change allowance
The Lavant	3.3% AEP + 25% climate change allowance
	3.3% AEP + 36% climate change allowance
	3.3% AEP + 64% climate change allowance
	1% AEP + 25% climate change allowance
	1% AEP + 36% climate change allowance
	1% AEP + 64% climate change allowance
	0.1% AEP + 25% climate change allowance

Model name	Model runs as part of the Level 1 SFRA
	0.1% AEP + 36% climate change allowance
	0.1% AEP + 64% climate change allowance
Upper Arun	1% AEP + 25% climate change allowance
	1% AEP + 36% climate change allowance
	1% AEP + 64% climate change allowance
Aldingbourne Rife	3.3% AEP + 25% climate change allowance
	3.3% AEP + 36% climate change allowance
	3.3% AEP + 64% climate change allowance
	1% AEP + 25% climate change allowance
	1% AEP + 36% climate change allowance
	1% AEP + 64% climate change allowance
Bosham Stream	3.3% AEP + 25% climate change allowance
	3.3% AEP + 36% climate change allowance
	3.3% AEP + 64% climate change allowance
	1% AEP + 25% climate change allowance
	1% AEP + 36% climate change allowance
	1% AEP + 64% climate change allowance
	0.1% AEP + 25% climate change allowance
	0.1% AEP + 36% climate change allowance
	0.1% AEP + 64% climate change allowance
River Ems	3.3% AEP + 25% climate change allowance
	3.3% AEP + 36% climate change allowance
	3.3% AEP + 64% climate change allowance
	0.1% AEP + 25% climate change allowance
	0.1% AEP + 36% climate change allowance
	0.1% AEP + 64% climate change allowance

Fluvial modelling issues

Issues encountered during the preparation of the fluvial climate change models are outlined below.

River Arun

It should be noted that the River Arun 3.3% AEP and 0.1% AEP scenarios were not re-run with climate change allowances as the present day simulations were not available from the Environment Agency.

Aldingbourne Rife

JBA attempted to run the Aldingbourne Rife model with the 0.1% AEP climate change allowances but despite a number of attempts encountered inherent instability problems due to the age of the model. Therefore, no climate change outputs for the 0.1% AEP event have been prepared for the Aldingbourne model.

River Ems

The River Ems model was provided by the Environment Agency with the 1% AEP + 25%, 36% and 64% climate change allowances.

Implications

Where there is no fluvial model available or the climate change allowances could not be run, Flood Zone 2 has been used to provide indicative information on climate change. This level of assessment is considered to be proportionate and suitable for a district level strategic assessment. **However, detailed hydraulic modelling using topographic survey would be required at a site-specific level to confirm the flood risk to these sites as part of a detailed FRA.**

The technical modelling reports for the climate change runs can be found in Appendix M.

Coastal modelling

The Arun to East Head and Chichester Harbour coastal modelling studies have been updated with the latest climate change allowances.

The Sequential Test methodology in Appendix L outlines the climate change allowances that should be assessed as part of the Sequential Test. If a site is located within the 0.1% AEP + climate change extent, the site will be considered at flood risk as part of the Sequential Test.

The following scenarios have been run for climate change:

- 3.3% AEP event for 2096 with the Higher Central allowance
- 3.3% AEP event for 2096 with the Upper End allowance
- 3.3% AEP event for 2100 with the H++ allowance
- 3.3% AEP event for 2121 with the Higher Central allowance
- 3.3% AEP event for 2121 with the Upper End allowance
- 0.5% AEP event for 2096 with the Higher Central allowance
- 0.5% AEP event for 2096 with the Upper End allowance
- 0.5% AEP event for 2100 with the H++ allowance
- 0.5% AEP event for 2121 with the Higher Central allowance
- 0.5% AEP event for 2121 with the Upper End allowance
- 0.1% AEP event for 2096 with the Higher Central allowance
- 0.1% AEP event for 2096 with the Upper End allowance
- 0.1% AEP event for 2100 with the H++ allowance
- 0.1% AEP event for 2121 with the Higher Central allowance
- 0.1% AEP event for 2121 with the Upper End allowance

Important note: The Arun to East Head climate change outputs for the Level 1 SFRA include the defended and undefended results. This is because the removal of the defences can allow flood water to flow back into the sea and so potentially provide an underestimate of the extent of land that is at risk. In the defended scenarios, the presence of the defences prevents the floodwater from flowing back to sea and as the volume of water increases behind the defences, this results in more extensive inland inundation. A full understanding of all the areas at flood risk could be obtained by combining the defended and undefended results.

The coastal model report can be found in Appendix M and provides the technical details of the updates made to the models. Climate change mapping can be found

in Appendix E and **interactive maps** are available the Chichester District Council's website.

Surface water

The Environment Agency's Risk of Flooding from surface water model has been re-run by JBA as part of the SFRA with the following climate change allowances:

- 3.3% AEP plus 40% climate change allowance
- 1% AEP plus 45% climate change allowance

6 Sources of information used in preparing the SFRA

6.1 Historic flood risk

The historic flood risk in the Local Plan area has been assessed using point information of recorded incidents provided by West Sussex County Council and on the Environment Agency's recorded flood outline dataset. This has supplemented with other information collected during the course of preparing the assessment.

6.2 Fluvial flood risk models used in this SFRA

Table 6-1 lists the fluvial flood risk modelling used to inform the SFRA.

It should be noted that generalised modelling has been used for the River Wey in this SFRA. At the time of preparing this SFRA, the Environment Agency were in the process of updating flood maps in the Wey Catchment. The Environment Agency should be consulted to obtain the most up to date modelling in preparation of any FRAs in this area.

Table 6-1: Fluvial flood risk models used in the Level 1 SFRA

Model name	Year	Software (type)
East Wittering	2015	InfoWorks
River Ems	2022	InfoWorks
The Lavant	2018	Flood Modeller/TUFLOW
Upper Arun	2003	ISIS (Flood Modeller)
Aldingbourne Rife	2016	InfoWorks
Bosham Stream	2012	ISIS-TUFLOW
Generalised main river and ordinary watercourse modelling	2004 and 2009	JFlow (2D)

6.3 Fluvial flooding

Flood Zones 2, 3a and 3b have been compiled for the study area as part of this SFRA. Flood Zones are based on the undefended scenario with the exception of Flood Zone 3b, which includes the presence of defences on the basis that land behind existing defences is not functional floodplain. The Flood Zones presented in this SFRA should be used for the basis for decision making in the Local Plan review. This will update the existing Environment Agency Flood Zones.

The following categories have been used to define each Flood Zone:

- **Flood Zone 1:** Comprised of land having a less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1% AEP)
- **Flood Zone 2:** Comprised of land having between a 1 in 100 (1% AEP) and 1 in 1,000 annual probability of river flooding or 1 in 200 (0.5% AEP) and 1 in 1,000 (0.1% AEP) annual probability of sea flooding.
- **Flood Zone 3a:** This zone comprises land assessed as having a greater than 1 in 100 (>1% AEP) annual probability of river flooding or Land having a 1 in 200 or greater annual probability of sea flooding.
- **Flood Zone 3b:** This zone comprises land where water has to flow or be stored in times of flood (the functional floodplain).

Flood Zone 3b

Flood Zone 3b, unlike other zones, does show flood risk that takes account of the presence of existing flood risk management features and flood defences, as land afforded this standard of protection is not appropriately included as functional floodplain.

The 2022 PPG provides an updated definition of Flood Zone 3b to include the 3.3% AEP flood extent as a starting point.

The 3.3% AEP flood extent was not available for the Upper Arun so the 4% AEP flood extent has been used in the SFRA. The potential differences in the predicted extents will be marginal and so the level of assessment is considered to be proportionate and appropriate when using the data to compare sites in a district level strategic assessment.

Where detailed modelling was not available, then Flood Zone 3a has been used as a precautionary approach. If a proposed development is shown to be within precautionary Flood Zone 3b, further investigation should be undertaken as part of a detailed site-specific FRA to define and confirm the extent of Flood Zone 3b.

The effect of wave overtopping along the coastline has been included in the Flood Zone 3b delineation.

If existing development or infrastructure is shown in Flood Zone 3b, additional consideration should be given to whether the specific location is appropriate for designation as 'Functional' with respect to the storage or flow of water in time of flood.

Flood Zone mapping for the Local Plan area can be found in Appendix D and **Interactive maps** on the Chichester District Council's website. The map highlights where a precautionary approach has been used to identify Flood Zone 3b.

6.4 Tidal/Coastal

The Arun to East Head and Chichester harbour coastal models have been updated as part of this SFRA to understand the tidal and coastal flood risk along the Local Plan area. The tidal mapping provides information for present day Flood Zone 3b, 3a and 2 (Appendix D and **CDC interactive maps** are also available the Chichester District Council's website.) and for the for the climate change events for the years 2096 and 2121 (Appendix E and **CDC interactive maps**). A model report for the updates made to the model as part of the SFRA can be found in Appendix M. It should be noted that the zones for sea flooding depict a combination of the condition where existing defences are taken into account or are not included so that the maximum extent of the risk zone is mapped, as these are the conditions used by the Environment Agency.

6.5 Surface Water

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

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

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

Although the RoFSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site-specific scale. Such an assessment will use the RoFSW in partnership with other sources of local flooding information, to confirm the presence of a surface water risk at that particular location.

The RoFSW map for the Local Plan area can be found in Appendix F and **CDC interactive maps**.

A **Flood Investigation report** prepared by West Sussex County Council reviewed the major flood event of June 2012. This report has been referred to in the preparation of this SFRA.

6.6 Groundwater

JBA has developed a range of Groundwater Flood Map products at the national scale. The 5m resolution JBA Groundwater map has been used within the SFRA. The modelling involves simulating groundwater levels for a range of return periods (including 75, 100 and 200-years). Groundwater levels are then compared to ground surface levels to determine the head difference in metres. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 100-year model outputs which are outlined in Table 6-2.

Table 6-2: JBA Groundwater flood risk map categories

Flood depth range during a 1% AEP flood event	Groundwater flood risk
Groundwater levels are either at or very near (within 0.025m of) the ground surface.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
Groundwater levels are between 0.025m and 0.5m below the ground surface.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. There is the possibility

Flood depth range during a 1% AEP flood event	Groundwater flood risk
	of groundwater emerging at the surface locally.
Groundwater levels are between 0.5m and 5m below the ground surface.	There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.
Groundwater levels are at least 5m below the ground surface.	Flooding from groundwater is not likely.
No Risk	This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, so would represent an extreme scenario. The map also shows where groundwater is predicted to emerge, but it does not show where the flooding is likely to occur, or to what depths, velocity or hazard.

It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad-scale assessment of the groundwater flood hazard in an area and it is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding. West Sussex County Council should be consulted at the earliest opportunity to understand local groundwater issues around development sites and developers should prioritise groundwater monitoring to further understand local impacts.

The JBA Groundwater Flood Map for the Local Plan areas can be found in Appendix G. The JBA Groundwater Flood Map should not be used for the purposes of the Sequential Test. The reasons for this are outlined in Appendix L.

6.7 Sewers

Historical incidents of flooding are detailed by Southern Water through their Sewer Incident Report Form (SIRF) Data. This database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding. For data protection reasons, this data has been supplied on a postcode basis from the SIRF for incidents recorded in the study area.

The SIRF for the Local Plan area can be found in Table 7-3.

6.8 Reservoirs

The risk of inundation due to reservoir breach or failure of reservoirs within the area has been assessed using the **Environment Agency's Reservoir inundation dataset**[4] for a wet and dry day. A wet day assumes that there is also a 0.1% AEP flood event (Flood Zone 2). If a site is affected by reservoir breach outside of Zone

4 Risk of Flooding from Reservoirs. Environment Agency. (2020) https://data.gov.uk/dataset/44b9df6e-c1d4-40e9-98eb-bb3698ecb076/risk-of-flooding-from-reservoirs-maximum-flood-extent-web-mapping-service

2 then the implications of this can be considered in a Level 2 SFRA. These sites are highlighted in the site screening spreadsheet (Appendix K).

The reservoir inundation mapping for the Local Plan area can be found in Appendix H and **CDC interactive maps**. Guidance on how this information should be used to inform the Sequential and Exception Tests can be found in L.

6.9 Suite of maps

All of the mapping can be found in the appendices to this SFRA and is presented in the following structure:

- Appendix A: SFRA appendix grid map
- Appendix B: Historic flooding
- Appendix C: Watercourses
- Appendix D: Fluvial and tidal Flood Zones
- Appendix E: Fluvial and tidal climate change flood risk mapping
- Appendix F: Surface water flood risk mapping
- Appendix G: JBA Groundwater Flood Map
- Appendix H: Reservoir inundation map
- Appendix I: Flood Defences
- Appendix J: Flood Alert and Flood Warning Areas

Interactive maps can be found on the Chichester District Council's website. Due to licencing arrangements, the JBA Groundwater Flood Map is not available on the interactive mapping.

6.10 Other relevant flood risk information

Users of this SFRA should also refer to other relevant information on flood risk where available and appropriate. This information includes:

- **Arun and Western Streams CFMP (2009)**

Provides information on the catchment-wide strategy for flood risk management. It should be ensured that any flood risk management measures are consistent with the plan.

- **West Sussex Local Flood Risk Management Strategy (2013)**

Provides information on local flooding issues and the plan for managing risk. It should be ensured that development and any flood risk management measures are consistent with the strategy. The LFRMS is currently being updated by West Sussex County Council.

- **South East River Basin District Flood Risk Management Plan (2016)**

Provides information on the catchment-wide strategy for flood risk management. It should be ensured that any flood risk management measures are consistent with the strategy.

- **Beachy Head to Selsey Bill Shoreline Management Plan (2006)**
- **North Solent Shoreline Management Plan** (2010)

These provide large-scale assessments of the risks associated with coastal evolution and presents the policy framework to address these risks in a sustainable manner. It should be ensured that any coastline development and flood risk management measures are consistent with the plan. The SMPs are currently undergoing a refresh.

- **Chichester District Council Surface Water and Drainage Supplementary Planning Document (SPD)**

This document provides useful advice to developers and consultants when preparing a planning application so that the development fully considers the water environment and how it should be managed. The document covers areas served by the wastewater treatment catchments: Apuldram (Chichester), Bosham, Thornham, Sidlesham, Pagham, Tangmere, Kirdford, Loxwood and Wisborough Green

7 Understanding flood risk in the Local Plan area

7.1 Historical flooding

The Local Plan area has a long history of recorded flood events, with multiple sources of flooding. The most notable flooding incidents occurred in 1974, 1993/1994, 2000, 2012 and 2013/2014, during which widespread flooding was observed across the study area.

Information collated from the Environment Agency's flood outline and West Sussex County Council recorded flood incidents data sets, were assessed to understand the historic flooding in the Local Plan area. The data shows that there have been a number of fluvial floods in the area including along the River Lavant, the Earnley Rife, River Ems, the Ham Brook, River Lox and River Kird.

Selsey and East Wittering have been susceptible to tidal flooding in the past and surface water flooding has been recorded throughout the Local Plan area.

Groundwater flooding has been recorded in Chichester, Emsworth, Wisborough Green and Woodmancote.

This information was supplemented by information collected from the 2008 Chichester SFRA, West Sussex County Council Flood Investigation reports and an online search.

The key historical incidents of flooding identified is summarised as follows:

- **September 1968:** A fluvial flood in Wisborough Green caused damage to the river bank, a road and to a cottage. The maximum recorded flood level was 11.18m AOD. There are also several records which show that Loxwood was subject to flooding during this event, which affected roads, properties and gardens.
- **November 1974**: Heavy rainfall resulted in widespread fluvial and tidal flooding across the Local Plan area. Among the areas affected were Chidham, Bosham and Southbourne. The main impacts of the flood were minor road flooding and damage to property.
- **1974, 1979 and 1981:** The Environment Agency flood records identify that Wisborough Green has been affected by several flood events. According to the WSCC records, areas frequently affected by flooding include Durham Road, the public house and the local green. During the 1981 flooding incident, several gardens and properties flooded.
- **June 1991**: Chidham was affected by flooding due to drainage.
- **December 1993/January 1994:** Heavy rain at the end of December led to burst banks along the River Lavant and subsequent flooding in the City of Chichester and surrounding areas. The A27, 3 miles west of Chichester was closed due to serious flooding for a lengthy period. This flood event was notable for the long duration and as characterised by groundwater flooding.
- **January 1996:** Fluvial flooding in East Wittering resulted in the flooding of several properties.
- **January 1998; November and December 2005; March 2008:** According to the historic flood records, Selsey has been affected by flooding on at least three different occasions. The main causes of these floods are tidal/coastal or overtopping of defences.
- **October 2000 and January 2003:** Bosham has also flooded on separate occasions, mainly due to drainage problems. Flooding was particularly bad in

October 2000, as road drainage systems and sewer networks became congested, which led to ditches and sewer chambers overflowing onto roads.

- **November 2000:** Overtopping of the River Ems led to flooding on Lumley Road in Southbourne. The same road was flooded again in December 2013.
- **June 2012:** Heavy rainfall led to widespread surface water flooding, with 138 properties affected within the study area. In response to the SFRA consultation exercise it was reported that residents in Birdham and Bracklesham were understood to have been evacuated from their properties for periods exceeding 6 months. The A27 was closed in both directions due to serious flooding[5]. To reduce flood damage, the Environment Agency used high volume pumps to lower river levels on Aldingbourne Rife[6].
- **Winter 2013/14:** Widespread flooding across the study area.
- **November 2022:** In response to the Level 1 SFRA consultation, exercise it was reported by a stakeholder that surface water flooding was understood to have affected the villages of Apuldram, Bosham, Donnington and Hambrook.

Appendix B shows the recorded historic flood points and historic flood extents provided by WSCC and the Environment Agency respectively. Not all of the historic data provided had a source of flooding and was therefore classified as 'Unknown'. Also, not all of the data provided had dates or a description of flooding recorded.

7.1.1 West Sussex County Council June 2012 Flood Event Report

West Sussex County Council produced a **Flood Investigation report** in November 2012 reviewing the major flood event of June 2012. The report identifies the event as a 1 in 200-year event (0.5% AEP) that overwhelmed the drainage network and led to widespread flooding across West Sussex. 110 properties were recorded as flooded in the Manhood Peninsula and 28 properties in West Chichester.

7.2 Topography, geology and soils

Chichester District, the largest district in West Sussex, covers an area of approximately 800km^2 and has a total population of 113,800. A substantial proportion of the district (544km^2) falls within the South Downs National Park which is excluded from the Local Plan area. There are 33 Parish Councils in the Local Plan area. The main settlement is the city of Chichester, with a population of around 26,000. Other sizeable towns include Selsey, Southbourne and Tangmere[7].

7.2.1 Topography

As shown in Figure 7-1 and Figure 7-2, the topography of the Local Plan area comprises of low-lying grounds in the south, associated with Chichester Harbour and Pagham Harbour, and further north, with the 'Low Weald' arable landscape[8]. The South Downs runs through the centre of the district, wherein the highest elevation is approximately 277m AOD. The majority of the Local Plan area is just above sea level, with the highest elevation located in the north-eastern corner at approximately 85m AOD.

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[5] Travel warning after roads flood in Chichester area, BBC News, June 2012, available: https://www.bbc.co.uk/news/uk-england-sussex-18392059

[6] Flood water pumped out as West Sussex rain alert issued, BBC News June 2012, available: https://www.bbc.co.uk/news/uk-england-sussex-18451257

7 Chichester District Council, Adopted Chichester Local Plan: Key Policies 2014-2029

8 Chichester District Council, Adopted Chichester Local Plan: Key Policies 2014-2029

Figure 7-1: Topography of the northern Local Plan area

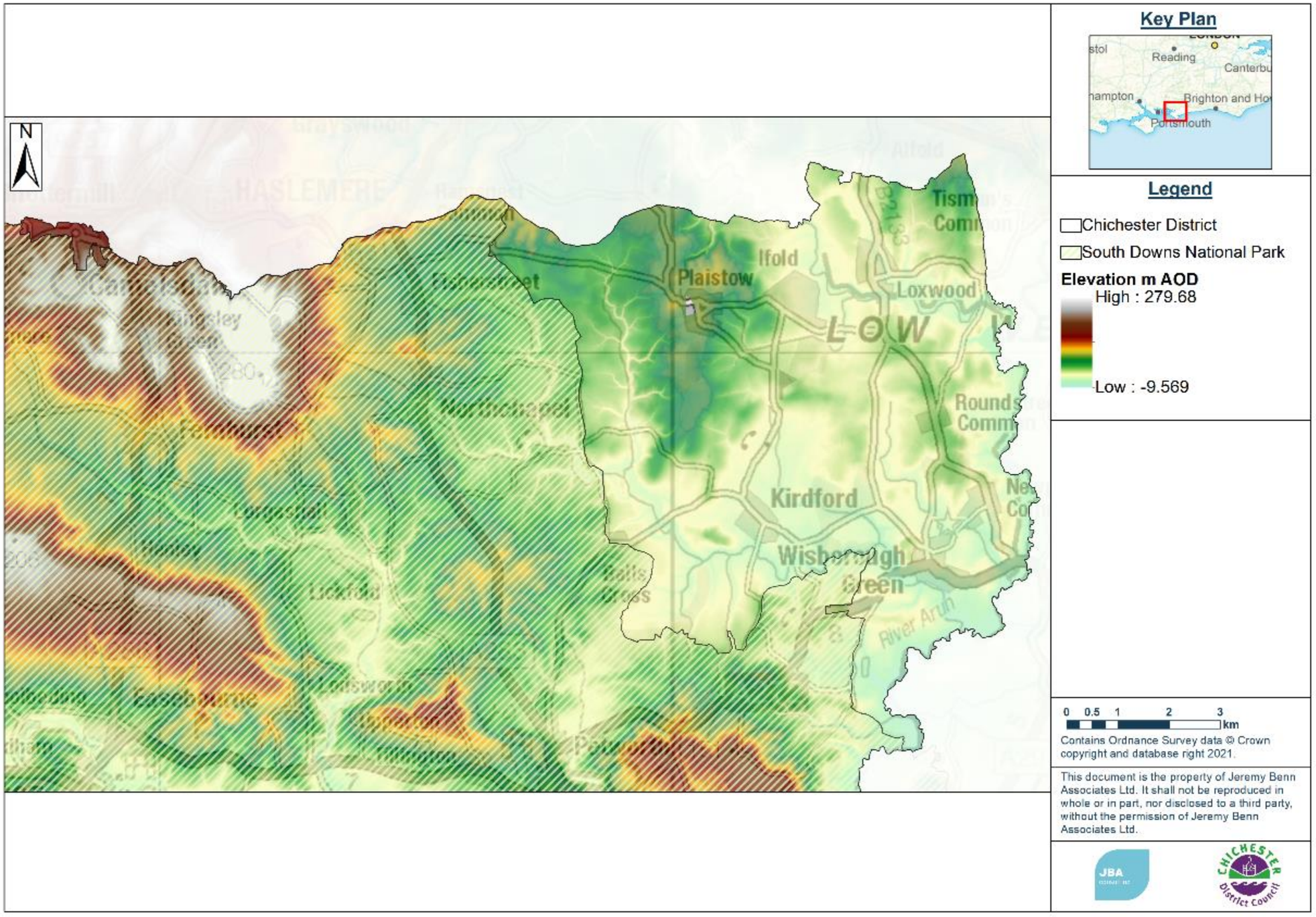
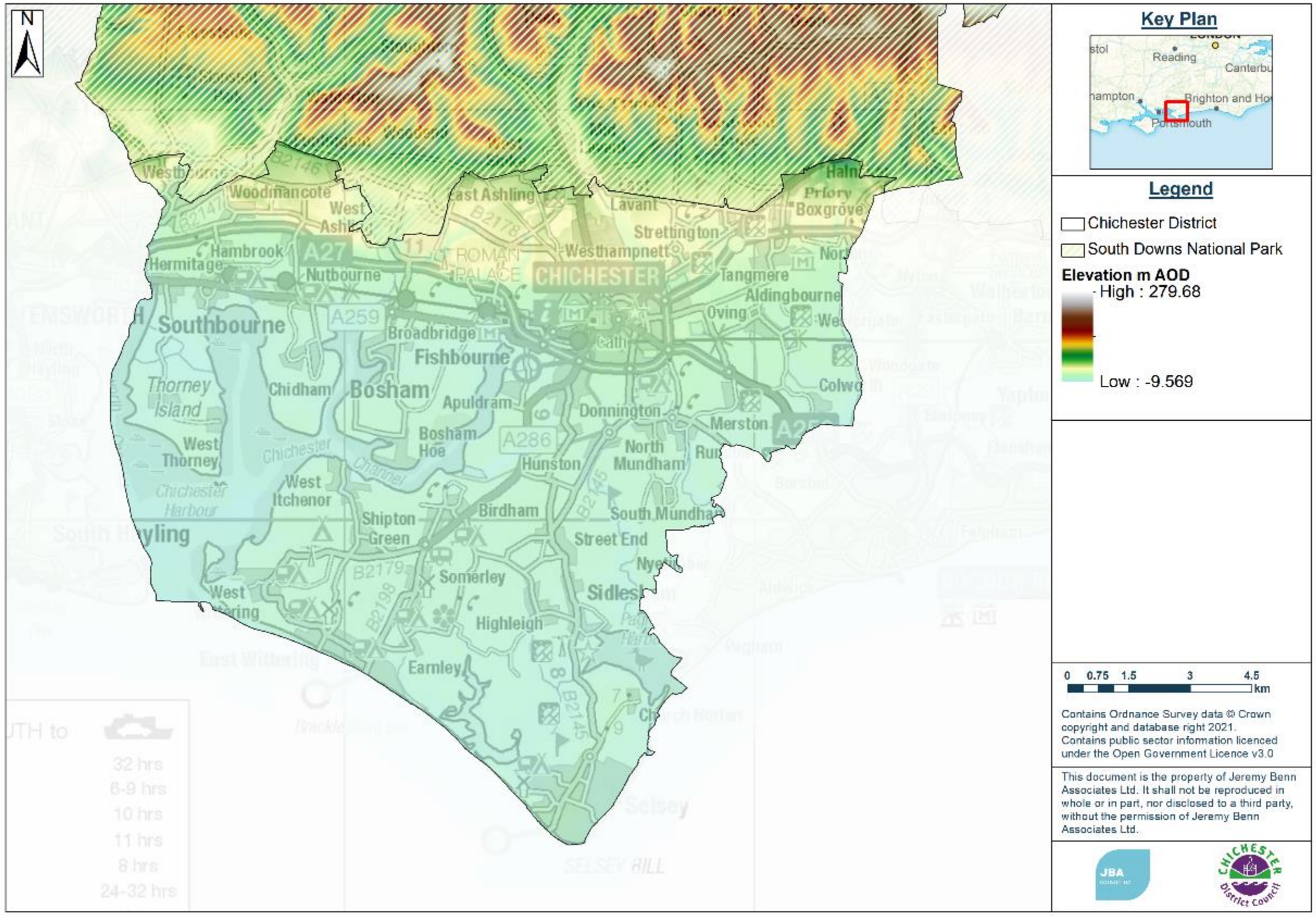


Figure 7-2: Topography of the southern Local Plan area



7.2.2 Geology and soils

The geology of the catchment can be an important influencing factor on the way that water runs off the ground surface. This is primarily due to variations in the permeability of the surface material and bedrock stratigraphy.

The Bedrock geology is shown in Figure 7-3 and Figure 7-4. Figure 7-5 and Figure 7-6 show the superficial deposits (permeable, unconsolidated).

The bedrock layers and superficial deposits are classified as the following aquifers and are shown in Figure 7-7, Figure 7-8, Figure 7-9 and Figure 7-10.

- **Principal**: layers of rock or drift deposits with high permeability and, therefore, provide a high level of water storage
- **Secondary A**: rock layers or drift deposits capable of supporting water supplies at a local level and, in some cases, forming an important source of base flow to rivers
- **Secondary B**: lower permeability layers of rock or drift deposits which may store and yield limited amounts of groundwater
- **Secondary undifferentiated**: rock types which do not fit into either category A or B.
- **Unproductive Strata**: rock layers and drift deposits with low permeability and, therefore, have a negligible impact on water supply or river base flow.

The bedrock geology in the study area is classified as a mixture of Principal and Secondary A aquifers and unproductive strata.

The superficial deposits in the study are primarily classified as Secondary A aquifers, which are associated with areas of sand and gravel, and Secondary (undifferentiated) aquifers are also located through the area.

Figure 7-3: Bedrock Geology in the northern Local Plan area

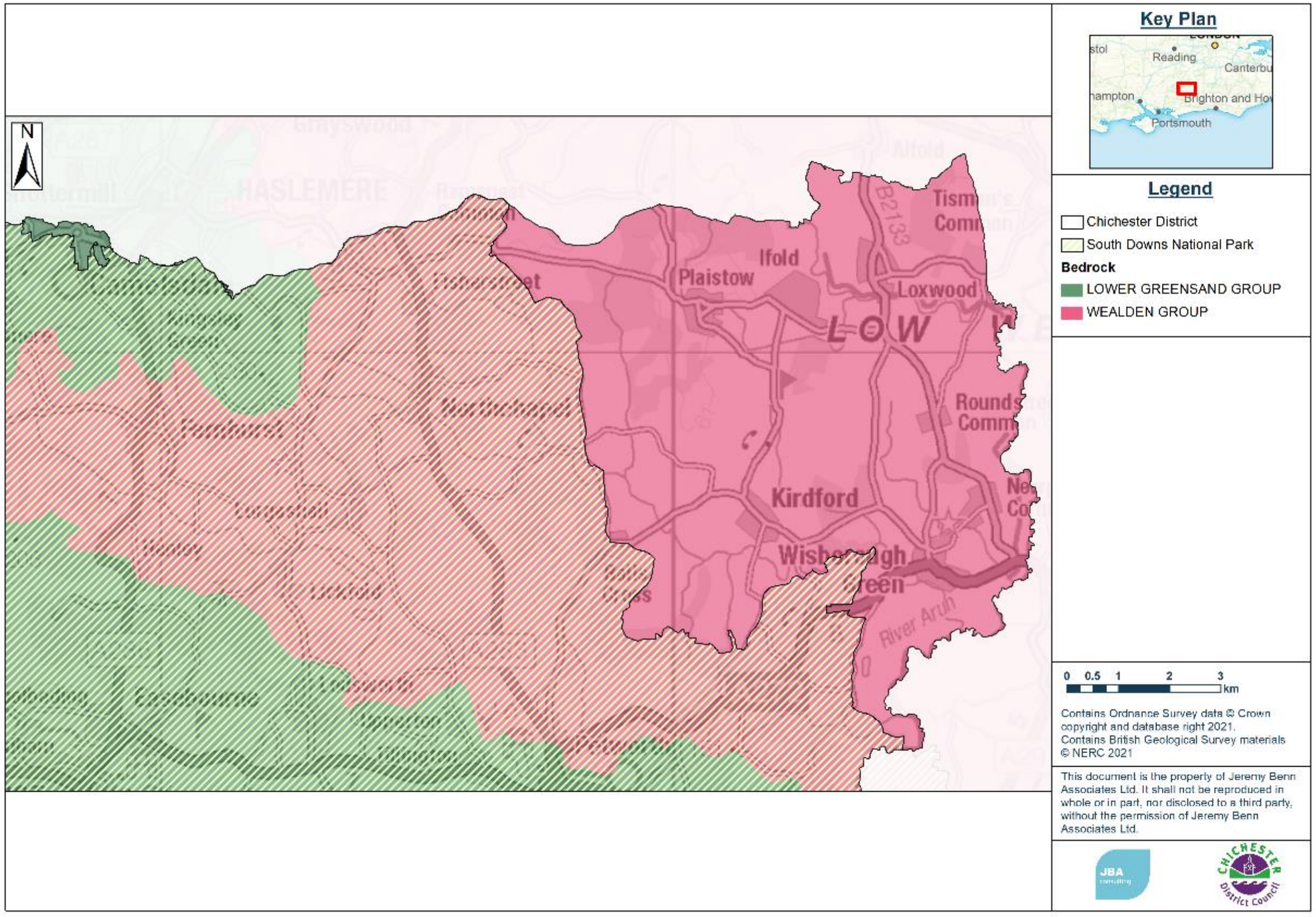


Figure 7-4: : Bedrock Geology in the southern Local Plan area

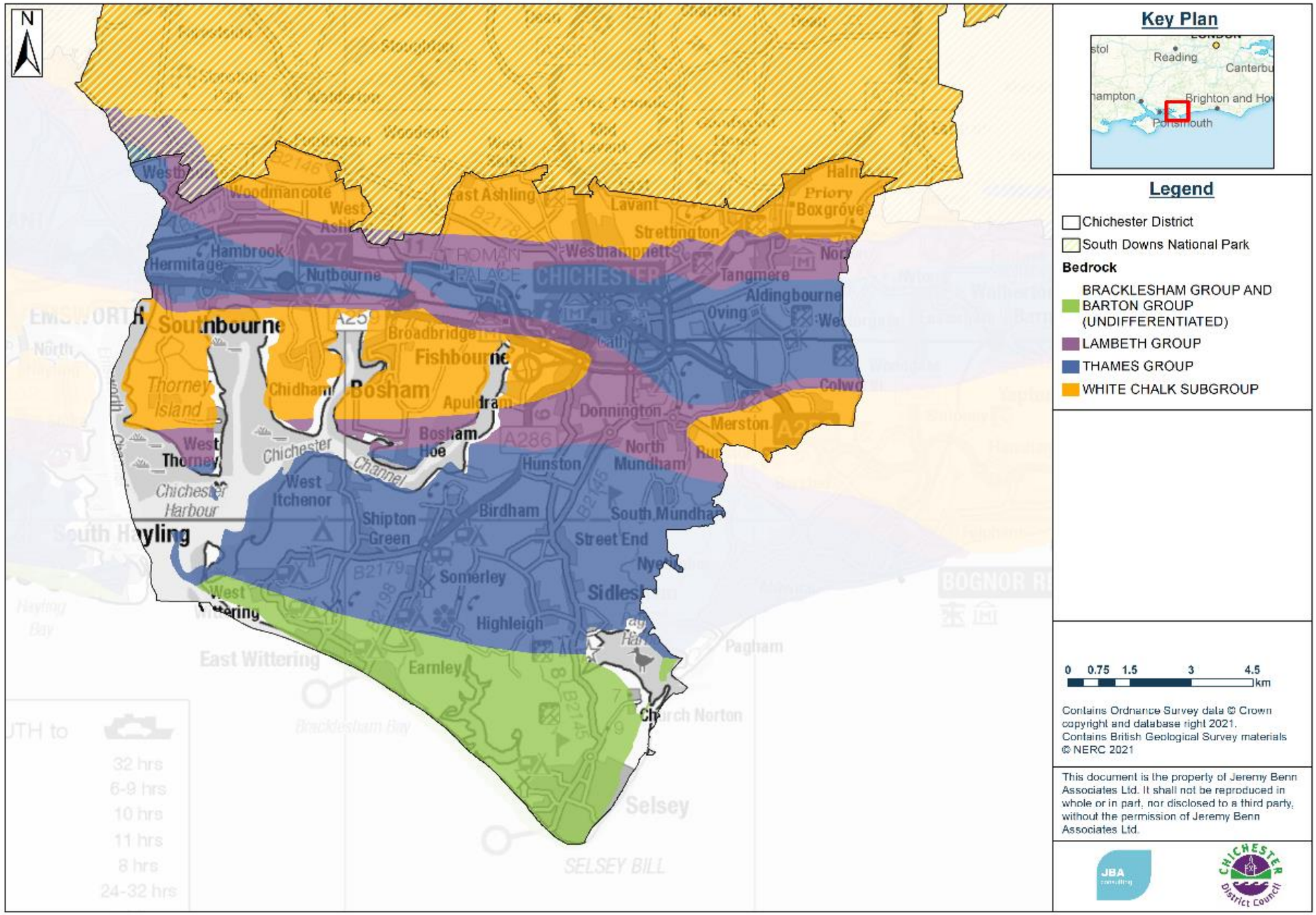


Figure 7-5: Superficial deposits in the northern Local Plan area

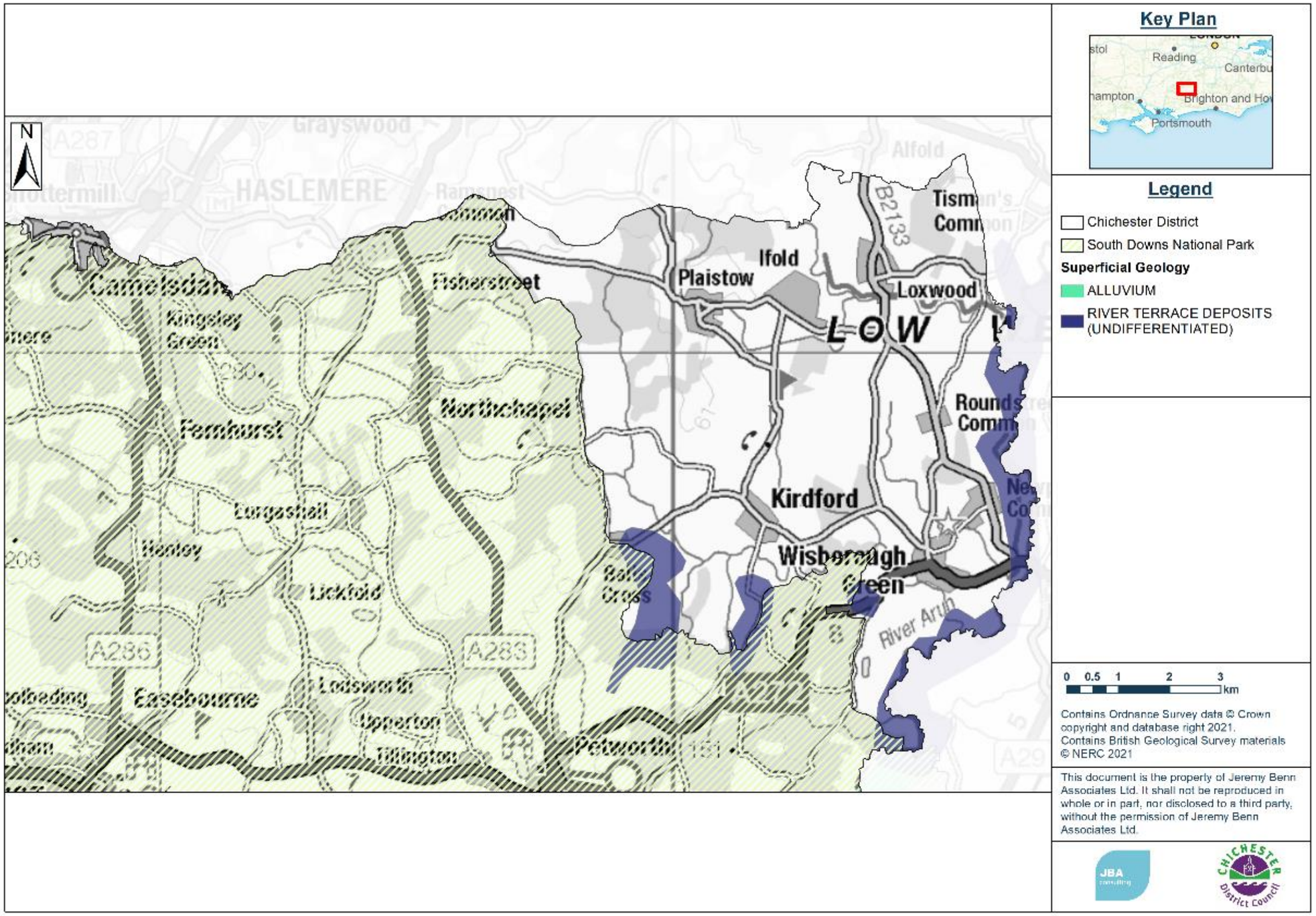


Figure 7-6: Superficial deposits in the southern Local Plan area

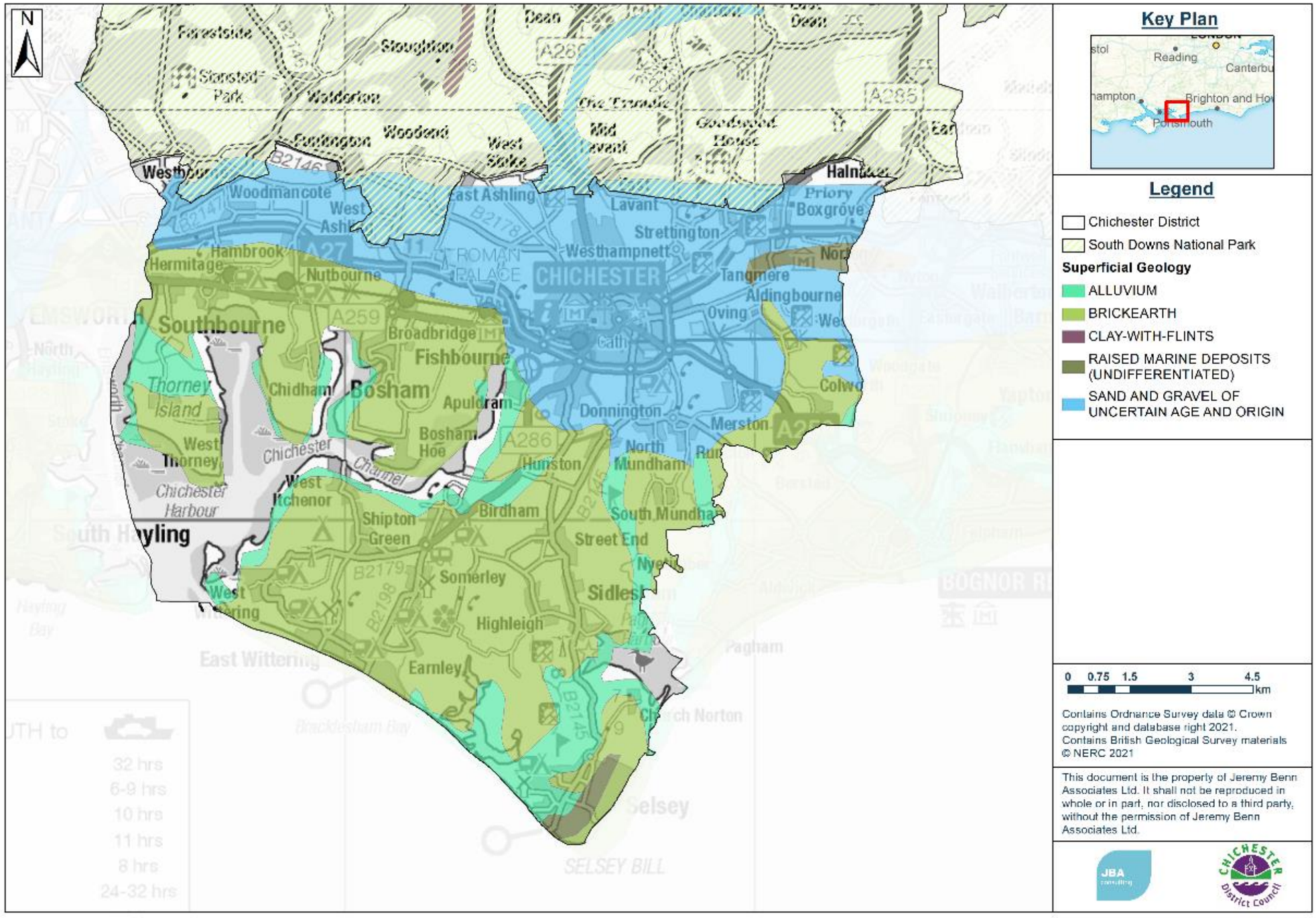


Figure 7-7: Bedrock aquifer designation in the northern Local Plan area

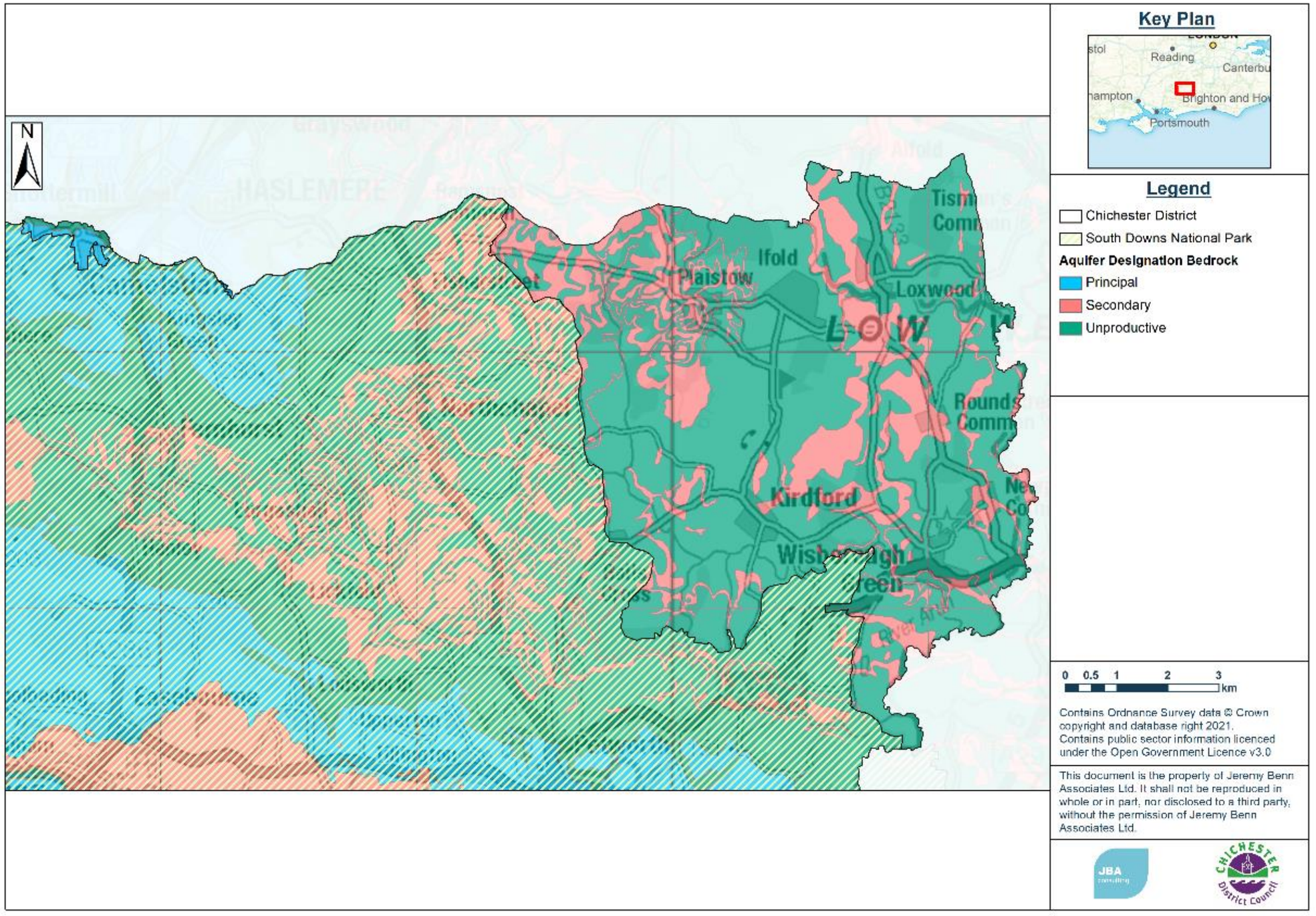


Figure 7-8: Bedrock aquifer designation in the southern Local Plan area

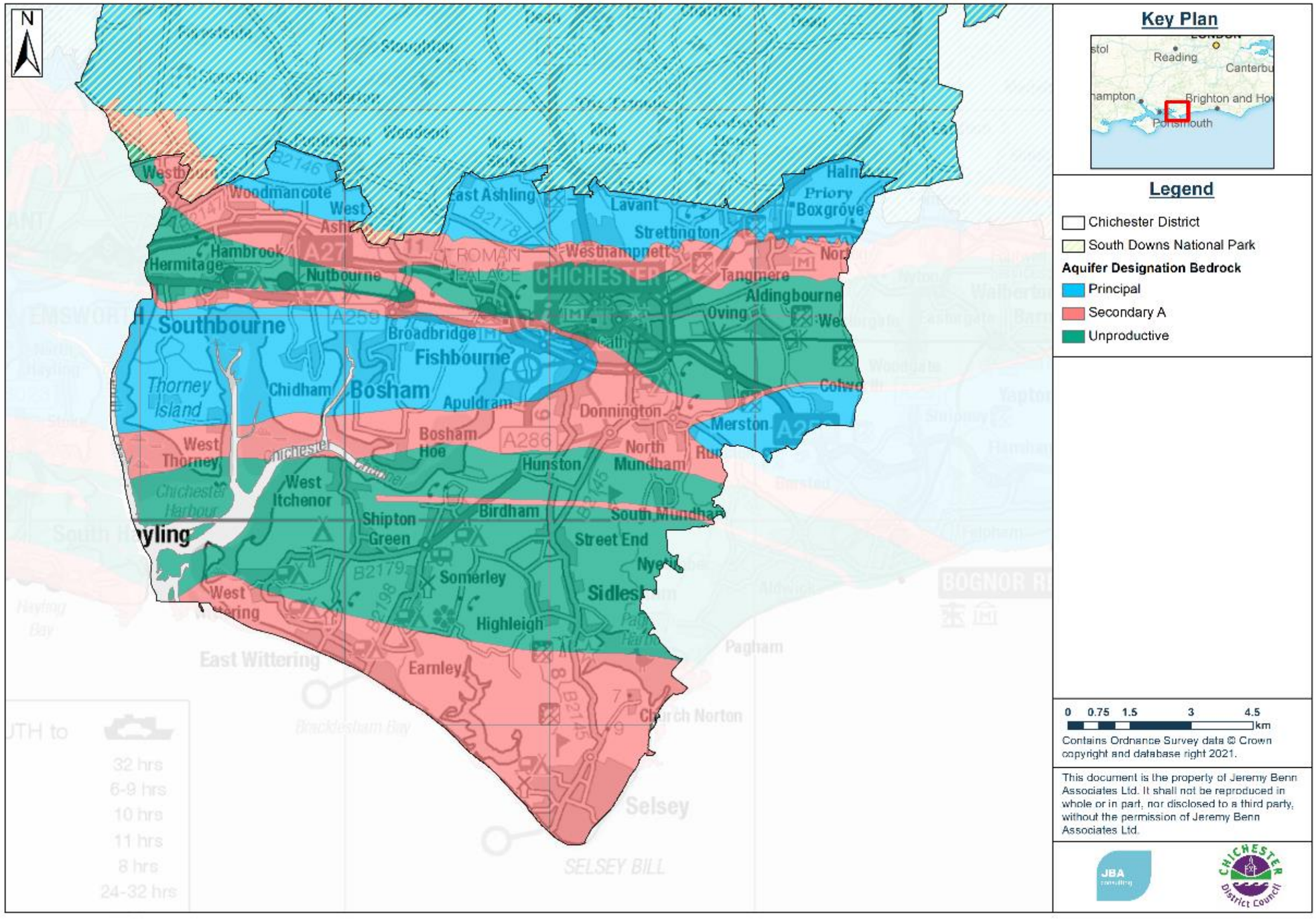


Figure 7-9: Superficial aquifer designation in the northern Local Plan area

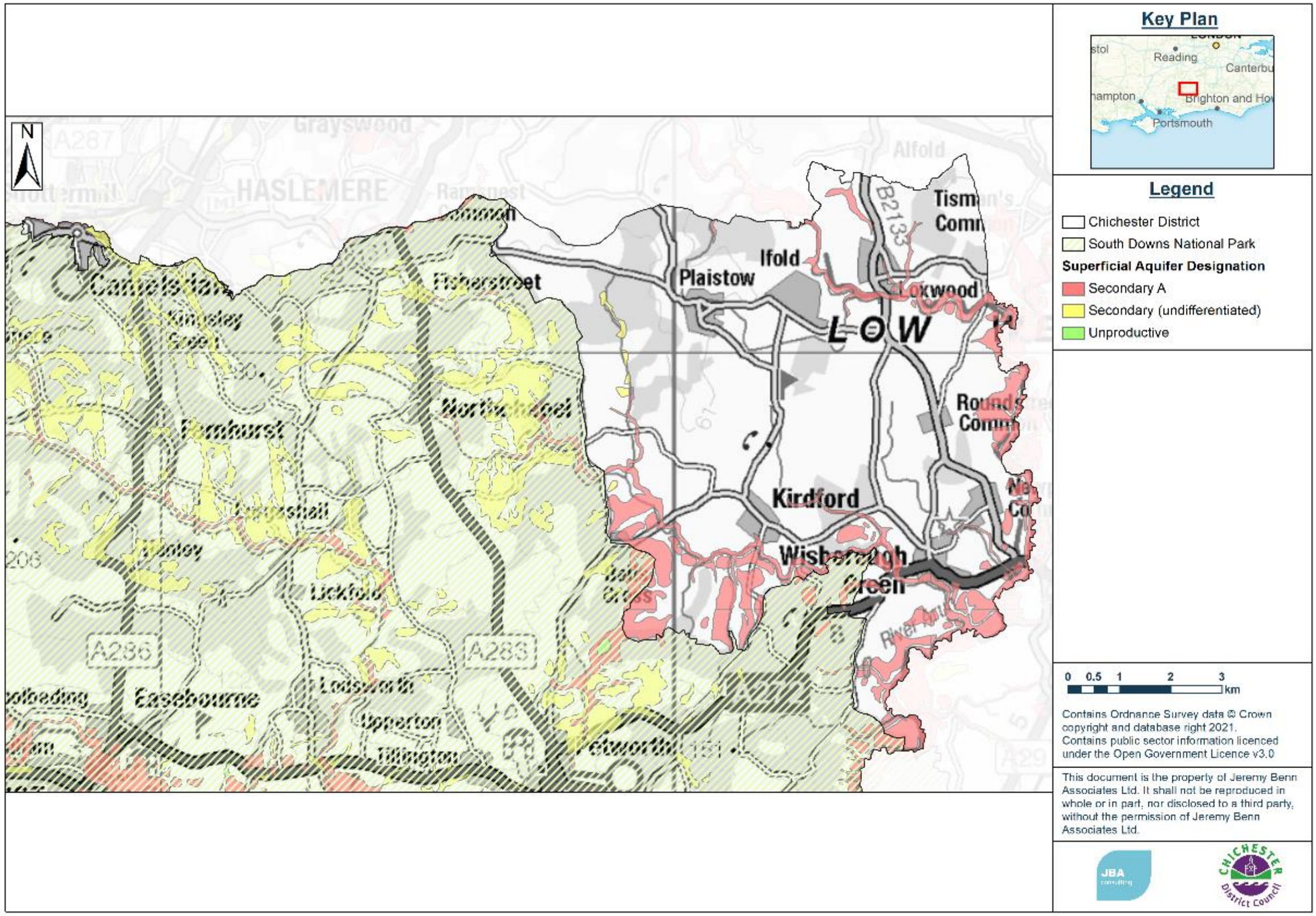
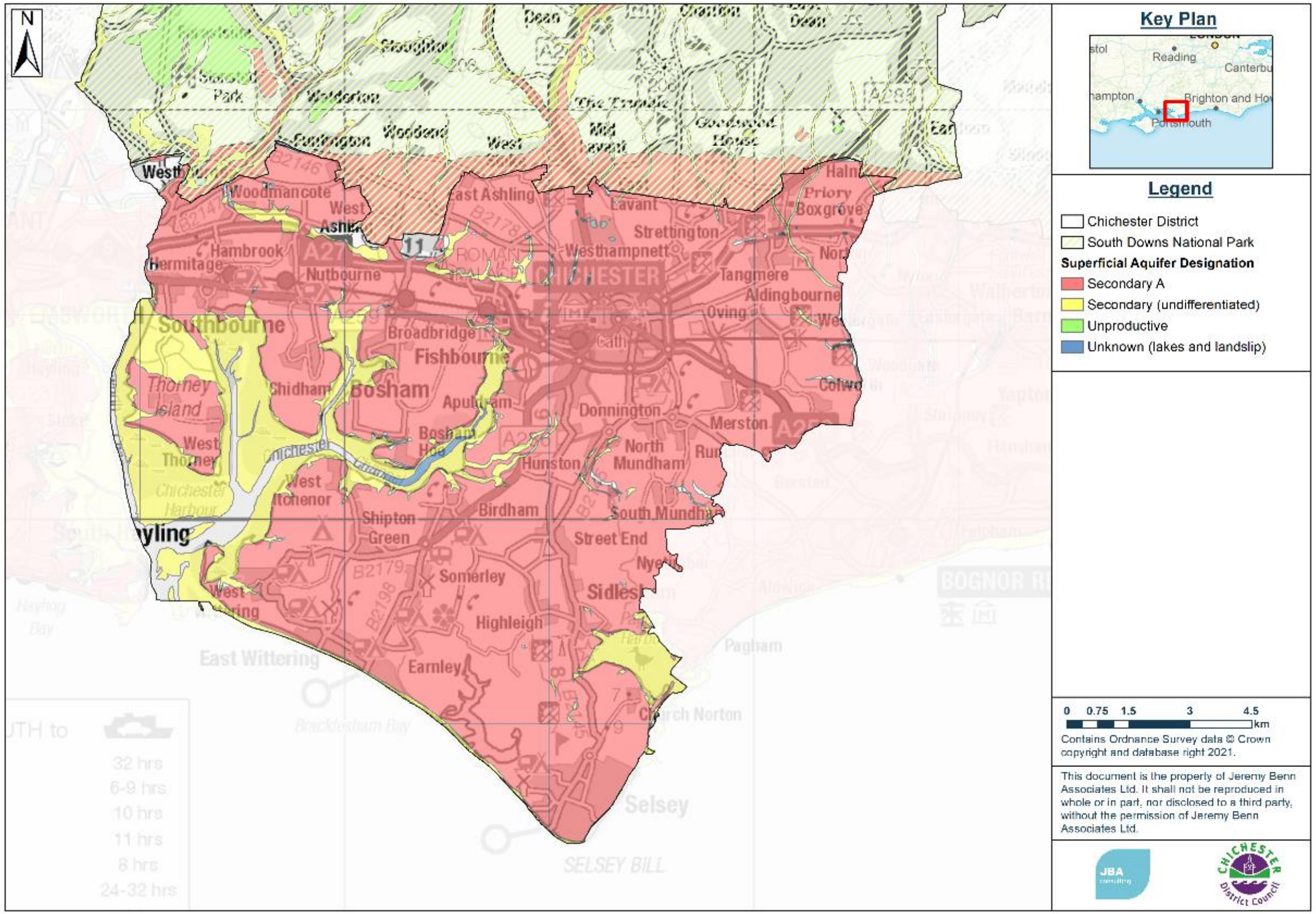


Figure 7-10: Superficial aquifer designation in the southern Local Plan area



7.2.3 Watercourses

The principal watercourses flowing through the Local Plan area are the River Lavant and its tributaries to the south, and tributaries of the River Arun to the north. Whilst the River Arun flows just outside the eastern boundary of the SFRA area, its main tributaries within the study area are the River Lox and the River Kird. The River Lavant flows through the city of Chichester and on towards the Chichester Channel, with several tributaries draining the coastal parts of the Local Plan area.

Pagham Harbour and Chichester Harbour are fed by a number of small streams from the South Downs and are of international importance and are protected. Many of these streams are groundwater fed and provide public water supply for the area.

A summary of the principal watercourses in the SFRA is provided below in Table 7-1. Mapping indicating the location of the principal watercourses can be found in Appendix C and **interactive maps** can be found on the Chichester District Council's website.

Table 7-1: Watercourses in the study area

Watercourse	Description
River Lox	River Lox flows easterly across the top north-eastern corner of the SFRA area, through Loxwood village, before joining the River Arun.
Wey and Arun Canal	A small portion of this canal flows through the north-eastern corner of the SFRA area, alongside the River Lox.
River Wey	The River Wey runs long the border of the SFRA study area boundary in the north-west through Hammer and Camelsdale.
River Kird	A tributary of the River Arun. Flows easterly from its source in the South Downs National Park across the SFRA area through Wisborough Green, before joining the River Arun at the edge of the SFRA area.
River Ems	River Ems flows southwest from its source in Stoughton, in the South Downs National Park and briefly enters the SFRA area north of Emsworth, before exiting again and continuing south to Emsworth Harbour.
River Lavant	River Lavant flows south into the SFRA area from its source in East Dean, in the South Downs National Park. The River Lavant flows through Chichester, before continuing south-west and discharging into the Chichester Channel.
Chichester Ship Canal	A 4-mile long waterway linking historic Chichester to the Harbour at Birdham.
Ham Brook	A tributary of the River Lavant, flowing south from Hambrook before flowing into Chichester Harbour.
Bosham Stream	A tributary of the River Lavant, which starts at the edge of the South Downs National Park boundary and flows south through Bosham towards the Chichester Channel.
Earnley Rife	A tributary of Broad Rife. Flows from its source in Earnley before joining Broad Rife near Bracklesham Bay.
Easton Rife	A tributary which flows in a southerly direction towards its confluence with Broad Rife.

Watercourse	Description
Broad Rife	A tributary of Pagham Rife. Flows southwest from its confluence with Pagham Rife and continues northwest along Bracklesham Bay, where it is joined by Earnley Rife.
Selsey Rife	A tributary of Broad Rife. Flows southeast towards Selsey from its confluence with Broad Rife.
Keynor Rife	A tributary of Broad Rife, which flows southerly through Highleigh village.
Bremerie Rife	A tributary of Pagham Rife. Flows southerly from its source near Hunston village before reaching its confluence with Pagham Rife.
Pagham Rife	A tributary of the River Lavant. Flows southerly from its confluence with the River Lavant in Westhampnett. The tributary exits the SFRA area around the town of Pagham, and enters again at Pagham Harbour.

7.3 Fluvial flood risk

One of the main sources of flooding in the Local Plan area is from rivers that are influenced by tidal conditions. Tide locking is also likely to be an issue where high tides prevent watercourses, such as The Rifes, from discharging effectively, raising levels in the lower reaches of the watercourses5.

The River Ems, Bosham Stream and Lavant are chalk-fed and their flows can vary seasonally depending on groundwater levels9. The characteristics of flooding differ for watercourses influenced by groundwater flows and thus flood events and can be associated with flood events where high flows occur for significant durations, such as affected Chichester and the A27 in the early 1990's.

Although much of the Local Plan area is rural, fluvial flooding from the River Lavant poses a risk to Chichester. The River Lavant flows through the centre of Chichester and has been the source of fluvial flooding in the city in the past. Notable flood events were in December 1993/ January 1994 and in 2000. The River Lavant Flood Alleviation Scheme is designed to reduce the flood risk to Chichester and surrounding area.

In addition to Chichester, there are several further urban areas where there is potential for watercourse to flow out of banks and cause flooding to property. The key settlements at fluvial flood risk, and the source, are summarised in Table 7-2.

Table 7-2: Settlements at risk of fluvial flooding

Settlement	Source of fluvial flood risk
Chichester	River Lavant
Loxwood	River Lox
Westbourne	River Ems
Broadridge	Bosham Stream
Bosham	Bosham Stream
Earnley	Earnley Rife
Almodington	Easton Rife
Highleigh	Keynor Rife

[9] Environment Agency (2009) Arun and Western Streams CFMP

Settlement	Source of fluvial flood risk
Hunston	Beremere Rife
Runcton	Pagham Rife
Merston	Pagham Rife
Oving	Aldingbourne Rife

It should be noted that flood risk management measures (defences) are present within the Local Plan area which act to reduce the risk of flooding. Such defences inhibit the function of the river floodplain as during flood events they prevent water being stored on the land adjacent to the river channel. This may be particularly important when considering the functional floodplain (Flood Zone 3b) for development. Further details on the existing defences in Chichester District are presented in Section 8.

The extents of the fluvial Flood Zones are shown in Appendix D . Consideration of how climate change may influence the fluvial flood risk is presented in Appendix E. **Interactive maps** can be found on the Chichester District Council's website.

In addition to flood risk shown by the flood risk mapping, there are a number of small watercourse and field drains which may pose a risk to development. Generalised Flood Zone mapping (where more detailed modelling investigations are not available) has only been prepared for watercourses with a catchment greater than 3km^2. Therefore, whilst these smaller watercourses may not be shown as having flood risk on the flood risk mapping, it does not necessarily mean that there is no flood risk. As part of a site-specific flood risk assessment the potential flood risk and extent of flood zones should be determined for these smaller watercourses and this information used as appropriate to perform the Sequential and Exception tests.

7.4 Tidal flood risk

Tidal flooding is caused by extreme tide levels exceeding ground and/or defence levels. The tidal flood risk to the Local Plan area has been based on the Arun to East Head and Chichester harbour coastal models. Flood Zone mapping can be found in Appendix D and the effects of climate change can be found in Appendix E. **Interactive maps** can be found on the Chichester District Council's website

The Local Plan area coast is bounded by the English Channel. As such the coastline is at risk of tidal flooding. In addition, the lower reaches of the flowing watercourse are affected by tide levels:

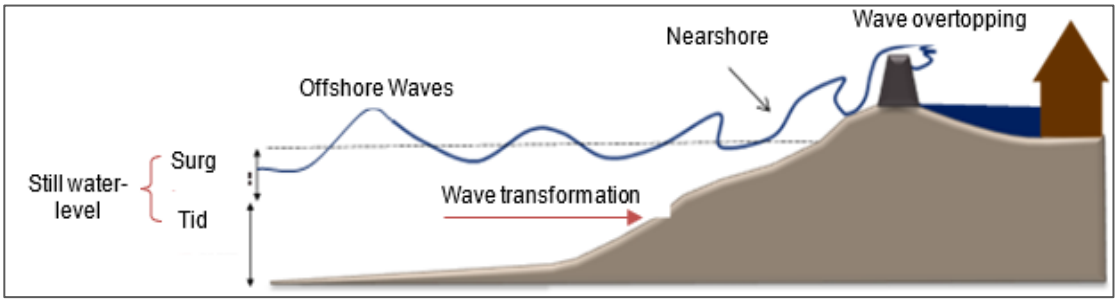
- River Ems
- Ham Brook
- Bosham Stream
- River Lavant
- Earnely Rife
- Broad Rife
- Easton Rife
- Selsey Rife
- Keynor Rife
- Bremere Rife
- Pagham Rife

Generally the land on the Manhood Peninsula is at potentially at high risk of flooding as it is less than 5m above sea level[10]. The risk is from a combination of fluvial, coastal and groundwater sources along with inadequate existing ditches. The influence of the change to mean sea level as a consequence of climate change effects is particularly important for these watercourses in their lower reaches, as this will contribute significantly to the height of predicted flood water levels. The predicted change in mean sea levels will also potentially have a material effect on the performance of local drainage systems at coastal locations since the discharge rates and 'emptying times' will be affected (reduced).

7.4.1 Wave overtopping

Tidal flooding along much of the south coast is characterised by the presence of risk associated with wave overtopping. In exposed locations along the coast, landward flooding is more likely to occur as a consequence of wave overtopping than inundation. Wave overtopping is a term, which encompasses a number of complex physical processes, which result in the transfer of water from the sea onto the coastal floodplain. The amount of wave overtopping that occurs during an extreme event is dependent on the local water depth, the properties of incoming waves and the geometry of local flood defences. Figure 7-11 outlines the process of wave overtopping in relation to the Extreme Still Water Sea-level.

Figure 7-11: Illustration of residual risk associated with wave overtopping



Wave overtopping is one of the principal mechanisms of flooding for the coastal frontage. The effect of wave overtopping has been included in the Flood Zone 3b delineation – the assumption with respect to the presence of the defences is selected so the worst case scenario is predicted.

7.4.2 Blockage of drainage ditches

Areas of land surrounding East Wittering are understood to drain through a network of ditches which have outfalls on the beach. It is reported that there is a high risk of blockages caused by movement of shingle which can result in water backing up.

It is reported that flow can be further impeded during Autumn when vegetation debris also enters the pipes. This increases the flood risk to properties upstream of these ditches.

7.5 Coastal flood risk

In coastal locations the risk of flooding is linked to the stability of the coastline. If the coast is eroding, then the potential effect is that tidal flood defences near to the sea will be lost and flood risk will increase. To maintain an appropriate standard of safety

[10] Manhood Peninsula Partnership, Coastal Management available at http://peninsulapartnership.org.uk/environment/coastal-management/

from flooding it is sometimes necessary to implement works to slow down or stop the rate of coastal erosion and so maintain the integrity of the tidal defences.

The **Beachy Head to Selsey Bill Shoreline Management Plan** and the **North Solent Shoreline Management Plan** describe the arrangements and strategy for managing coastal erosion and the influential measures.

The Environment Agency, Chichester District Council and Arun District Council worked together to prepare the **Pagham to East Head coastal defence strategy (2009)**. The strategy provides further details about ways to manage the risk of flooding and erosion to 5,300 properties at risk between Pagham Beach and West Wittering. The main areas at risk are Pagham, Selsey and the Witterings with 20,000 permanent residents, and thousands of visitors each year.

The Environment Agency has prepared a draft Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy which is relevant to a small section of the coastline near Slipper Close in Emsworth.

The coastline between East Head and Emsworth does not currently have a coastal defence strategy, but the Environment Agency are currently promoting its production.

7.6 Surface water flood risk

Flooding from surface water runoff (or 'pluvial' flooding) is caused by intense short periods of rainfall and usually affects lower lying areas, often where the natural (or artificial) drainage system is unable to cope with the volume of water. Surface water flooding problems are inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding.

Tide locking is also an issue where high tides prevent surface water from draining from gravity outfalls along the defended coastal plain.

The Risk of Flooding from Surface Water (RoFSW) map shows predicted flood extents that predominantly follow topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas. Mapping of the RoFSW throughout the Local Plan area is provided in Appendix F and **interactive maps** can be found on the Chichester District Council's website.

7.6.1 Surface water management plans

In response to the WSCC's June 2012 Flood Event report, Surface Water Management Plans (SMWPs) have been and are currently being developed for five key areas in West Sussex which have suffered from significant flooding in the past. Among these are the Manhood Peninsula and West Chichester.

The Manhood Peninsula SMWP was produced in July 2015. The area is known to have long standing flooding problems. In the past, extreme rainfall events (e.g. June 2012) and long wet periods (e.g. Winter 2013/14) have resulted in significant flooding across the area, mainly because the Rifes, local ditch networks and the highway drainage system do not have sufficient capacity to drain large amounts of water away. The Manhood Peninsula is also prone to regular flooding due to its low-lying nature, and this is often caused by poor maintenance or collapses/blockages of culverts and ditches.

The emerging West Chichester SWMP focuses on the Fishbourne and Parklands Estates, which were first identified as prone to flood risk by the June 2012 report. The area has suffered from flooding problems in the past and there have already been many actions taken to alleviate flooding. The SWMP has identified three primary surface water flow catchments: Parklands Catchment, Fishbourne Road East Catchment and the Fishbourne Catchment. Similar to the Manhood Peninsula, the main cause of surface water flooding in this area is the exceedance of drainage

systems and culverts, because they do not have the capacity to cope with large amounts of water.

7.6.2 WSCC's Local Flood Risk Management Strategy

The WSCC's Local Flood Risk Management Strategy covers flood risk in West Sussex, from all sources of flooding, including surface water flooding. In relation to the Chichester District Local Plan area, the report has identified Bosham, Selsey, Birdham and Ifold as the residential areas that are most susceptible to surface water flooding.

7.6.3 Chichester District Council's Surface Water and Drainage Supplementary Planning Document

Chichester District Council's **Surface Water and Drainage Supplementary Planning Document** (SPD) explains that in the south of the district, as the land is low-lying, there is a risk of fluvial and tidal flooding. As well as this, there is a lack of capacity and infiltration into the sewer network which causes surface water and foul water flooding. It highlights that new development should not exacerbate existing problems and increase the flood risk.

7.7 Groundwater flood risk

Groundwater flooding is the term used to describe flooding caused by unusually high groundwater levels. It occurs as excess water emerging at the ground surface or within manmade underground structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, in some cases lasting for weeks or months, and it can result in significant damage to property.

JBA has developed a range of Groundwater Flood Map products at national scale. The 5m resolution JBA Groundwater Flood Map for the Local Plan area can be found in Appendix G. The modelling involves simulating groundwater levels for a range of return periods (including 75, 100 and 200-years). Groundwater levels are then compared to ground surface levels to determine the head difference in metres. The JBA Groundwater Flood Map categorises the head difference (m) into five feature classes based on the 100-year model outputs. The JBA Groundwater Flood Map for the Local Plan area can be found in Appendix G. Due to licencing arrangements, the JBA Groundwater Flood Map is not available on the interactive mapping.

It should be noted that the JBA Groundwater Flood Map is suitable for general broad-scale assessment of the groundwater flood hazard in an area, but is not explicitly designed for the assessment of flood hazard at the scale of a single property. It also describes the risk of groundwater emergence rather than the risk of flooding and so is not appropriate for use when comparing the comparative risk of flooding. In high risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform on the likelihood of flooding.

As illustrated in the map, a large proportion of the Chichester District Local Plan area is potentially at risk from groundwater flooding as there is a high risk of emergence. The southern part of the Local Plan area is particularly vulnerable to groundwater flooding, with the city of Chichester and surrounding towns being the most vulnerable areas.

The West Sussex Groundwater Management Study was produced in October 2017 by WSP, commissioned by WSCC. This project was initially undertaken with the purpose of improving the WSCC's level of understanding of groundwater flood risk across West Sussex. Results of the study will be used to inform the specification of groundwater monitoring pilot study sites. Use of a Flood Risk Grading Tool (FRGT) identified the key areas at risk from flooding. Findings of this analysis predicted that coastal areas such as Southbourne, West Ashling/Nutbourne and Chichester are more

vulnerable to groundwater flooding than areas in the mid or northern regions of West Sussex.

The south of the Local Plan area is at particularly high risk due to the chalk valleys feeding from the South Downs. Rain can infiltrate the chalk through large fissures into the underlying aquifers and is released slowly though springs further downstream in the Local Plan area.

The River Ems and Bosham Stream are particularly sensitive to groundwater levels and have high winter baseflows as their headwaters are fed by the chalk springs to the south of the South Downs. When there are prolonged wet winters periods, high groundwater levels result in saturated ground and surface water flooding. This leads to an immediate response to additional rainfall and high flow velocities due to the steep stream gradients at the foot of the Downs. Groundwater processes are an important contributor to flooding in these areas.

7.8 Flooding from sewers

Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment (such as pumps) failure occur in the sewerage system. Surface water inundation of manhole openings, entry of soil or groundwater, and may cause high flows for prolonged periods of time.

Since 1980, the Sewers for Adoption guidelines have meant that most new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year (3.33% AEP), although until recently this did not apply to smaller private systems. This means that, even where sewers are built to current specifications, they can still be overwhelmed by larger events of the magnitude often considered when looking at river or surface water flooding (e.g. a 1 in 100 chance of occurring in any given year 1% AEP). Existing sewers can also become overloaded as new development adds to their catchment, even with restrictions in place on permitted discharge, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

Historical incidents of flooding are detailed by Southern Water in their DG5 register. This database records incidents of flooding relating to public foul, combined or surface water sewers and identifies which properties suffered flooding. For data protection reasons, this data has been supplied on a postcode basis from the Sewer Incident Report Form (SIRF) hydraulic overload database. Data covers all reported incidents between 2013 and 2022. The information from the SIRF database is shown in Table 7-3.

The SIRF indicates a total of 272 recorded flood incidents in the Local Plan area, (excluding properties located within the South Downs National Park). The most frequently flooded postcodes are: RH14 0 (52 incidents) and PO20 7 (56 incidents). It is important to recognise that the information does not indicate the cause of the sewer flooding incidents and represents a snap shot in time and may become outdated following future rainfall events or when new properties are added. The historic event database did not provide information required to determine whether flood incidents were resolved and rectified and therefore it does not represent locations remain 'at risk'. Risk of flooding may also be reduced in some locations by capital investment to increase of the capacity of the network. As such, the sewer flooding flood risk register is not a comprehensive 'at risk register' and updated information should be sought to enhance understanding of flood risk from sewers at a given location and time.

Table 7-3 Sewer Incident Report Form database for Chichester SFRA area, 2013-2022

Post Code	Recorded Flood Incidents	Post Code	Recorded Flood Incidents
PO10 8	17	P019 8	16
PO18 0	25	PO20 0	11
PO18 8	15	PO20 1	7
PO18 9	5	PO20 2	8
PO19 1	2		
PO19 2	1	PO20 7	56
PO19 3	24	PO20 8	30
PO19 6	1	RH14 0	52
PO19 7	2		
Total: 272			

Studies and assessments performed by the Chichester Water Quality Group (**Water Quality and Strategic Growth for Chichester District Background Paper November 2012**) indicate that the capacity of sewers and drains is adversely affected by infiltration of groundwater.

The 2018 Chichester District Council's Water Quality Assessment states that areas around west Chichester, east Chichester and Tangmere are at medium risk of groundwater flooding and there is the potential for increased infiltration into the sewer network which can impact on capacity in these areas.

Additionally, West Sussex County Council has confirmed that when groundwater levels have been high over recent winters, exceptional discharges of surcharged sewers were regularly permitted by the Environment Agency to be discharged into the River Lavant.

Thus, the groundwater flooding not only has a direct effect on flood risk, but also an indirect effect if poorly designed, constructed and maintained drainage systems permit ingress of flows that reduces the capacity of drainage systems. In addition, the condition of sewers is impacted by ground movements or tree roots. The ingress of groundwater through the joints in the pipework, or through cracks, may occur not only in the adopted network but also in private laterals that connect to the public system. Accordingly proposed development should seek to deploy designs and be implemented such that the risk of groundwater ingress is minimised; **Infiltration Reduction Plans (IRP)** are implemented in areas that experience this issue.

In 2023, Southern Water prepared a **Drainage and Wastewater Management Plan**. This is a risk-based catchment screening where existing data is used to identify where there is a current and/or potential risk or vulnerability in the sewer catchment to future changes. This will enable Southern Water's detailed assessment of risk for high priority areas for investment.

JBA reviewed the information within the DWMP (Appendix N) and convened a meeting with Southern Water to discuss the findings. It was confirmed by Southern Water that the mapping provided within the DWMP is not suitable for use in the Sequential Test as the data and mapping is prepared to prioritise investment

priorities and the resolution of the data does not enable comparative risk at different sites to be evaluated appropriately.

7.9 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975 and are listed on a register held by the Environment Agency. The level and standard of inspection and maintenance required under the Act means that the risk of flooding from reservoirs is relatively low. Recent changes to legislation under the Flood and Water Management Act require the Environment Agency to designate the risk of flooding from these reservoirs. The Environment Agency is currently progressing a 'Risk Designation' process so that the risk is formally determined.

Outlines from the Reservoirs inundation dataset show predicted inundation extents during a wet and dry day of five reservoirs impacting the Local Plan area, as detailed in Table 7-4.

Table 7-4 Reservoirs in the Chichester District Local Plan area

Reservoir	Reservoir owner	Environment Agency area	Local authority
Park Mill Pond	Haslemere Angling Society	Solent and South Downs	West Sussex
Upper North Pond	Wakefield	Solent and South Downs	West Sussex
Hunston Reservoir	Ashmarden Ltd	Solent and South Downs	West Sussex
Southend Farm No.2	Fleming	Solent and South Downs	West Sussex
Park Mill Pond	Haslemere Angling Society	Solent and South Downs	West Sussex

Reservoir flooding is very different from other forms of flooding. It may happen with little or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate and the methods used to describe flood extents are not based on an understanding of the probability of a reservoir failure, but it is very much less likely than flooding from rivers or surface water. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

A further consideration with respect to reservoirs is the placement of development at a location where it can be affected by high water velocities or depths if there was a breach of a reservoir. Proposals for placement of development in such high risk zones are not only associated with substantive safety issues for residents but also could require that significant investment is made to the reservoir so that it could safely accommodate an extreme flood.

The Environment Agency maps represent a credible worst case scenario. In these circumstances, it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential. The Environment Agency Risk of Flood from Reservoir Map for Chichester is shown in Appendix H and **interactive maps** can be found on the Chichester District Council's website.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage:

- Developers should seek to contact the reservoir owner to obtain information which may include
  - reservoir characteristics: type, dam height at outlet, area/volume, overflow location;
  - operation: discharge rates / maximum discharge;
  - discharge during emergency drawdown; and
  - inspection / maintenance regime.
- Developers should apply the sequential approach to locating development within the site. The following questions should be considered
  - can risk be avoided through substituting less vulnerable uses or by amending the site lay-out?
  - can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
  - can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?
- Consult with relevant authorities regarding emergency plans in case of reservoir breach
- In addition to the risk of inundation those considering development in areas affected by breach events should also assess the potential hydraulic forces imposed by the rapid flood event and check that the proposed infrastructure fabric can withstand the loads imposed on the structures by a breach event.

7.10 Flooding from canals

Canal water flow is controlled by artificial structures (such as locks) so that water levels remain below adjacent ground. Therefore, such watercourses rarely flood as they are generally designed to retain a controlled volume of water rather than collect and convey water running off from adjacent land. However, intense rainfall can increase the risk of flooding from canals through increased artificial conveyance between catchments or interaction of this watercourse within another which may cause water to back up and spill out of the channel. The other potential source of flooding is from a failure in the structure of the canal channel that results in a sudden cascade of water onto adjacent land.

There are two canals located in the Local Plan area, the Chichester Canal and the Wey and Arun Canal. The flood risk from these sources should be considered for individual developments.

The Chichester Canal is partially navigable (for recreation). Road culverts connect the upper, middle and lower sections so the canal is theoretically connected to the sea. The upper section from the Chichester Basin to the B2201 is open for recreational use (approximately (3km). The lower section from the BB2201 to the Chichester Marina is used for the stationing of houseboats, but is not navigable. There is a lock at Chichester Marina. The maintenance of the canal is the responsibility of the Chichester Ship Canal Trust, who lease the canal from West Sussex County Council[11].

The Wey and Arun Canal runs through a small part of the north-east of the study area. The canal is currently being restored with some parts which are navigable through Loxwood. The Wey and Arun Canal Trust are currently restoring the canal.

[11] Chichester Ship Canal, About: Chichester Ship Canal, available at https://chichestercanal.org.uk/about-chichester-canal/

Part of the aim is to create a 23 mile 'green corridor' through the West Sussex and Surrey countryside[12].

The main flood risk from the canals is from a breach, leakage or overtopping.

There are no recorded incidents of breach or overtopping of canals within the study are and there is no evidence to suggest the risk posed by canal flooding warrants a detailed assessment in the Level 1 SFRA.

The 2008 SFRA undertook breach modelling of one possible scenario in the Chichester Canal at Hunston. The modelled flood depths are shown in Figure 7-12. The modelling shows that flood depths of over 1m could be experienced during a breach scenario.

Figure 7-12: Breach modelling of the Chichester Ship Canal

7.11 Summary of flood risk to key settlements

A high-level review of the flood risk to key settlements in Chichester District Local Plan area has been undertaken. Table 7-5 summarises the flood risk to the main settlements in the Chichester District outside of the South Downs National Park authoritative area.

[12] West Sussex County Council, The Wey and Arun Canal, available at https://www.westsussex.gov.uk/leisure-recreation-and-community/places-to-visit-and-explore/the-wey-and-arun-canal/

Table 7-5: Summary of flood risk to the key settlements in the study area

Settlement	Fluvial/tidal/coastal flood risk	Formal flood defences	Surface water flood risk	Susceptibility to groundwater flooding, according to JBA map					Reservoir inundation
				No risk	5m below surface	0.5m to 5m below surface	0.025m to 0.5m below surface	Within 0.025m of surface	
Loxwood	The River Lox and the Wey and Arun Canal flow to the south of Loxwood, and a stream flows through the town, close to the B2133. Flood Zones 2 and 3 surround these watercourses. Several properties in the south of Loxwood are located in Flood Zones 2 and 3. The Environment Agency historic flood outline dataset shows that there has been a history of fluvial flooding at the settlement.	See Section 8	Mapping shows that surface water flood risk generally follows similar paths to the watercourses and roads. The roads at most risk of surface water flooding are Pond Copse Lane, B2133 Guildford Road, Pond Close and Station Road.	✓		✓	✓		None
Plaistow / Ifold	The River Lox flows east of Ifold, and a stream flows east of Plaistow. Flood Zone mapping shows that the eastern side of Ifold is vulnerable to fluvial flooding, The Environment Agency historic flood outline dataset shows that there has been no previous history of flooding in the area.	None	Mapping shows that surface water flood risk generally follows similar paths to the watercourses. In Plaistow, Rickmans Lane and several settlements along this road are at risk of surface water flooding. In Ifold, mapping shows that roads and residential areas close to Loxwoodhills Pond are at risk of surface water flooding, particularly The Drive. Other roads at risk include Plaistow Road and The Lane.	✓	✓	✓	✓	✓	None
Kirdford	The River Kird passes south of the settlement, flowing from west to east. Several streams also flow through Kirdford. A small proportion of Kirdford is located within Flood Zones 2 and 3. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Kirdford.	None	Mapping shows that surface water flood risk generally follows routes of the watercourses. Away from the watercourses, the mapping shows ponding of residential gardens and risk to multiple roads, including Kirdford Road and Glasshouse Lane.	✓			✓	✓	Inundation from two ponds, Upper North Pond and Park Mill Pond, may affect areas of Kirdford where the River Kird passes through.
Wisborough Green	The River Kird and several small streams flow through Wisborough Green. Flood Zones 2 and 3 surround these watercourses. Several properties lie close to these Flood Zones. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Wisborough Green.	None	Mapping shows that surface water flood risk generally follows the main watercourses and roads. The roads at most risk are the A272, Newpound Lane, Durbans Road, and Kirdford Road. The mapping also shows surface water ponding in open spaces and residential gardens.	✓	✓	✓	✓	✓	Inundation from two ponds, Upper North Pond and Park Mill Pond, may affect areas of Wisborough Green where the River Kird passes through.
Westbourne	The main watercourse flowing through Westbourne is the River Ems. Flood Zone mapping shows that most of Westbourne is located in Zone 2 or 3. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Westbourne.	See Section 8	Mapping shows that surface water flood risk generally follows the route of the River Ems and runs onto roads. Several roads are at a high risk of flooding, particularly North Road, River Road and East Street. Houses and residential gardens along these roads are also at risk of flooding.	✓			✓	✓	None
Southbourne	The path of Ham Brook flows through Southbourne on route to Chichester Harbour. Not located in Flood Zones The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Southbourne.	See Section 8	Mapping shows that surface water flood risk generally follows similar paths to the roads and open spaces in Southbourne. Roads at risk include the main road A259 and Stein Road running through the town centre, particularly by the train station, as well as Cooks Lane and Priors Leaze Lane.				✓	✓	None
Hambrook / Nutbourne	Not located in Flood Zones; apart from an area that stretches from the A259 (Main Road) up to Priors Leaze Lane. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Hambrook and Nutbourne.	See Section 8	Mapping shows that surface water flood risk in Hambrook and Nutbourne is relatively low, but it generally follows similar paths to the Ham Brook watercourse, roads and open spaces.	✓			✓	✓	None
Bosham / Broadbridge	The main watercourse passing through these two settlements is Bosham Stream, which flows southwards to Chichester Channel. Flood Zone mapping shows that Bosham and Broadbridge are susceptible to fluvial flooding from Bosham Stream and coastal flooding from Chichester Channel. Those at highest risk of flooding are residential areas located close to the shoreline in Bosham, particularly along Shore Road. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Bosham and Broadbridge.	See Section 8	Mapping shows that surface water flood risk generally follows similar paths to the roads in Bosham, including Bosham Lane, Walton Lane, Taylor's Lane and Chequer's Lane. In Broadbridge, surface water follows the watercourse alongside the town. The A27 just north of the town has a high risk of flooding.	✓		✓	✓	✓	None
Fishbourne	The River Lavant flows through Fishbourne, into the Chichester Channel. Southern parts of Fishbourne near Fishbourne Road are located in Flood Zones and are at risk of coastal flooding from the channel. Parts of Apuldram, especially along Appledram Lane (South) are also at risk of flooding. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Fisbourne.	See Section 8	Mapping shows that surface water flood risk generally follows similar routes to roads and open spaces in Fishbourne. The A27 north of the town has a high risk of surface water flooding. Other roads at risk include Blackboy Lane and Salthill Road. Fishbourne Train Station and surrounding buildings are at risk of surface water flooding.	✓		✓	✓	✓	None

Settlement	Fluvial/tidal/coastal flood risk	Formal flood defences	Surface water flood risk	Susceptibility to groundwater flooding, according to JBA map					Reservoir inundation
				No risk	5m below surface	0.5m to 5m below surface	0.025m to 0.5m below surface	Within 0.025m of surface	
Birdham	Chichester Ship Canal and the River Lavant lie north of Birdham. Birdham is not located in Flood Zones. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Birdham.	See Section 8	Mapping shows that surface water flood risk is fairly limited in Birdham, but generally follow routes of roads and open spaces.				✓		None
West Wittering	West Wittering is located very close to Chichester Harbour. Flood Zone mapping shows that this settlement is prone to coastal flooding. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in West Wittering.	See Section 8	Mapping shows that surface water flood risk generally follows similar paths to the watercourse and roads, including Rookwood Lane.			✓	✓	✓	None
East Wittering / Bracklesham	Earnley and Easton Rifes flow through East Wittering and Bracklesham. According to Flood Zone mapping, there is limited flood risk in these settlements. Areas at risk include buildings located closest to the coastline and those located close to Earnley Rife. Earnley Beach Centre is at high risk of flooding. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in East Wittering and Bracklesham.	See Section 8	Mapping shows that surface water flood risk generally follows roads, open spaces and residential gardens. In East Wittering, Church Road and Shore Road are at risk of flooding, as well as several pockets of residential areas. In Bracklesham, surface water follows Earnley Rife and several roads.	✓		✓	✓	✓	None
Selsey	Selsey is at risk of flooding from several rifes and the coastline. Flood Zone mapping shows that some parts of Selsey are at risk of coastal and fluvial flooding. To the north-west of Selsey, holiday parks, including Bunns Leisure, and Selsey Country Club are located in Flood Zones 2 and 3. To the east, a large area is located in the flood zones, including Kingsway and East Beach Road. Areas directly on the coastline are also in the flood zones. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Selsey.	See Section 8	Mapping shows that surface water flood risk follows roads and also appears in open spaces around the town.	✓		✓	✓	✓	None
Hunston	Not in Flood Zones	See Section 8	Mapping shows that surface water flood risk mainly follows the B2145 Selsey Road through the centre of Hunston and spreads to open spaces near the road.	✓			✓	✓	Inundation may affect Sidlesham Common, south of Hunston. Affected area spreads from Manhood End Farm to Hoe Farm.
North Mundham / Runcton	Pagham Rife flows southerly through Runcton. Runcton Lane and Saltham Lane are at high risk of flooding. There are no main watercourses flowing through North Mundham. A few houses located on Lagness Road in North Mundham are located in Flood Zone 2. There has been a limited history of recorded flooding in North Mundham and Runcton.	See Section 8	Mapping shows that surface water flood risk mainly follows roads. In North Mundham, roads prone to surface water flooding include Church Road and Post Office Lane. In Runcton, surface water follows the watercourse, particularly impacting the intersection of the watercourse and Lagness Road. Other roads affected include Marsh Lane and Vinnetrow Lane.				✓	✓	None
Chichester	The River Lavant passes through the centre of Chichester, and continues towards Chichester Harbour. Flood Zone mapping shows that Chichester is located in both Zones 2 and 3, and is prone to fluvial flooding. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Chichester.	See Section 8	Mapping shows that surface water flood risk mainly follows roads. A large number of roads in Chichester are at risk of flooding, including St Paul's Road (B2178) and several roads near Sherbourne Road. Surface water also accumulates in open spaces and residential gardens.				✓	✓	None
Westhampnett	The River Lavant also passes directly through Westhampnett. Flood Zone mapping shows that Westhampnett is prone to fluvial flooding from the River Lavant. Areas most at risk include parts of Madgwick Lane, Stane Street and Maudlin Farm. The Environment Agency historic flood outline dataset shows that there has been a history of flooding in Westhampnett.	See Section 8	Mapping shows that surface water flood risk on some roads near Westhampnett, including Stane Street, and also some risk of flooding near the local school and residential area.			✓	✓	✓	None
Boxgrove	Not in Flood Zones	None	Mapping shows that surface water flood risk mainly follows the roads in Boxgrove, particularly Crouch Cross Lane and The Street, with substantial flooding at the A27 roundabout.				✓		None
Tangmere	Not in Flood Zones	None	Mapping shows that surface water flood risk mainly follows roads. Roads most at risk of flooding include Tangmere Road.				✓	✓	None

8 Fluvial and coastal defences

A high-level review of flood defences was carried out for this SFRA and this involved an interrogation of existing information on asset condition and standard of protection. Defences are categorised as either raised flood defences (e.g. walls/embankments) or flood storage areas (FSAs). Man-made and natural defences which may arise for instance due to the presence of naturally high ground adjacent to a settlement have been considered. The defences and their locations are summarised in the following sections.

8.1 Defence standard of protection and residual risk

One of the principal aims of the SFRA is to outline the present risk of flooding across Chichester District Local Plan area including consideration of the effect of flood risk management measures (including flood banks and defences). The modelling that informs the understanding of flood risk within the Local Plan area is typically of a catchment wide nature, suitable for preparing evidence on possible site options for development. In cases where a specific site risk assessment is required, detailed studies should be used to seek to refine the results and provide an appropriate understanding of flood risk from all sources.

Consideration of the residual risk behind flood defences has been undertaken as part of this study. Residual risk includes the consideration of flood events that exceed the design thresholds of the flood defences or circumstances where there is a failure of the defences, e.g. flood banks collapse. Developers should also consider the standard of protection provided by defences and residual risk when preparing detailed Flood Risk Assessments.

Standard of Protection

Flood defences are designed to give a specific standard of protection, reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP standard of protection means that the flood risk in the defended area is reduced to a 1% chance of flooding in any given year.

Although flood defences are designed to a standard or protection it should be noted that, over time, the actual standard of protection provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change

8.2 Defence condition

Formal structural defences are given a rating by the Environment Agency based on a grading system for their condition[13]. A summary of the grading system used by the Environment Agency for condition is provided in Table 8-1.

[13] Condition Assessment Manual, Environment Agency (2012)

Table 8-1: Defence asset condition rating

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

The condition of existing flood defences and whether there are plans and commitment for them to be maintained and/or improved in the future must be considered with respect to the safety and sustainability of development over its intended life and also with respect to the financial and economic commitment to the long-term provision of appropriate standards of protection. In some cases, the relevant strategy may suggest that it is not appropriate to maintain the condition of the assets, which may prove influential for the development over its intended life. In addition, detailed FRAs undertaken by developers (if a defence is influential to the proposed development) will need to thoroughly explore the condition of defences, especially where these defences are informal and demonstrate a wide variation of condition grades. It is important that all of these assets are maintained to a good condition and their function remains unimpaired in accordance with the policy and strategy for Flood Risk Management.

Key defences across Local Plan area are displayed in the 5km grid maps in Appendix I including their condition and standard of protection, using spatial defence data provided by the Environment Agency. **Interactive maps** can be found on the Chichester District Council's website.

8.3 Fluvial defences in the Local Plan area

The key fluvial defences in the Local Plan area are raised barriers such as walls or embankments. The maps shown in Appendix I provide a summary of the fluvial defences in Chichester District provided by the Environment Agency.

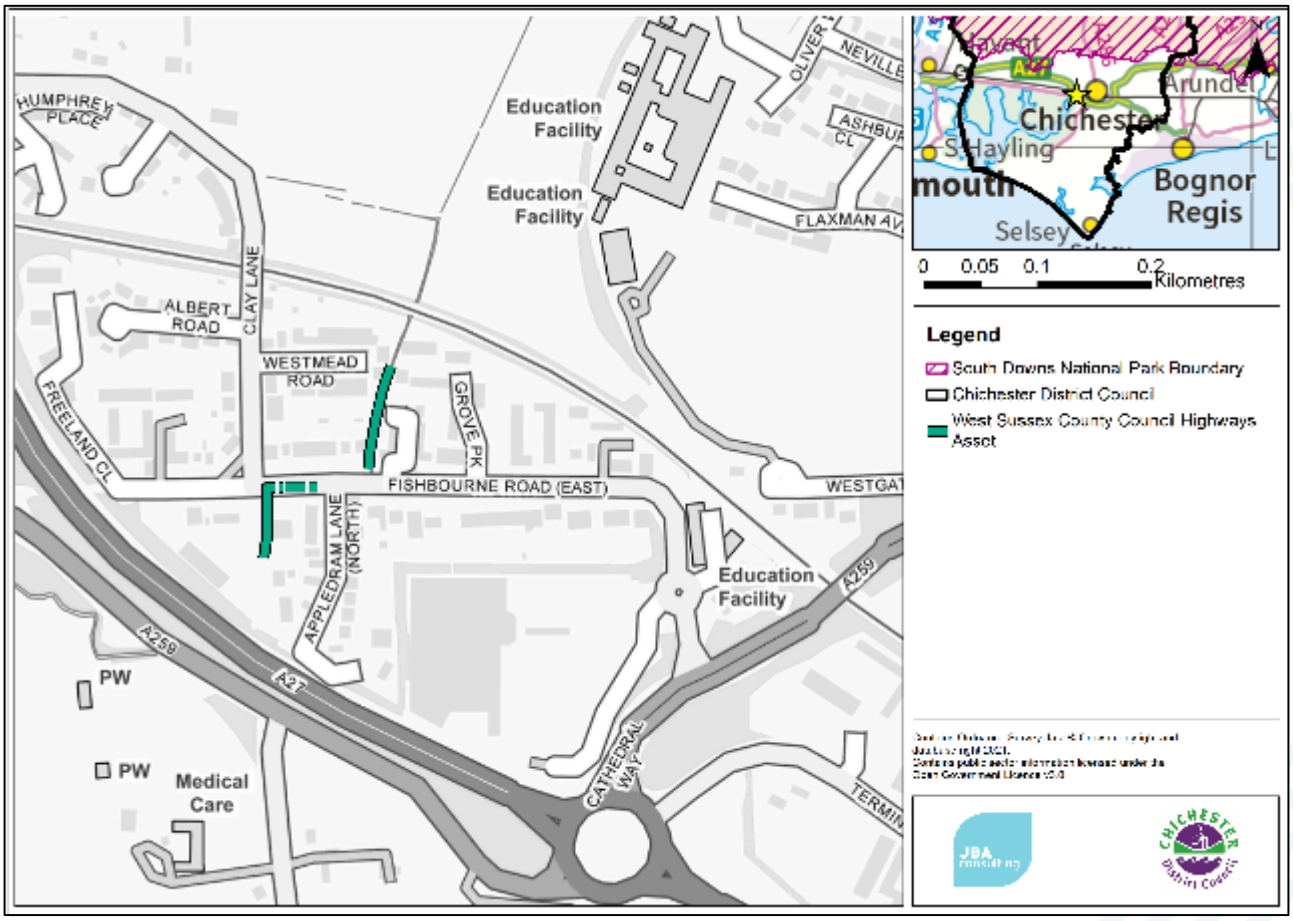
8.3.1 Chichester

Fluvial defences along the River Lavant in the city of Chichester mainly consist of high ground and embankments. Given the type of defence used, the majority of these defences do not have a current standard of protection or current condition of defence recorded.

These fluvial defences are designed to operate in conjunction with measures implemented under the wider River Lavant Flood Alleviation Scheme (Section 8.4.1).

Chichester also benefits from a headwall along the River Lavant which runs south to and under Fishbourne Road. The headwall remains in Riparian Ownership and responsibility. However, West Sussex County Council have confirmed that as far as they are aware, a full land charges or an ownership report has not been undertaken to formally identify the owners. The location of the headwall shown in Figure 8-1.

Figure 8-1: Riparian owned headwall



8.3.2 Runcton and Hunston

The flood defences in Runcton and Hunston are both classified as high ground, information regarding condition of this defence is not available They are shown to not provide any standard of protection.

8.3.3 South of Loxwood

Alongside the River Kird and the Wey and Arun Canal is a fluvial defence in the form of high ground. The Environment Agency owned assets are in-fair condition, but no condition is provided for the privately owned assets. Again, they are shown to not provide any standard of protection.

8.3.4 River Ems

The flood defences along the River Ems are predominately natural high ground, walls, and embankments. There is one embankment noted to be in fair condition, but they are shown to not provide any standard of protection.

8.4 Alleviation Schemes

Whilst there are limited fluvial defences on the Chichester District Local Plan watercourses with a significant standard of protection (protect against a 5% AEP flood event or greater), schemes have been introduced to reduce flooding from the River Lavant.

8.4.1 River Lavant Flood Alleviation Scheme

The River Lavant Flood Alleviation Scheme was introduced by the Environment Agency to reduce the risk of flooding in Chichester and the surrounding areas. The scheme involves the construction of a new flood flow route, which diverts high flows away from the culverted watercourse through Chichester town centre and towards Pagham Harbour.

There are also several Flood Alleviation Schemes in the pipeline. These include the Environment Agency's Siddlesham Inland Banks Project and Loxwood Flood Alleviation Scheme.

8.5 Coastal and tidal defences in the Local Plan area

Coastal defences in the Local Plan area consist of a combination of soft and hard engineering solutions. The area is mainly protected by soft engineering methods, in the form of shingle defences. There are large shingle banks which dominate Pagham Beach, Pagham Harbour and Church Norton. Environment Agency asset maps are also shown in Appendix I.

Hard engineering methods are also incorporated along the coast and these are in the form of seawalls, groynes, gabions, revetments and embankments. These hard engineering methods often support the soft engineering methods.

When considering defences along the coastline, it is important to differentiate between those which are constructed to protect the coastal frontage from erosion and those which are designed to protect the coast from flood risk from the sea e.g. still water levels exceeding the defence crest, or waves overtopping the defence. Each of these types of defence are present in the Local Plan area but are not designed to necessarily fulfil the dual purpose of managing flood risk and coastal protection.

The defences which are identified by the Environment Agency as coastal and tidal are shown in Appendix I. Many of the defences around the coastline are coastal defences. With climate change, it is likely that many of the coastal defences will need to become tidal defences in the future.

The majority of coastal and tidal defences provide a standard of protection against an event with an annual probability of at least 5% AEP. The defences at Pagham Harbour, provide a standard of protection against a 1% AEP and 0.5% AEP flood event.

Defences to the east of Selsey are noted to not currently provide a standard of protection according to the EA's dataset. Defences to the west of Selsey do not provide any protection against flood events with the exception of a section of the beach noted to provide protection against a 0.1% AEP event and the Medmerry Scheme on this section of coastline providing protection against a 0.33% AEP event.

Where a condition has been provided by the Environment Agency the defences are in 'good' or 'fair' condition.

The Environment Agency, Chichester District Council and Arun District Council worked together to prepare the **Pagham to East Head coastal defence strategy (2014)**. The strategy provides further details about ways to manage the risk of flooding and erosion to 5,300 properties at risk between Pagham Beach and West Wittering. The main areas at risk are Pagham, Selsey and the Witterings with 20,000 permanent residents, and thousands of visitors each year.

The Environment Agency has prepared a draft Portchester Castle to Emsworth Coastal Flood and Erosion Risk Management Strategy which is relevant to a small section of the coastline near Slipper Close in Emsworth.

The coastline between East Head and Emsworth does not currently have a coastal defence strategy, but the Environment Agency are currently promoting its production.

8.5.1 Selsey East and West Beach

The **Pagham to East Head coastal defence strategy** recommends the option for the coastline along Selsey is hold the line – sustain. Selsey has been hit by some of the worst storms in the area. Coastal protection schemes have been carried out by Chichester District Council along Selsey East and West beach. These include:

- 2010 - 2011 Selsey West Beach Coast Protection Beach Recharge;
- 2009 - 2010 Selsey West Beach Permanent Repairs to Sea Wall;
- 2009 - 2010 Selsey East Beach Groyne Refurbishment

In 2012, further beach and sea defence work was completed[14]. The scheme was privately funded by the holiday village Bunn Leisure and took six months to complete. The scheme used granite rocks, sand and shingle.

8.5.2 Selsey

During the first phase of the **Selsey and Wittering Beach Management Plan** (2011-2016), beach recharges were undertaken in 2014 and 2016 (6,500 tonnes and 8,500 tonnes). These bolstering exercises were performed to address depleting beach levels to maintain the existing level of protection while extending the life of existing hard defences.

8.5.3 Medmerry managed realignment scheme

The **Pagham to East Head coastal defence strategy** states that for Medmerry the recommended option is managed realignment. The managed realignment scheme at Medmerry was completed in 2013 by the EA[15], in partnership with the RSPB, and has resulted in major improvements in flood protection along the shoreline from Selsey to Bracklesham. Previously, the flood defence along this part of the coast was a 3km shingle bank, which was prone to regular breaching and was very costly to maintain. The new flood defence scheme protects 348 properties, as well as sewage works, caravan parks and Selsey's main road route, to a standard of protection in excess of 0.5% AEP. Furthermore, the site is an RSPB Nature Reserve and an intertidal habitat for a range of wildlife[16].

8.5.4 West Wittering Flood Defence 2012

Following recommendations from the **North Solent Shoreline Management Plan** and the Pagham to East Head Coastal Defence Strategy to improve flood defences in West Wittering, the Environment Agency finished building a new defence in 2012. Located close to Chichester Harbour, West Wittering has long been at significant risk of flooding from high tides. The newly built flood defence provides improved flood protection to 55 properties, the local school and Southern Water's sewage pumping station[17].

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14 Selsey £17 million flood defence scheme completed, Chichester Observer, available at https://www.chichester.co.uk/news/environment/selsey-17-million-flood-defence-scheme-completed-1-4343967
15 Medmerry coastal flood defence scheme, EA, available: https://www.gov.uk/government/publications/medmerry-coastal-flood-defence-scheme/medmerry-coastal-flood-defence-scheme
16 Managed realignment at Medmerry, West Sussex, ICE, available: https://www.ice.org.uk/knowledge-and-resources/case-studies/managed-realignment-at-medmerry-sussex
17 West Wittering Tidal Flood Defences, available: https://www.gov.uk/government/publications/west-wittering-tidal-flood-defences/west-wittering-tidal-flood-defences

8.5.5 East Head

In 2009, Chichester District Council undertook a beach recycling scheme at East Head[18]. In 2016, additional shingle was recycled from the spit and placed behind the hinge. This work supports the policy for the frontage of "adaptive management" where hard defences are removed as they fail.

8.5.6 East Wittering / Bracklesham

During the first phase of the **Selsey and Wittering Beach Management Plan** (2011-2016), a number of defences were upgraded. In 2012, groynes in East Wittering were raised, 8,500 m^3 of shingle was recycled from the western end of the frontage in 2014 and 8,000 tonnes of course shingle was imported at Jolliffe Road in 2015. These works bolstered and more evenly distributed the beach levels, better absorbing wave energy and extending the life of existing hard defences.

8.6 Future schemes

Chichester District Council plans to promote the following schemes in the future:

- Selsey, Bracklesham & East Wittering Beach Management 2021 to 2026.
- Selsey Coastal Defence & Flood Scheme
- 2022: Economic Assessment & Implementation Plan
- Adaptive Management at East Head

8.7 Residual flood risk

Residual risks are those remaining after applying the sequential approach and taking mitigating actions. It is the responsibility of the developer to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed.

This SFRA does not assess the probability of failure other than noting that such events are very rare. However, in accordance with NPPF, all sources of flooding need to be considered. If a breach or overtopping event were to occur, then the consequences to people and property could be high. Developers should be aware that any site that is at or below defence level may be subject to flooding if an event occurs that exceeds the design capacity of the defences, or the defences fail and this should be taken into account when building resilience into low level properties.

8.7.1 Overtopping

Overtopping conditions occur when a wave meets a structure lower than the maximum wave height or when the mean sea level exceeds the top of the defences. The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest level of the defence. During these conditions there is a regular intermittent discharge of sea water over the defences which can cause flooding. The Defra and Environment Agency **Flood Risks to People** guidance document provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

The risk of violent waves overtopping sea walls in particular can lead to a significant flood hazard. Therefore, as part of this SFRA, the risk of overtopping is included in the production of the Flood Zones within the Local Plan area.

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18 Chichester District Council, Planning the Management of our Coastline, available at http://www.chichester.gov.uk/article/25457/Planning-the-management-of-our-coastline

8.7.2 Defence breach

A breach of a defence occurs when there is a failure in the structure and a subsequent ingress of flood water.

It is important to consider the type of breach that would be most likely to occur, ground levels and tidal conditions when it comes to breach modelling. Where defences are present, risk of breach events should be considered as part of the site-specific flood risk assessment. Flood flows from breach events can be associated with significant depths and flow velocities in the immediate vicinity of the breach location and so FRAs must include assessment of the hazards that might be present so that the safety of people and structural stability of properties and infrastructure can be appropriately taken into account. Whilst the area in the immediate vicinity of a breach can be subject to high flows, the whole flood risk area associated with a breach must also be considered as there may be areas remote from the breach that might, due to topography, involve increased depth hazards.

9 FRA requirements and flood risk management guidance

9.1 Over-arching principles

This SFRA focuses on delivering a strategic assessment of flood risk within Chichester District Local Plan area. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk at a site are fully addressed. Some sites may additionally require the application of the Exception Test following the Sequential Test if the Sequential Test indicates that there are safety and sustainability issues to be addressed. At these locations further work will need to be carried out to inform a detailed Flood Risk Assessment (FRA). Any site that does not pass the Exception Test should not be allocated for development. It is the responsibility of the developer to provide an FRA with an application.

It should be acknowledged that a detailed FRA may show that a site is not appropriate for development of a particular vulnerability or even at all. Where the FRA shows that a site is not appropriate for a particular use, a lower vulnerability classification may be appropriate.

9.2 Requirements for site-specific flood risk assessments

9.2.1 What are site specific FRAs?

Site specific FRAs are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted with planning applications and should demonstrate how flood risk will be managed over the development's lifetime, taking into account climate change and vulnerability of users.

Paragraph 068 of the NPPG Flood Risk and Coastal Change Planning Practice Guidance sets out a checklist for developers to assist with site specific flood risk assessments.

Site specific FRAs are required in the following circumstances:

- Proposals for new development (including minor development and change of use) in Flood Zones 2 and 3
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency)
- Proposals of 1 hectare or greater in Flood Zone 1
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding
- Proposals of less than one hectare in Flood Zone 1 where they could be affected by sources of flooding other than rivers and the sea (e.g. surface water)

An FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1)
- Where the site is intended to discharge to the catchment or assets of a water management authority which requires a site-specific FRA
- Where evidence of historical or recent flood events have been passed to the LPA

9.2.2 Objectives of site specific FRAs

The aim of an FRA is to demonstrate that the development is protected to the 1% AEP fluvial and 0.5% AEP tidal flood scenario and is safe for its intended life span during the 'design' flood event, including an allowance for climate change. This includes assessment of mitigation measures required to safely manage flood risk. Development proposals requiring FRAs should establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source;
- Whether a proposed development will increase flood risk elsewhere;
- Whether the measures proposed to deal with the effects and risks are appropriate;
- Assess the potential cumulative impact of development on flood risk;
- The evidence, if necessary, for the Local Planning Authority to apply the Sequential Test; and
- Whether, if applicable, the development will be safe and pass the Exception Test, if applicable.

FRAs for sites located in the Local Plan area should follow the approach recommended by the 2021 NPPF (and associated guidance) and guidance provided by the Environment Agency and West Sussex County Council. This includes:

- **Site-specific Flood Risk Assessment: CHECKLIST** (NPPF PPG, Defra)
- **Standing Advice on Flood Risk** (Environment Agency)
- **Flood Risk Assessment for Planning Applications** (Environment Agency)
- **West Sussex County Council LLFA Policy for the Management of Surface Water**

The **UKCP18** was published on 26 November 2018. The UKCP18 projections replace the UKCP09 projections and is the official source of information on how the climate of the UK may change over the rest of this century. The Environment Agency have updated the climate change allowances to take account of the UKCP18 projections. When undertaking an FRA, please refer to the most up to date climate change allowances provided by the Environment Agency.

Guidance for local planning authorities for reviewing flood risk assessments submitted as part of planning applications has been published by Defra in 2015 – **Flood Risk Assessment: Local Planning Authorities.**

9.3 Mitigation measures

Mitigation measures should be seen as a last resort to address flood risk issues. Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered.

Often the determining factor in deciding whether a particular development is appropriate is the practical feasibility, financially viability and long-term maintenance implications of flood risk mitigation rather than technical limitations. Detailed technical assessments are required in the FRA to assess the practical feasibility, together with a commercial review by the developer of the cost of the mitigation works and how contributions will be made for their long-term maintenance. At the SFRA stage, broad assumptions must be made regarding the feasibility of flood risk mitigation to highlight sites with greater development potential. The formulation of measures that not only provides an appropriate standard of protection to new

development, but also reduces the risk to existing communities will be an important consideration.

Attention must also be paid to the provision of safe access and egress during flood events, including climate change, and how this is linked to flood warning and emergency evacuation where necessary. The Emergency Services and local authority should be consulted on the evacuation and rescue capabilities and any advice or requirements included. Consideration should also be given to residual risk to understand the safety implications during events where the design capacity is exceeded or there is a failure.

There should be no interruption to flood flows or loss of flood storage as a result of any proposed development. Flood storage compensation may be appropriate for sites on the edge of the existing floodplain or within a flood cell.

Whilst it might be possible to identify appropriate flood mitigation measures for some sites, it is worth noting that in some instances the findings of individual FRAs may determine that the risk of flooding to a proposed development is too great and mitigation measures are not feasible or appropriate. In these instances, the development is likely to be subject to an objection by the Environment Agency.

The minimum acceptable standard of protection against flooding for new residential property within flood risk areas is the 1% AEP event for fluvial flooding, 0.5% AEP event for tidal flooding, and 1% AEP storm for surface water flooding. Developments susceptible to flood risk resulting from blockage or exceedance of structures should be protected beyond the 1% AEP plus climate change scenario. An allowance for climate change over the lifetime of the development must be made when assessing each of these scenarios and be conducted in line with latest guidance for climate change.

9.4 Reducing flood risk

9.4.1 Site layout and design

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from flood zones, to higher ground, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. However, vehicular parking in floodplains should be based on the nature of parking, flood depths and hazard including evacuation procedures and flood warning. The nature of risk to water quality also needs to be considered and mitigated for to ensure that accumulated hydrocarbons and other vehicle related pollutants are not released to the aquatic environment. Particular consideration should be given to designing drainage systems that reduce the risk of groundwater ingress, as this is a known existing problem.

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

9.4.2 Raised floor levels

The raising of internal floor levels within a development avoids damage occurring to the interior, furnishings and electrics in times of flood.

According to the government's guidance on **'Preparing a flood risk assessment: standing advice**' minimum finished floor levels for vulnerable development should normally be above whichever is higher of the following:

- a minimum of 300mm above average ground level of the site.
- a minimum of 300mm above the adjacent road level to the building.
- 300mm above estimated river or sea flood level.

Construction materials that have low permeability up to at least the same height as finished floor levels should be used. If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency will be required to determine alternative approaches.

The above guidelines should also apply to replacement dwellings not solely the construction of new properties and in line with the August 2022 changes to the PPG thresholds should be set to provide appropriate freeboard above flooding from surface water and groundwater and not just river and sea flooding.

If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency will be required to determine alternative approaches.

The additional height that the floor level is raised above the maximum water level is referred to as the "freeboard". Additional freeboard may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels.

Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route. However, access and egress would still be an issue, particularly when flood duration covers many days.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the Exception Test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

9.4.3 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain if they are overtopped or breached. Compensatory storage must be provided where raised defences remove storage from the floodplain. It would be preferable for schemes to involve an integrated flood risk management solution.

Temporary or demountable defences are not acceptable forms of flood protection for a new development but might be appropriate to address circumstances where the consequences of residual risk are severe. In addition to the technical measures the proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate.

9.4.4 Modification of ground levels

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken at locations where raising ground levels could adversely affect existing communities and property.

In most areas of fluvial flood risk, raising land above the floodplain would reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land.

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

Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment.

9.4.5 Developer contributions

In some cases, and following the application of the sequential test, it may be necessary for the developer to make a contribution to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS).

DEFRA's Flood and Coastal Risk Management Grant in Aid (FCRMGiA)[19] can be obtained by operating authorities to contribute towards the cost of a range of activities including flood risk management schemes that help reduce the risk of flooding and coastal erosion. Some schemes are only partly funded by FCRMGiA and therefore any shortfall in funds will need to be found from elsewhere when using Resilience Partnership Funding, for example local levy funding, local businesses or other parties benefitting from the scheme.

For new development in locations without existing defences, or where the development is the only beneficiary, the full costs of appropriate risk management measures for the life of the assets proposed must be funded by the developer.

However, the provision of funding by a developer for the cost of the necessary standard of protection from flooding or coastal erosion does not mean the development is appropriate as other policy aims must also be met. Funding from developers should be explored prior to the granting of planning permission and in partnership with the Council and the Environment Agency.

The appropriate route for the consideration of strategic measures to address flood risk issues is the Local Flood Risk Management Strategy (LFRMS) prepared by the Lead Local Flood Authority. The LFRMS should describe the priorities with respect to local flood risk management, the measures to be taken, the timing and how they will be funded. It will be preferable to be able to demonstrate that strategic provisions are in accordance with the LFRMS, can be afforded and have an appropriate priority.

The Environment Agency is also committed to working in partnership with developers to reduce flood risk. Where assets are in need of improvement or a scheme can be implemented to reduce flood risk, the Environment Agency request that developers contact them to discuss potential solutions.

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19 Principles for implementing flood and coastal resilience funding partnerships (Environment Agency, 2012)

9.5 Buffer strips

The provision of a buffer strip to 'make space for water', allows additional capacity to accommodate climate change and ensure access to the watercourse, structures and defences is maintained for future maintenance purposes.

It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection. Building adjacent to riverbanks can also cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult.

9.6 Resistance and Resilience measures

There may be instances where flood risk to a development remains despite implementation of such planning measures as those outlined above. For example, where the use is water compatible, where an existing building is being changed, where residual risk remains behind defences, or where floor levels have been raised but there is still a risk at the 0.1% AEP scenario. In these cases, (and for existing development in the floodplain), additional measures can be put in place to reduce damage in a flood and increase the speed of recovery. These measures should not normally be relied on for new development as an appropriate mitigation method.

Resistance measures aim to reduce the amount of floodwater entering the building and resilience measures aim to reduce the damage caused by flood water which has enter the property.

9.6.1 Resistance measures

Most of the resistance measures should be regarded as reducing the rate at which flood water can enter a property during an event and considered an improvement on what could be achieved with sand bags. They are often deployed with small scale pumping equipment to control the flood water that does seep through these systems. The effectiveness of these forms of measures is often dependant on the availability of a reliable forecasting and warning system, so the measures are deployed in advance of an event. The following resistance measures are often deployed:

Permanent barriers

Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers.

Temporary barriers

Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.

9.6.2 Resilience measures

Interior design measures to reduce damage caused by flooding. For example:

- Electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level
- Water-resistant materials for floors, walls and fixtures
- If redeveloping existing basements for non-residential purposes, new electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level to minimise damage if the development floods

Resistance and Resilience measures will be specific to the nature of flood risk, and as such will be informed and determined by the FRA. Further guidance relating to

appropriate resistance and resilience measures can be found on the Environment Agency's **Flood risk assessment in flood zones 2 and 3** webpage.

9.6.3 Community resistance measures

These include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.

9.6.4 Emergency planning

Safe access and egress from the site should be provided to reduce the residual risks to a development. The developer should seek to incorporate an emergency plan and a safe refuge point if the development site has been identified to be at risk of flooding. This assessment should also include evacuation routes over a wider area, particularly on the coastal peninsula where a limited road network reduces the number of evacuation routes. The local authority and Emergency Services should be consulted when designing an emergency plan. For further details on emergency planning, see Section 11.

9.7 Making space for water

The **PPG** sets out a clear aim in Flood Zone 3 to create space for flooding by restoring functional floodplain and generally development should be directed away from these areas.

The updated PPG establishes the purposes and impacts of utilising Natural Flood Management as a method to restore and maintain the natural functions of the environment including the functional floodplain, channels and coastlines. Proposed techniques from the PPG include the restoration of the functional floodplain, to mitigate the impact of floods on populated urban spaces. Generally, future development should be directed away from these areas.

All new developments close to rivers should consider the opportunity to improve and enhance the river environment. Details within the PPG highlights the importance of river restoration, where future developments should be looking for opportunities to improve and enhance rivers in the area. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of structures such as culverts. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, improving water quality, increasing biodiversity, and the overall reduction in flood risk through removal of obstructions at river structures.

Increasing green space and access to the river will also bring additional social benefits and improving local natural amenity.

Consideration for making space for water should also be applied to surface water generated by impermeable surfaces. All new developments should aim to incorporate SuDS to minimise the amount of surface water that is generated. Through a sequential design, known areas of flood risk from surface water can be set aside as open space to ensure flow routes are not blocked, preventing water from building up to potentially dangerous depths. The provision of SuDS also allows water related features to become part of the landscape, offering improved aesthetics to a development and removing the need for underground storage or culverting.

9.8 Reducing flood risk from other sources

9.8.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and for this reason many conventional flood defence and mitigation methods are not suitable. A way to substantially reduce flood risk would be through building design (development form), so floor levels are raised above the water levels caused by a 1% AEP plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off of the site. Developers should provide evidence and ensure that this will not be a significant risk.

When redeveloping existing buildings, it may be acceptable to install pumps in basements as a resilience measure. However, for new development this is not considered an appropriate solution.

At locations where groundwater levels are high it will be important that consideration is given to the prevention of groundwater ingress to foul and surface water sewer systems, as this mechanism reduces the hydraulic capacity of the drainage system and induces increased flows in foul and surface water systems.

9.8.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. The development must improve the drainage infrastructure to reduce flood risk on site and the wider area. It is important that a drainage impact assessment shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk.

When redeveloping existing buildings, the installation of some permanent or temporary flood-proofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers. These can be installed within gravity sewers or drains in a property's private sewer upstream of the public sewerage system. They need to be carefully installed and must be regularly maintained. Consideration must also be given to attenuation and flow ensuring that flows during the 1% AEP plus climate change storm event are retained within the site if any flap valves shut. This must be demonstrated with suitable modelling techniques. As described, particular consideration should be given to designing drainage systems that reduce the risk of groundwater ingress, as this is a known existing problem.

9.8.3 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of greenfield surface water drainage by encouraging water to flow along natural flow routes and thereby reduce runoff rates and volumes during storm events while providing some water treatment benefits. SuDS also have the advantage of providing effective blue and green infrastructure and ecological and public amenity benefits when designed and maintained properly.

The inclusion of SuDS within developments should be seen as an opportunity to enhance ecological and amenity value, and promote green infrastructure,

incorporating above ground facilities into the development landscape strategy. SuDS must be considered at the outset, during preparation of the initial site conceptual layout to ensure that enough land is given to design spaces that will be an asset to the development rather than an after-thought. Advice on best practice is available from the Environment Agency and the Construction Industry Research and Information Association (CIRIA).

More detailed guidance on the use of SuDS is providing in Section 10.3.

10 Surface water management and SuDS

10.1 What is meant by surface water flooding?

Surface water flooding describes flooding from sewers, drains, and ditches that occurs during heavy rainfall.

Surface water flooding includes

- **pluvial flooding**: flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (overland surface runoff) before it either enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity;
- **sewer flooding**: flooding that occurs when the capacity of underground water conveyance systems is exceeded, resulting in flooding inside and outside of buildings. Normal discharge of sewers and drains through outfalls may be impeded by high water levels in receiving waters which may cause water to back up and flood around buildings or in built up areas. Sewer flooding can also arise from operational issues such as blockages or collapses of parts of the sewer network; and
- **overland flows entering the built-up area from the rural/urban fringe**: includes overland flows originating from groundwater springs.

10.2 Role of the LLFA and Local Planning Authority in surface water management

From April 2015 local planning policies and decisions on planning applications relating to major development or major commercial development should make provision for sustainable drainage systems to manage run-off, where major developments are defined as:

- residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known; and
- non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of one hectare or more.

The Local Planning Authority must satisfy themselves that clear arrangements are in place for future management of the maintenance arrangements and the LLFA (West Sussex County Council), as statutory consultee is required to review the drainage and Sustainable Urban Drainage (SuDS) proposals to confirm they are appropriate.

When considering planning applications, local planning authorities should seek advice from the relevant flood risk management bodies, principally the LLFA on the management of surface water (including what sort of SuDS they would consider to be reasonably practicable), satisfy themselves that the proposed minimum standards of operation are appropriate and ensure, through the use of planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the development's lifetime. Judgement on what SuDS system would be reasonably practicable should be through reference to Defra's **'Non-statutory technical standards for SuDS' document** and should take into account design and construction costs.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. This will assist with the delivery of well designed, appropriate and effective SuDS. Proposals should also comply with the key SuDS principles regarding solutions that deliver multiple long-term benefits. These principles are:

- **Quantity:** should be able to cope with the quantity of water generated by the development at the agreed rate with due consideration for climate change via a micro-catchment based approach
- **Quality:** should utilise SuDS features in a "treatment train" that will have the effect of treating the water before infiltration or passing it on to a subsequent water body
- **Amenity/Biodiversity:** should be incorporated within "open space" or "green corridors" within the site and designed with a view to performing a multifunctional purpose

West Sussex County Council and Chichester District Council:

- promote the use of SuDS for the management of run off;
- ensure their policies and decisions on applications support and compliment the building regulations on sustainable rainwater drainage, giving priority to infiltration over watercourses and then sewer conveyance;
- incorporate favourable policies within development plans;
- adopt policies for incorporating SuDS requirements into Local Plans;
- encourage developers to utilise SuDS whenever practical, if necessary, through the use of appropriate planning conditions; and
- develop joint strategies with sewerage undertakers to further encourage the use of SuDS.

Chichester District Council's **'Surface Water and Drainage: Supplementary Planning Document'** investigates surface water management in the Chichester District (excluding the South Downs National Park) and describes how development should be managed in order to fully enhance and protect the water environment. This document should be referred to by developers and consultants when preparing planning applications.

DEFRA has announced an intention to update to Schedule 3 of the FWMA 2010 that will mandate sustainable drainage (SuDS) in new developments in England[20]. This update follows discussions in April 2015 in which the government addressed increasing the use of SuDS through planning policy. Current policy requires that SuDS are included in all new major developments (over 10 homes), unless there is clear evidence that this would be inappropriate. It is understood that this update will come into effect in 2024 following a further consultation.

10.3 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems are water management practices which aim to enable surface water to be drained in a way that mimics (as closely as possible) the run-off and drainage prior to site development. The primary benefits of SuDS can be categorised under four distinct themes. These are highlighted in Figure 10-1 and are referred to as the four pillars of SuDS design.

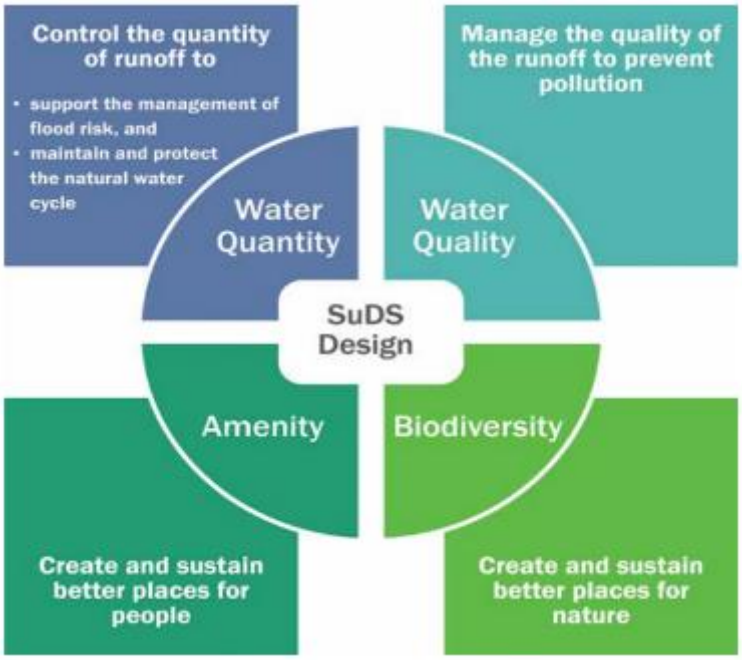
There are a number of ways in which SuDS can be designed to meet surface water quantity, water quality, biodiversity and amenity goals. Given this flexibility, SuDS are generally capable of overcoming or working alongside various constraints

20 Schedule 3 FWMA Update. (2023). https://www.gov.uk/government/publications/sustainable-drainage-systems-review

affecting a site, such as restrictions on infiltration, without detriment to achieving these goals.

The inclusion of SuDS within developments should also be seen as an opportunity to enhance ecological and amenity value as well as promote Green Infrastructure by incorporating above ground facilities into the landscape development strategy. SuDS must be considered at the outset and during preparation of the initial conceptual site layout to ensure that enough land is given to design spaces that will be an asset to the development as opposed to an ineffective afterthought. For SuDS trains to work effectively it needs to be ensured that appropriate techniques are selected based on the objectives for drainage and the site-specific constraints. It is recommended that on all developments source control is implemented as the first stage of a management train allowing for improvements in water quality and reducing or eliminating runoff from smaller, more frequent, rainfall events.

Figure 10-1: Four pillars of SuDS design



Source: The SuDS Manual C753 (2015)

All new major development proposals should ensure that sustainable drainage systems for management of run-off are put in place. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and existing drainage arrangements is essential.

10.4 Types of SuDS System

There are many different SuDS techniques that can be implemented in attempts to mimic pre-development drainage (Table 10-1). Techniques can include soakaways, infiltration trenches, permeable pavements, grassed swales, green roofs, ponds and wetlands and these do not necessarily need to take up a lot of space. The suitability of the techniques will be dictated in part by the development proposal and site conditions. Advice on best practice is available from the Environment Agency and the

Construction Industry Research and Information Association (CIRIA) e.g. the **CIRIA SuDS Manual C753** (2015).

Table 10-1: Examples of SuDS techniques and potential benefits

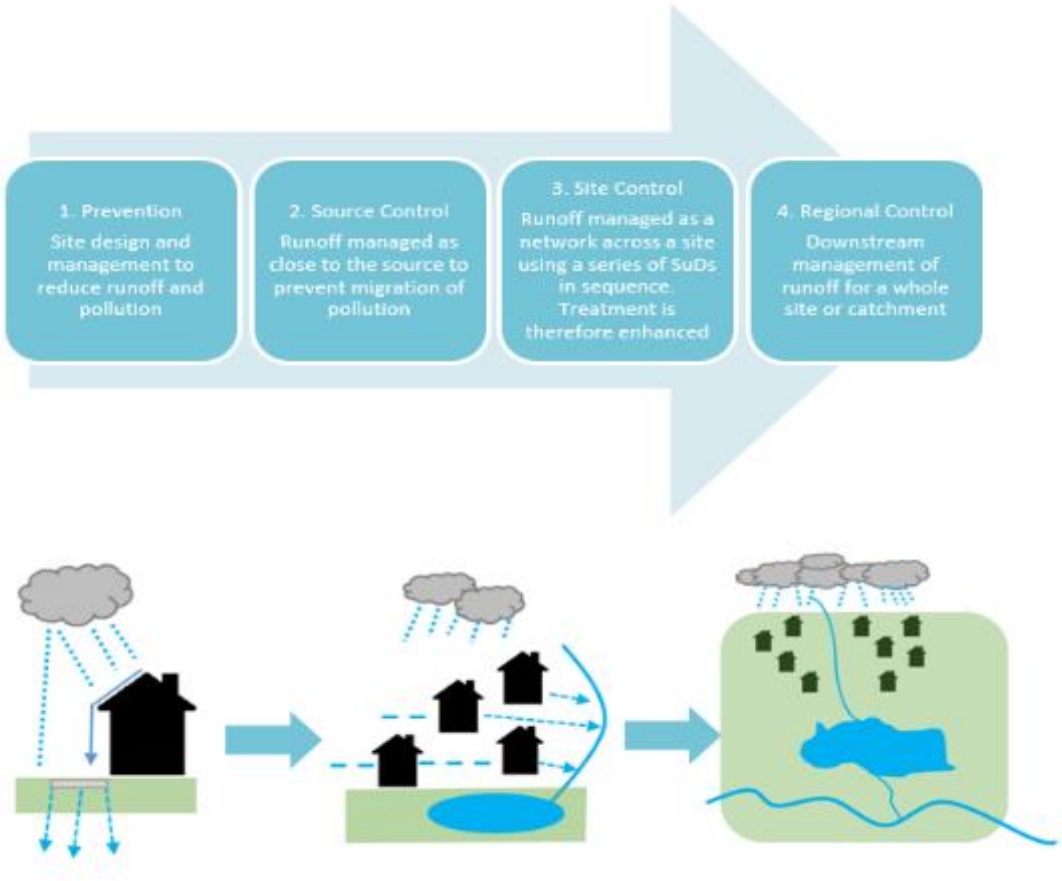
SuDS Technique	Flood Reduction	Water Quality Treatment & Enhancement	Landscape and Wildlife Benefit
Living roofs	✓	✓	✓
Basins and ponds	✓	✓	✓
Constructed wetlands	✓	✓	✓
Balancing ponds	✓	✓	✓
Detention basins	✓	✓	✓
Retention ponds	✓	✓	✓
Filter strips and swales	✓	✓	✓
Infiltration devices	✓	✓	✓
Soakaways	✓	✓	✓
Infiltration trenches and basins	✓	✓	✓
Permeable surfaces and filter drains	✓	✓	
Gravelled areas	✓	✓	
Solid paving blocks	✓	✓	
Porous pavements	✓	✓	
Tanked systems	✓		
Over-sized pipes/tanks	✓		
Storm cells	✓		

10.4.1 SuDS Management

SuDS should not be used individually but as a series of features in an interconnected system designed to capture water at the source and convey it to a discharge location. Collectively this concept is described as a SuDS Management Train (see Figure 10-2). The number of treatment stages required within the Management Train depends primarily on the source of the runoff and the sensitivity of the receiving waterbody or groundwater. A drainage strategy will need to demonstrate that an appropriate number of treatment stages are delivered.

SuDS components should be selected based on design criteria and how surface water management is to be integrated within the development and landscaping setting. By using a number of SuDS features in series it is possible to reduce the flow and volume of runoff as it passes through the system as well as minimising pollutants which may be generated by a development.

Figure 10-2: SuDS Management Train



10.4.2 Treatment

A key part of the four pillars of SuDS is to provide the maximum improvement to water quality through the use of the "SuDS management train". To maximise the treatment within SuDS, CIRIA recommends[21] the following good practice is implemented in the treatment process:

1. **Manage surface water runoff close to source:** This makes treatment easier due to the slower velocities and also helps isolate incidents rather than transport pollutants over a large area.
2. **Treat surface water runoff on the surface:** This allows treatment performance to be more easily inspected and managed. Sources of pollution and potential flood risk is also more easily identified. It also helps with future maintenance work and identifying damaged or failed components.
3. **Treat a range of contaminants:** SuDS should be chosen and designed to deal with the likely contaminants from a development and be able to reduce them to acceptably low levels.
4. **Minimise the risk of sediment remobilisation:** SuDS should be designed to prevent sediments being washed into receiving water bodies or systems during events greater than what the component may have been designed.

21 C753 CIRIA SuDS Manual (2015)

5. **Minimise the impact of spill:** Designing SuDS to be able to trap spills close to the source or provide robust treatment along several components in series.

The number of treatment stages required depends primarily on the source of the runoff. A drainage strategy will need to demonstrate that an appropriate number of treatment stages are delivered. This involves determining a pollutant hazard score for each pollutant type. An index is then used to determine the treatment potential of different SuDS features for different pollutant types. This is known as the mitigation index. The Total SuDS mitigation index should be equal or greater than the pollution hazard score to deliver adequate treatment.

10.4.3 Overcoming SuDS constraints

The design of a SuDS system will be influenced by a number of physical and policy constraints. These should be taken into account and reflected upon during the conceptual, outline and detailed stages of SuDS design. Table 10-2 details some possible constraints and how they may be overcome.

Table 10-2: Example SuDS design constraints and possible solutions

Considerations	Solution
Land availability	SuDS can be designed to fit into small areas by utilising different systems. For example, features such as permeable paving and green roofs can be used in urban areas where space may be limited.
Contaminated soil or groundwater below site	SuDS can be placed and designed to overcome issues with contaminated groundwater or soil. Shallow surface SuDS can be used to minimise disturbance to the underlying soil. The use of infiltration should also be investigated as it may be possible in some locations within the site. If infiltration is not possible linings can be used with features to prevent infiltration.
High groundwater levels	Non-infiltrating features can be used. Features can be lined with an impermeable line or clay to prevent the egress of water into the feature. Additional, shallow features can be utilised which are above the groundwater table.
Steep slopes	Check dams can be used to slow flows. Additionally, features can form a terraced system with additional SuDS components such as ponds used to slow flows.
Shallow slopes	Use of shallow surface features to allow a sufficient gradient. If the gradient is still too shallow pumped systems can be considered as a last resort.
Ground instability	Geotechnical site investigation should be done to determine the extent of unstable soil and dictate whether infiltration would be suitable or not.
Sites with deep backfill	Infiltration should be avoided unless the soil can be demonstrated to be sufficiently compacted. Some features such as swales are more adaptable to potential surface settlement.
Open space in floodplain zones	Design decisions should be done to take into consideration the likely high groundwater table and possible high flows and water levels. Features should also seek to not reduce the capacity of the floodplain and take into consideration the influence that a watercourse may have on a system. Facts such as siltation after a flood event should also be taken into account during the design phase.
Future adoption and maintenance	Local Planning Authority should ensure development proposals, through the use of planning conditions or planning obligations, have clear arrangements for on-going maintenance over the development's lifetime.

For SuDS techniques that are designed to encourage infiltration, it is imperative that the water table is low enough and a site-specific infiltration test is conducted early on as part of the design of the development. Infiltration should be considered with caution within areas of possible subsidence or sinkholes. Where sites lie within or close to groundwater protection zones (GSPZs) or aquifers, further restrictions may be applicable and guidance should be sought from the LLFA and the Environment Agency.

10.5 Sources of SuDS guidance

West Sussex County Council and partner LLFAs produced a document on SuDS design and guidance, aimed at developers and planners involved in designing small and large developments in the South East of England. This document is called **'Water, People, Places: A guide for master planning sustainable drainage into developments'**.

West Sussex County Council also produced a document called **West Sussex County Council LLFA Policy for the Management of Surface Water**. This policy statement should be used by developers, professionals and local authorities involved in the development of new or brownfield sites; drainage schemes for major developments; and local planning and land-use policy.

Chichester District Council's **'Surface Water and Drainage: Supplementary Planning Document'** should also be referred to by developers if the site is within a wastewater treatment catchment. More information and guidance on SuDS is available on the **Susdrain** website.

The **C753 CIRIA SuDS Manual (2015)** replaces and updates the previous version (C697) providing up to date guidance on planning, design, construction and maintenance of SuDS. The document is designed to help the implementation of these features into new and existing developments, whilst maximising the key benefits regarding flood risk and water quality. The manual is divided into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document. It is recommended that developers and the LPA utilise the information within the manual to help design SuDS which are appropriate for a development.

10.5.1 Surface Water Advice Note – Using SuDS on new developments (June 2015)

When considering SuDS as part of a major planning application, local planning authorities need to satisfy themselves that the minimum standard of operation is appropriate for SuDS and ensure through the use of planning conditions that clear arrangements are in place for their ongoing maintenance over the lifetime of the development.

The NPPF expects local planning authorities to give priority to the use of SuDS in determining planning applications. Where SuDS are used, it must be established that these options are feasible, can be adopted and properly maintained and would not lead to any other environmental problems. This is a material planning consideration for all major applications as of the 6 April 2015 and should therefore be given full consideration in an application.

10.5.2 Non-Statutory Technical Guidance, Defra (March 2015)

Non-Statutory Technical Guidance has been developed by Defra to sit alongside PPG to provide non-statutory standards as to the expected design and performance for SuDS.

In March 2015, the latest guidance was released providing amendments as to what is expected by the LPA to meet the National standards. The guidance provides a

valuable resource for developers and designers outlining peak flow control, volume control, structural integrity of the SuDS, and flood considerations both within and outside the development as well as maintenance and construction considerations. It considers the following: flood risk inside and outside the development, peak flow, volume control, structural integrity, designing for maintenance considerations and construction.

The LPA will make reference to these standards when determining whether proposed SuDS are considered reasonably practicable.

10.5.3 Groundwater Vulnerability Zones

The Environment Agency have published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise the underlying bedrock. The maps show the vulnerability of groundwater at a location based on the hydrological, hydrogeological and soil properties within a one-kilometre grid square.

Two maps are available

- **Basic groundwater vulnerability map:** this shows the likelihood of a pollutant discharged at ground level (above the soil zone) reaching groundwater for superficial and bedrock aquifers and is expressed as high, medium and low vulnerability
- **Combined groundwater vulnerability map:** this map displays both the vulnerability and aquifer designation status (principal or secondary). The aquifer designation status is an indication of the importance of the aquifer for drinking water supply.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas.

10.5.4 Groundwater Source Protection Zones (GSPZ)

In addition to the AStGWF data the Environment Agency also defines Groundwater Source Protection Zones in the vicinity of groundwater abstraction points. These areas are defined to protect areas of groundwater that are used for potable supply, including public/private potable supply, (including mineral and bottled water) or for use in the production of commercial food and drinks. The Groundwater SPZ requires attenuated storage of runoff to prevent infiltration and contamination. The definition of each zone is shown below:

- **Zone 1 (Inner Protection Zone)** – Most sensitive zone: defined as the 50-day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres
- **Zone 2 (Outer Protection Zone)** – Also sensitive to contamination: defined by a 400-day travel time from a point below the water table. This zone has a minimum radius around the source, depending on the size of the abstraction
- **Zone 3 (Total Catchment)** - Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. Individual source

protection areas will still be assigned to assist operators in catchment management

- **Zone 4 (Zone of special** interest) – A fourth zone SPZ4 or 'Zone of Special Interest' usually represents a surface water catchment which drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream). In the future this zone will be incorporated into one of the other zones, SPZ 1, 2 or 3, whichever is appropriate in the particular case, or become a safeguard zone

GSPZs in the Local Plan area

Three locations have been identified to be within a Groundwater Source Protection Zone (GSPZ) in the Chichester District Local Plan area. These locations are shown in Figure 10-3 and provided below:

- Woodmancote and West Ashling (Zone 1c, 2 and 3)
- East Ashling and Fishbourne (Zone 1c, 2 and 3)
- Boxgrove and East Hampnett (Zone 1c, 2, 2c and 3)

There are no Groundwater Source Protection Zones in the north of the Local Plan area.

Portsmouth Water relies on groundwater abstractions for public water supply. Developers should refer to **Portsmouth Water's Groundwater Protection Guide** which provides guidance on Portsmouth Water's preferred approach to development relating the groundwater quality and quantity for their catchments.

10.5.5 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies.

The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process. The definition of each NVZ is as follows:

- **Groundwater NVZ** – an area of land where groundwater supplies are at risk from containing nitrate concentrations exceeding the 50mg/l level dictated by the EU's Surface Water Abstraction Directive (1975) and Nitrates Directive (1991).
- **Surface Water NVZ** – an area of land where surface waters (in particular those used or intended for the abstraction of drinking water) are at risk from containing nitrate concentrations exceeding the 50 mg/l dictated by the EU's Surface Water Abstraction Directive (1975) and Nitrate Directive (1991).
- **Eutrophic NVZ** – an area of land where nitrate concentrations are such that they could/will trigger the eutrophication of freshwater bodies, estuaries, coastal waters and marine waters.

The locations of the Nitrate Vulnerable Zones in the Local Plan area are shown in Figure 10-4 and Figure 10-5

Figure 10-3: Groundwater Source Protection Zones in the south Local Plan area

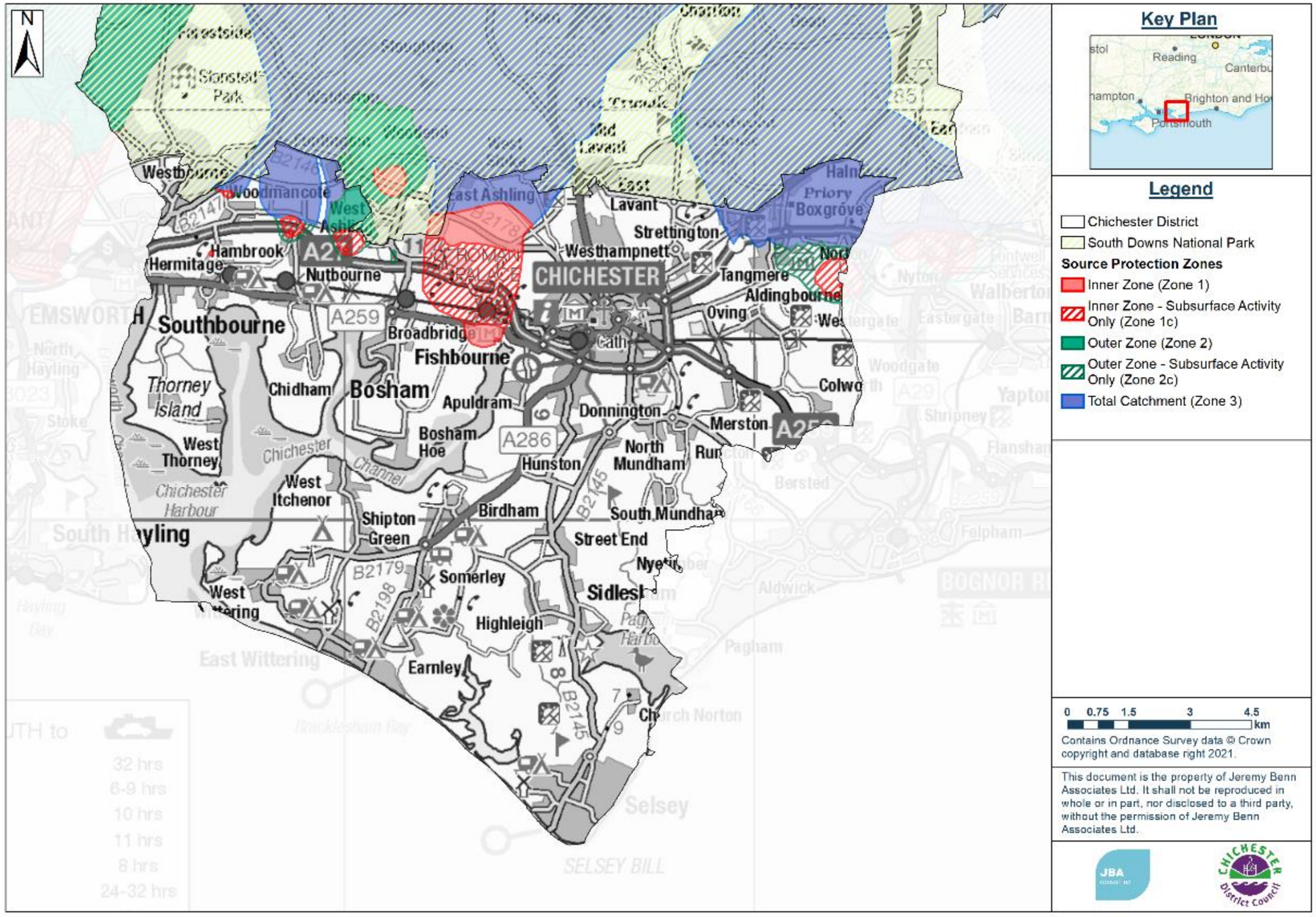


Figure 10-4: Nitrate Vulnerability Zones in the north Local Plan area

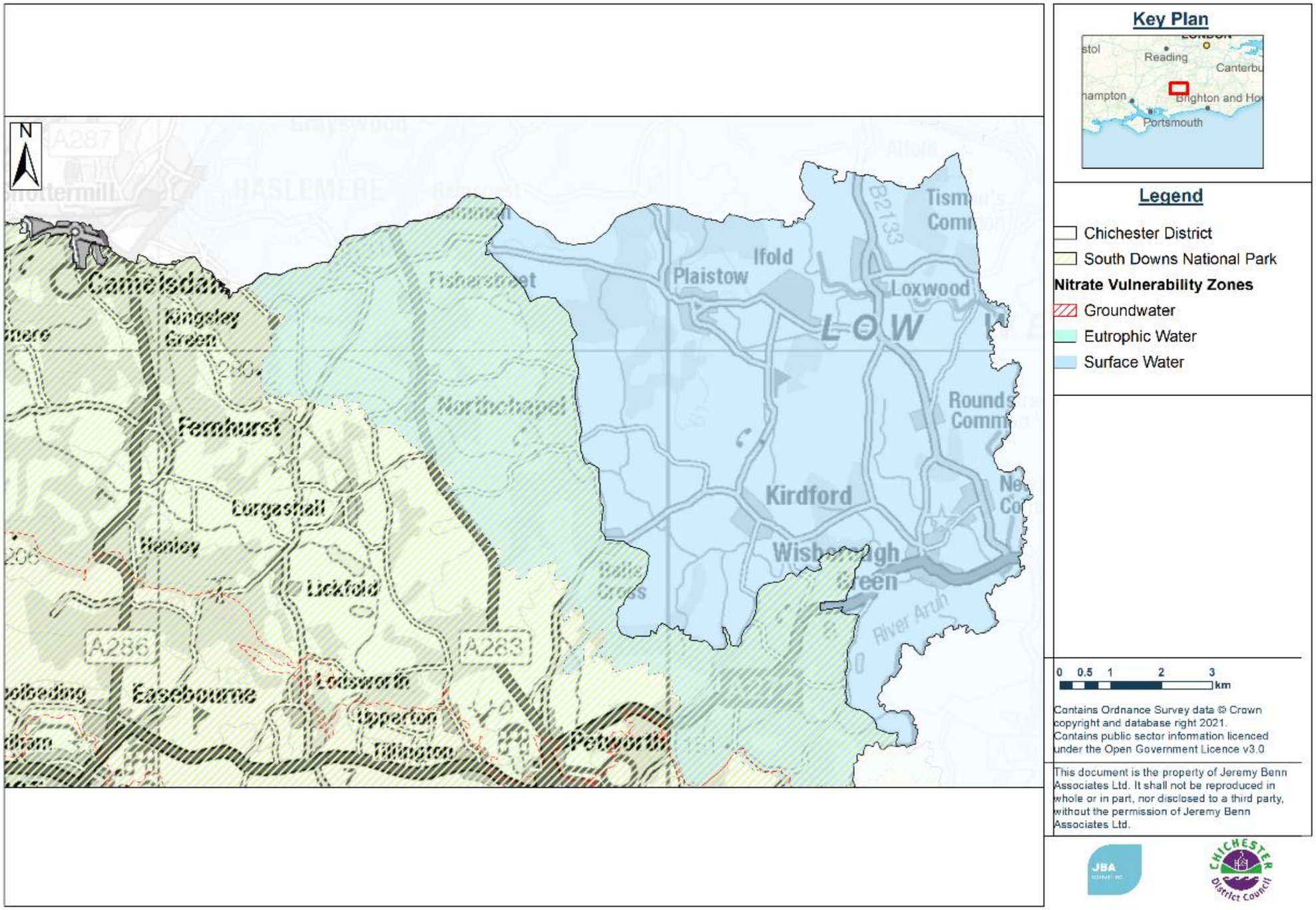
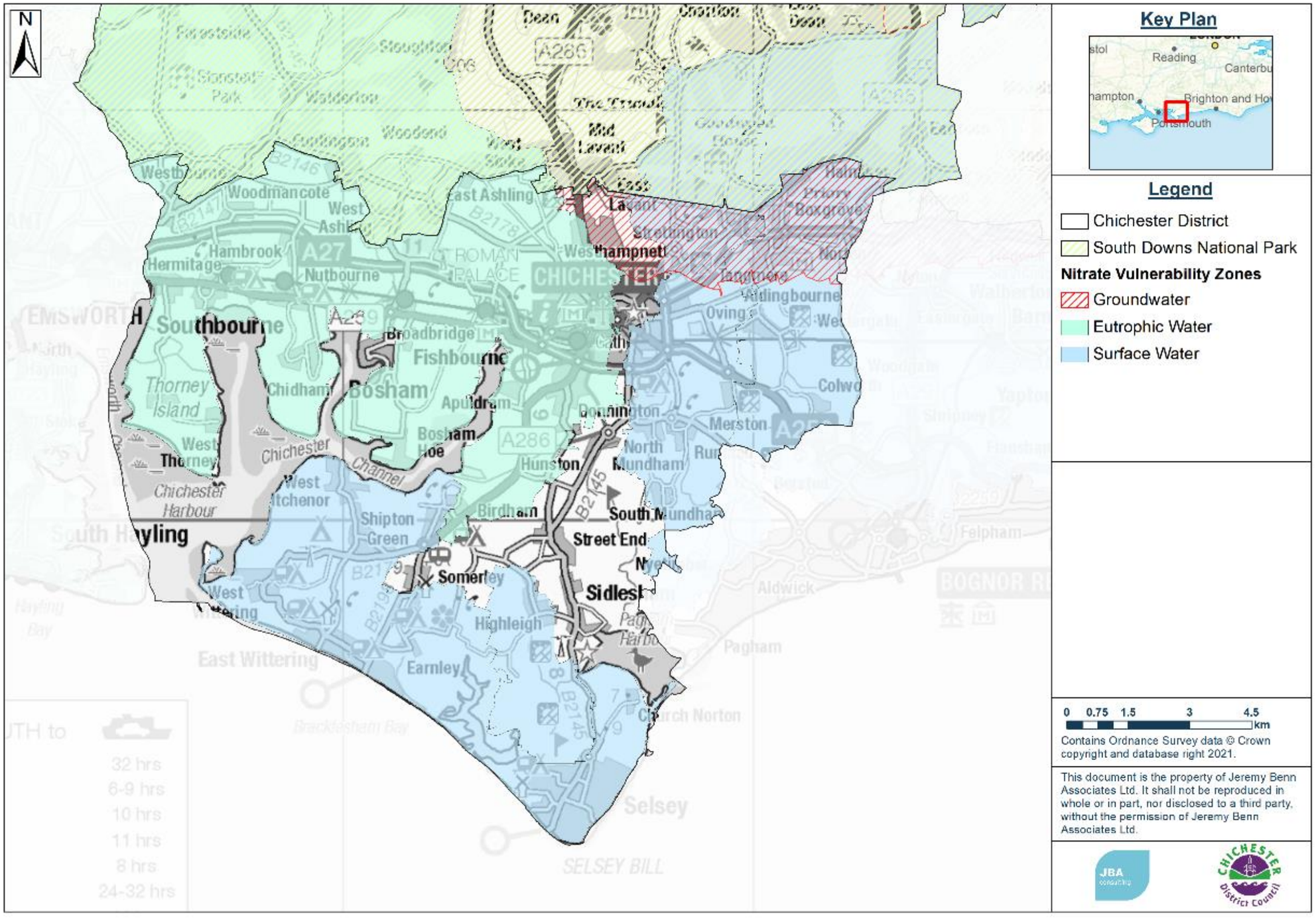


Figure 10-5: Nitrate Vulnerability Zones in the north Local Plan area



11 Flood warning and emergency planning

11.1 Emergency planning

Emergency planning is one option to help manage flood related incidents. From a flood risk perspective, emergency planning can be broadly split into three phases: before, during and after a flood. The measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding.

In development planning, a number of emergency planning activities are already integrated in national building control and planning policies e.g. the NPPF Flood Risk Vulnerability and Flood Zone 'Compatibility' table seeks to avoid inappropriate development in areas at risk from all sources of flooding. Flood warning and emergency planning is a last resort after using this SFRA to undertake the Sequential Test appropriately first.

However, safety is a key consideration for any new development and includes residual risk of flooding, the availability of adequate flood warning systems for the development, safe access and egress routes and evacuation procedures.

The Association of Directors of Environment, Economy, Planning and Transport (ADEPT) and the Environment Agency have published a **Flood Risk Emergency Plans for New Development**[22] document which provides guidance for Local Planning Authorities regarding their decisions over planning applications.

The **NPPF Planning Practice Guidance** outlines how developers can ensure safe access and egress to and from development in order to demonstrate that development satisfies the second part of the Exception Test. As part of an FRA, the developer should review the acceptability of the proposed access in consultation with the LPA (where appropriate) and the Environment Agency.

There are circumstances where a flood warning and evacuation plan[23] is required and / or advised:

- It is a **requirement under the 2021 NPPF** that safe access and escape routes are included in an FRA where appropriate, as part of an agreed emergency plan.
- The **Environment Agency and DEFRAs standing advice** for undertaking flood risk assessments for planning applications states that details of emergency escape plans will be required for any parts of the building that are below the estimate flood level.

It is recommended that Emergency Planners at Chichester District Council (where appropriate) are consulted prior to the production of any emergency flood plan. It should be noted that for coastal communities located on the Manhood peninsula evacuation routes can be limited with potentially only one road in/out of a settlement.

In addition to the **flood warning and evacuation plan considerations listed in the NPPF / PPG**, it is advisable that developers also acknowledge the following:

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22 Flood Risk Emergency Plans for New Development. ADEPT, Environment Agency. (2019). https://www.adeptnet.org.uk/system/files/documents/ADEPT%20%26%20EA%20Flood%20risk%20emergency%20plans%20for%20new%20development%20September%202019....pdf

23 Flood warning and evacuation plans may also be referred to as an emergency flood plan or flood response plan.

- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.
- Proposed new development that places additional burden on the existing response capacity of the Councils will not normally be considered to be appropriate.
- Developers should encourage those owning or occupying developments, where flood warnings can be provided, to sign up to receive them. This applies even if the development is defended to a high standard.
- The vulnerability of site occupants.
- Situations may arise where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. at risk of a breach). These allocations should be assessed against the outputs of the SFRA and where applicable, a site-specific Flood Risk Assessment to help develop emergency plans.

Further emergency planning information links:

- **2004 Civil Contingencies Act**
- **DEFRA (2014) National Flood Emergency Framework for England**
- **Sign up for Flood Warnings with the Environment Agency**
- **National Flood Forum**
- **GOV.UK Make a Flood Plan guidance and templates**
- **FloodRe**

11.2 Flood warning systems

Flood warnings can be derived and, along with evacuation plans, can inform emergency flood plans or flood response plans. The Environment Agency is the lead organisation for providing warnings of fluvial flooding (for watercourses classed as Main Rivers) and coastal flooding in England. Flood Warnings are supplied via the Flood Warning Service (FWS), to homes and business within Flood Zones 2 and 3. The different levels of warnings are shown in Table 11-1.

Table 11-1: Environment Agency Warnings

Flood Warning Symbol	What it means	What to do
	Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. It is issued earlier than a flood warning, to give customers advance notice of the possibility of flooding, but before there is full confidence that flooding in Flood Warning Areas is expected.	Be prepared to act on your flood plan Prepare a flood kit of essential items Monitor local water levels and the flood forecast on the Environment Agency website Stay tuned to local radio or TV Alert your neighbours Check pets and livestock Reconsider travel plans
	Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.	Move family, pets and valuables to a safe place Turn off gas, electricity and water supplies if safe to do so Seal up ventilation system if safe to do so Put flood protection equipment in place Be ready should you need to evacuate from your home 'Go In, Stay In, Tune In'
	Severe Flood Warnings warn people of expected severe flooding where there is a significant threat to life.	Stay in a safe place with a means of escape Co-operate with the emergency services and local authorities Call 999 if you are in immediate danger
Warnings no longer in force	Informs people that river or sea conditions begin to return to normal and no further flooding is expected in the area. People should remain careful as flood water may still be around for several days.	Be careful. Flood water may still be around for several days If you've been flooded, ring your insurance company as soon as possible

It is the responsibility of individuals to sign-up to this service in order to receive the flood warnings via FWS. Registration and the service is free and publicly available. It is recommended that any household considered at risk of flooding signs-up.

Developers should also encourage those owning or occupying developments, where flood warnings can be provided, to sign up to receive them. This applies even if the development is defended to a high standard.

11.2.1 Flood Alert and Warning Areas in the Local Plan area

There are currently 16 Flood Warning Areas (FWAs) and 12 Flood Alert Areas (FAAs). These are displayed in Appendix J. A list of the FAAs in the study area are shown in Table 11-2 and a list of FWAs are shown in Table 11-3.

Table 11-2: Flood Alert Areas within Chichester District Local Plan area

Flood Alert Code	Flood Alert Name	Watercourse	Description
065WAC402	Coastal areas of Medmerry	English Channel	Earnley Beach Centre, West Sands, Selsey Country Club and Ferry, Oakhurst, Greenwood and Easton Farm
065WAF422	River Lox	River Lox	Rivier Lox in West Sussex from Chiddingfold to Drungewick, including Loxwood Stream
065WAC162	Langstone to Emsworth Harbour	Langstone Harbour, Emsworth Harbour	Coastal area from Langstone to Emsworth Harbour
065WAF411	Lower River Ems	Ems	The River Ems and tributaries from Racton to Emsworth Harbour including Westbourne
065WAC401	Thorney Island to Bracklesham	English Channel	Coastal areas between Thorney Island and Bracklesham, including Bosham, West Itchenor and West Wittering
065WAC403	Selsey Bill to Elmer	English Channel	Coastal areas between Selsey Bill and Elmer, including Pagham, Sidlesham and Bognor
065WAF413	River Lavant	Lavant	The River Lavant from Mid Lavant to Shopwhyke including Chichester
065WAF415	Aldingbourne and Barnham Rifes	Aldingbourne and Barnham Rifes	Elbridge, Lidsey, Aldingbourne, Barnham, Yapton and Ryebank Rifes

Flood Alert Code	Flood Alert Name	Watercourse	Description
065WAF412	Bosham Stream	Bosham Stream	Bosham Stream from West Ashling to Bosham including Churchfield Stream
065FAG016	Groundwater flooding in West Dean, Singleton, Charlton, East Dean and Chilgrove	Groundwater	Communities at risk of groundwater flooding to the north of Chichester, including West Dean, Singleton, Charlton, East Dean and Chilgrove
061WAF30UpperWey	Upper River Wey	River Wey	Upper River Wey including Alton, Farnham, Bordon, Frensham, Tilford, Godalming, Guildford and Peasmarsh
065WAF423	Upper Arun	Arun	The Rivers Arun and Kird, Boldings Brook, North River and Par Brook

Table 11-3: Flood Warning Areas within Chichester District Local Plan area

Flood Warning Code	Flood Warning Name	Watercourse	Description
065FWC1801	Thorney Island, Southbourne and Nutbourne	The Solent	Coastal areas of Thorney Island, Southbourne and Nutbourne
065FWC1901	Bosham and West Itchenor	The Solent	Coastal areas of Bosham and West Itchenor, including Chidham, Broadbridge, and Bosham Hoe
065FWC2001	West Wittering	The Solent	Coastal areas of West Wittering
065FWC1401	Langstone and Emsworth	Langstone Harbour	Tidal areas at Langstone and Emsworth
065FWC2002	East Wittering and Bracklesham coast	The Solent	Coast at East Wittering and Bracklesham, including Marine Drive, Marine Close, Tamarisk Walk, Bracklesham Drive and Bracklesham Caravan Park
065FWC2101	Medmerry	The Solent	Coastal areas of Medmerry beach, including the West Sands caravan park

Flood Warning Code	Flood Warning Name	Watercourse	Description
065FWC2201	Selsey East Beach	English Channel	Coastal areas of Selsey Bill, including Church Norton, and East Beach
065FWC2302	Sidlesham	English Channel	Coastal areas of Sidlesham
065FWF4602	Mid and East Lavant	River Lavant	The River Lavant at Mid Lavant and East Lavant
065FWF4603	Westhampnett on the River Lavant	River Lavant	The River Lavant at Westhampnett, including Church Farm pit, the A27, and the Supermarket retail park at Portfield Way
065FWF5201	Loxwood, Brewhurst and Drungewickon the River Lox	Loxwood Stream	Loxwood Stream at Loxwood, including Loxwood Village, and Brewhurst Mill
065FWF4604	Chichester on the River Lavant	River Lavant	The River Lavant within Chichester City Centre, including Whyke, the A285, A286, and Chichester College
065FWF4702	Bosham on the Bosham Stream	Bosham Stream	The Bosham Stream at Bosham, including the Old Bosham Ditch, Shore Road, and Churchfield Stream
065FWF5002	Broadbridge Heath to Pallingham Quay on the River Arun	River Arun	The River Arun from Broadbridge Heath to Pallingham Quay, including Broadbridge Heath, Slinfold, Wanford Mill, Gibbons Mill, Newbridge, and Pallingham Lock
065FWC2301	Pagham	English Channel	Coastal areas of Pagham
065FWC2401	Bognor	English Channel	Coastal areas of Bognor, including Felpham, South Bersted, North Bersted and Shripney

11.2.2 Local arrangements for managing flood risk

The Chichester District Council's **website** provides information on local flood risk, how to protect your property from flooding and useful contacts in case of a flood incident.

11.3 Lead times and onset of flooding

Flood alerts and warnings provide advanced notification that flooding is possible or expected. The time from when the alert or warning is issued to the onset of property flooding (termed the lead time) can provide time for people to prepare for flooding. The Environment Agency endeavour to give a two-hour lead time for issuing Flood Warnings; however, for fast responding catchments and areas at risk of flash flooding, this may not be possible.

A failure or breach of flood defences can cause immediate and rapid inundation to areas located near the vicinity of the breach or failure. Such incidents can pose a significant risk to life given the near lack of warning and lead time to prepare or respond.

For developers, it is therefore important to consider how to manage the consequences of events that are un-foreseen or for which no warnings can be provided. A typical example would be managing the residual risk of a flood defence breach or failure.

11.4 Emergency planning and development

11.4.1 NPPF

The NPPF Flood Risk Vulnerability and Flood Zone 'Incompatibility' table seeks to avoid inappropriate development in areas at risk from all sources of flooding. It is essential that any development which will be required to remain operational during a flood event is located in the lowest flood risk zones to ensure that, in an emergency, operations are not impacted on by flood water or that such infrastructure is resistant to the effects of flooding such that it remains serviceable/operational during 'Higher Central' and 'upper end' events, as defined in the Environment Agency's Climate Change allowances (updated May 2022). For example, the NPPF classifies police, ambulance and fire stations and command centres that are required to be operational during flooding as Highly Vulnerable development, which is not permitted in Flood Zones 3a and 3b and only permitted in Flood Zone 2 providing the Exception Test is passed. Essential infrastructure located in Flood Zone 3a or 3b must be operational during a flood event to assist in the emergency evacuation process. All flood sources such as fluvial, surface, groundwater, sewers and artificial sources (such as canals and reservoirs) should be considered. In particular, sites should be considered in relation to the areas of drainage critical problems highlighted in the relevant SWMPs.

The outputs of this SFRA should be compared and reviewed against any emergency plans and continuity arrangements. This includes the nominated rest and reception centres (and prospective ones), so that evacuees are outside of the high-risk Flood Zones and will be safe during a flood event.

11.4.2 Safe access and egress

The NPPF Planning Practice Guidance outlines how developers can secure safe access and egress to and from development in order to demonstrate that development satisfies the second part of the Exception Test. Access considerations should include the voluntary and free movement of people during a 'design flood' as well as for the potential of evacuation before a more extreme flood. The access and egress must be functional for changing circumstances over the lifetime of the development. The NPPF Planning Practice Guidance sets out that:

- Access routes should allow occupants to safely access and exit their dwellings in design flood conditions. Vehicular access to allow the emergency services to safely reach the development during design flood conditions will also normally be required in addition to the requirements of the building regulations.

- Wherever possible, safe access routes should be provided that are located above design flood levels and which avoid flow paths. Where this is not possible, limited depths of flooding may be acceptable, provided that the proposed access is designed with appropriate signage etc. to make it safe. The acceptable flood depth for safe access will vary depending on flood velocities and the risk of debris within the flood water. Even low levels of flooding can pose a risk to people in situ (because of, for example, the presence of unseen hazards and contaminants in floodwater, or the risk that people remaining may require medical attention).
- Where a failure of flood risk management infrastructure would result in flooding with a speed-of-onset that would not allow sufficient time for safe access and escape, an internally accessible place of safety, capable of accommodating the likely number of occupants or users of the proposed development should also be provided. Local planning authorities should consider whether the development can be considered safe given the predicted duration of flooding and the vulnerability of occupants/users. In doing so, local planning authorities should account for the likely impacts of flooding on essential services such as electricity, gas, telecommunications, water supply and sewerage. Any place of safety needs to be designed to facilitate rescue in case emergency care is needed or if it is unlikely to be safe for occupants/users to wait until flood waters have receded sufficiently for safe access/escape to be possible.

The depth, velocity and hazard mapping from hydraulic modelling should help inform the provision of safe access and egress routes.

As part of an FRA, the developer should review the acceptability of the proposed access in consultation with Chichester District Council and the Environment Agency. Site and plot specific velocity and depth of flows should be assessed against standard hazard criteria to ensure safe access and egress can be achieved.

11.4.3 Potential evacuations

During flood incidents, evacuation may be considered necessary. The NPPF Planning Guidance states practicality of safe evacuation from an area will depend on:

1. the type of flood risk present, and the extent to which advance warning can be given in a flood event;
2. the number of people that would require evacuation from the area potentially at risk;
3. the adequacy of both evacuation routes and identified places that people from evacuated places use/are taken to (and taking into account the length of time that the evacuation may last); and
4. sufficiently detailed and up to date multi-agency flood plans being in place for the locality that address these and related issues. These are prepared by local resilience forums.

The vulnerability of the occupants is also a key consideration. The NPPF and application of the Sequential Test aims to avoid inappropriate development in flood risk areas. However, developments may contain proposals for mixed use on the same site. In this instance, the NPPF Planning Practice Guidance states that the most vulnerable aspects of development in areas of lowest flood risk, unless there are overriding reasons to prefer a different location. In addition, measures to avoid flood risk vertically can then be taken, by locating the most vulnerable uses on upper storeys, and by raising finished floor and/or ground levels, where appropriate and that such techniques are suitably designed. Such measures should also account for residual flood risks from flood risk management infrastructure.

There should be consideration of evacuation routes over the wider area, particularly on the coastal peninsula where a limited road network reduces the number of evacuation routes.

The Environment Agency and DEFRA provide standing advice for undertaking flood risk assessments for planning applications. Please refer to **the government website** for the criteria on when to following the standing advice. Under these criteria, you will need to provide details of emergency escape plans for any parts of the building that are below the estimated flood level. Follow the **Flood Risk Emergency Plans for New Development guidance**. The plans should show:

- that any single storey buildings or ground floors without access to upper floors can access a safe refuge above the estimated flood level
- that any basement rooms have clear internal access (for example a staircase) to an upper floor above the estimated flood level
- a safe route of access and escape which is set above the estimated flood level and connects the site to an area away from flood risk

You will also need to comply with relevant Building Regulations in Part B. They require you to provide suitable access for the fire service.

Situations may arise where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. developments located immediately behind a defence and at risk of a breach). These allocations should be assessed against the outputs of the SFRA and where applicable, a site-specific Flood Risk Assessment to help develop appropriate emergency plans.

11.4.4 Flood warning and evacuation plans

Flood warning and evacuation plans are potentially mitigation measures to manage the residual risk, as stated in the NPPF Planning Practice Guidance. It is a requirement under the NPPF that a flood warning and evacuation plan is prepared for sites at risk of flooding used for holiday or short-let caravans and camping and are important at any site that has transient occupants (e.g. hostels and hotels).

A flood warning and evacuation plan should detail arrangements for site occupants on what to do before, during and after a flood as this will help to lessen its impact, improve flood response and speed up the recovery process. The Environment Agency provides practical advice and templates on how to prepare a flood plans for individuals, communities and businesses (see text box for useful links).

It is recommended that emergency planners at Chichester District Council are consulted prior to the production of any emergency flood plan. The council will provide guidance to help local communities to protect their home and valuables and understand what to do before, during and after a flood.

Once the emergency flood plan is prepared, it is recommended that it is distributed to emergency planners at Chichester District Council and the emergency services. When developing a flood warning and evacuation plan, it is recommended that it links in with any existing parish / community level plan.

Guidance documents for preparation of flood response plans

- **Environment Agency (2012) Flooding – minimising the risk, flood plan guidance for communities and groups**
- **Environment Agency (2014) Community Flood Plan template**
- **Environment Agency Personal flood plans**
- **ADEPT and the Environment Agency (2019) - Flood Risk Emergency Plans for New Development**

12 Strategic flood risk measures

12.1 Introduction

Strategic flood risk solutions may offer a potential opportunity to reduce flood risk in the Local Plan area. The following sections outline different options which could be considered for strategic flood risk solutions. Any strategic solutions should ensure they are consistent with wider catchment policy and the local policies. It is important that the ability to deliver strategic solutions in the future is not compromised by the location of proposed development. When assessing the extent and location of proposed development consideration should be given to the requirement to secure land for flood risk management measures that provide wider benefits.

12.2 Flood storage schemes

Flood storage schemes aim to reduce the flows passed downriver to mitigate downstream flooding. Development increases the impermeable area within a catchment, creating additional and faster runoff into watercourses. Flood storage schemes aim to detain this additional runoff, releasing it downstream at a slower rate, to avoid any increase in flood depths and/or frequency downstream. Methods to provide these schemes include[24]:

- enlarging the river channel;
- raising the riverbanks; and/or
- constructing flood banks set back from the river.

Flood storage schemes have the advantage that they generally benefit areas downstream, not just the local area.

12.3 Natural Flood management

Developments provide opportunities to work with natural processes to reduce flood and erosion risk, benefit the natural environment and reduce costs of schemes. Natural flood management requires integrated catchment management and involves those who use and shape the land. It also requires partnership working with neighbouring authorities, organisations and water management bodies. The Environment Agency has developed **working with natural process mapping** which displays opportunities for NFM.

Conventional flood prevention schemes may be preferred, but consideration of 're-wilding' rivers upstream could provide cost efficiencies as well as considering multiple sources of flood risk; for example, reducing peak flows upstream such as through felling trees into streams or building earth banks to capture runoff, could be cheaper and smaller-scale measures than implementing flood walls for example. With flood prevention schemes, consideration needs to be given to the impact that flood prevention has on the WFD status of watercourses. It is important that any potential schemes do not have a negative impact on the ecological and chemical status of waterbodies.

12.4 Catchment and Floodplain restoration

Compared to flood defences and flood storage, floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, and by creating space for naturally functioning floodplains working with natural processes.

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24 http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter10.aspx?pagenum=2

Although the restoration of floodplain is difficult in previously developed areas where development cannot be rolled back, the following measures should be adopted:

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible. Buffer areas around watercourses provide an opportunity to restore parts of the floodplain
- Removal of redundant structures to reconnect the river and the floodplain.
- Apply the Sequential Approach to avoid new development within the floodplain.

For those sites considered within the Local Plan Review and / or put forward by developers, that also have watercourses flowing through or past them, the sequential approach should be used to locate development away from these watercourses. This will ensure the watercourses retain their connectivity to the floodplain. Loss of floodplain connectivity could potentially increase flooding.

12.4.1 River Ems Restoration

In 2015, Portsmouth Water proposed the restoration of the Deepsprings to Racton Park Dell reach of the River Ems. The project formed part of the National Environment Programme (NEP) and was supported by the Environment Agency. The works were delivered by the Arun & Rothers Rivers Trust (ARRT) and the Wild Trout Trust (WTT). The aim of the project was to create a sinuous channel over a 300m chalk stream, in order to increase the biodiversity of flora and fauna[25].

12.4.2 Re-naturalisation

There is potential to re-naturalise a watercourse by re-profiling the channel, removing hard defences, re-connecting the channel with its floodplain and introducing a more natural morphology (particularly in instances where a watercourse has historically been modified through hard bed modification). Detailed assessments and planning would need to be undertaken to gain a greater understanding of the response to any proposed channel modification.

12.4.3 Structure Removal and/ or modification (e.g. Weirs)

Structures, both within watercourses and adjacent to them can have significant impacts upon rivers including alterations to the geomorphology and hydraulics of the channel through water impoundment and altering sediment transfer regime, which over time can significantly impact the channel profile including bed and bank levels, alterations to flow regime and interruption of biological connectivity, including the passage of fish and invertebrates.

Many artificial in-channel structures (examples include weirs and culverts) are often redundant and / or serve little purpose and opportunities exist to remove them where feasible. The need to do this is heightened by climate change, for which restoring natural river processes, habitats and connectivity are vital adaptation measures. However, it also must be recognised that some artificial structures may have important functions or historical/cultural associations, which need to be considered carefully when planning and designing restoration work.

In the case of weirs, whilst weir removal should be investigated in the first instance, in some cases it may be necessary to modify a weir rather than remove it. For example, by lowering the weir crest level or adding a fish pass. This will allow more natural water level variations upstream of the weir and remove a barrier to fish migration.

25 River Ems Restoration, Arun & Rothers River Trust (2015): http://arrt.org.uk/river-ems-restoration/

12.4.4 Bank Stabilisation

Bank erosion should be avoided and landowners encouraged to avoid using machinery and vehicles close to or within the watercourse.

There are several techniques that can be employed to restrict the erosion of the banks of a watercourse. In an area where bankside erosion is particularly bad and/or vegetation is unable to properly establish, ecologically sensitive bank stabilisation techniques, such as willow spiling, can be particularly effective. Live willow stakes thrive in the moist environment and protect the soils from further erosion allowing other vegetation to establish and protect the soils.

12.5 Habitat creation

There are also opportunities to deliver sites through the Environment Agency's Regional Habitat Creation Programme which seeks to replace intertidal habitats that are lost through coastal squeeze. Potential sites highlighted include locations at Chidham and Thorney Island.

12.6 Green Infrastructure

Green Infrastructure (GI) is a planned and managed network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and rural fringe and consist of:

- Open spaces – parks, woodland, nature reserves, lakes
- Linkages – River corridors and canals, and pathways, cycle routes and greenways
- Networks of "urban green" – private gardens, street trees, verges and green roofs.

The identification and planning of Green Infrastructure is critical to sustainable growth. It merits forward planning and investment as much as other socio-economic priorities such as health, transport, education and economic development. GI is also central to climate change action and is a recurring theme in planning policy. With regards to flood risk, green spaces can be used to manage storm flows and free up water storage capacity in existing infrastructure to reduce risk of damage to urban property, particularly in city centres and vulnerable urban regeneration areas. Green infrastructure can also improve accessibility to waterways and improve water quality, supporting regeneration and improving opportunity for leisure, economic activity and biodiversity.

A **Green Infrastructure Delivery Document (2016)** has been prepared by Chichester County Council as a guidance note to help developers incorporate green infrastructure into their development.

12.7 Promotion of SuDS

Surface water flood risk is present in the area. By considering SuDS at an early stage in the development of a site, the risk from surface water can be mitigated to a certain extent within the site as well as reduce the risk that the site poses to third party land. Regionally SuDS should be promoted on all new developments to ensure the quantity and quality of surface water is dealt with sustainably to reduce flood risk. Given the various policies and guidance available on SuDS, developers should use this information to produce technically proficient and sustainable drainage solutions that conform with the non-statutory standards for SuDS (2015).

12.8 Flood defences

There are a number of formal flood and coastal defences present within the study area (see Section 8 for further information).

Flood mitigation measures should only be considered if, after application of the Sequential Approach, development sites cannot be located away from higher risk areas. If defences are constructed to protect a development site, it will need be demonstrated that the defences will not have a resulting negative impact on flood risk elsewhere, and that there is no net loss in floodplain storage.

12.9 Engaging with key stakeholders

Flood risk to an area or development can often be attributed to a number of sources such as fluvial, surface water and/or groundwater. In rural areas the definition between each type of flood risk is more distinguished. However, within urban areas flooding from multiple sources can become intertwined. Where complex flood risk issues are highlighted it is important that all stakeholders are actively encouraged to work together to identify issues and provide suitable solutions.

Engagement with riparian owners is also important to ensure they understand their rights and responsibilities including:

- maintaining river bed and banks;
- allowing the flow of water to pass without obstruction; and
- controlling invasive alien species e.g. Japanese knotweed.

More information about riparian owner responsibilities can be found in the Environment Agency's guidance on **Owning a Watercourse** (2018).

13 Level 1 summary assessment of potential development locations

13.1 Introduction

Details of potential development sites were provided by Chichester District Council, as shown in Figure 13-1 and Figure 13-2. These sites essentially encompass the sites contained within the Council's Housing and Land Availability Assessment (HELAA). As the process has progressed gypsy and traveller sites were also included, but details of this element of the process is covered elsewhere in the Council's evidence base.

These sites were screened against a suite of available flood risk information and spatial data to provide a summary of risk to each site (see Appendix K).

Information considered includes the flood risk datasets listed below.

- Environment Agency Flood Zones 2 and 3
- Flood Zone 3b
- Fluvial and coastal climate change allowances
- Environment Agency Risk of Flooding from Surface Water
- Environment Agency Risk of Flooding from Surface Water with climate change allowances
- Environment Agency reservoir inundation mapping
- JBA groundwater flood map
- Environment Agency and West Sussex County Council's historic Flood Map

A summary has been prepared on the proportion of a given site affected by levels and types of flood risk, along with whether historic incidences of flooding have occurred.

The information provided is to be used in accordance with the Sequential Test Methodology set out in Appendix L.

Figure 13-1: Northern sites screened

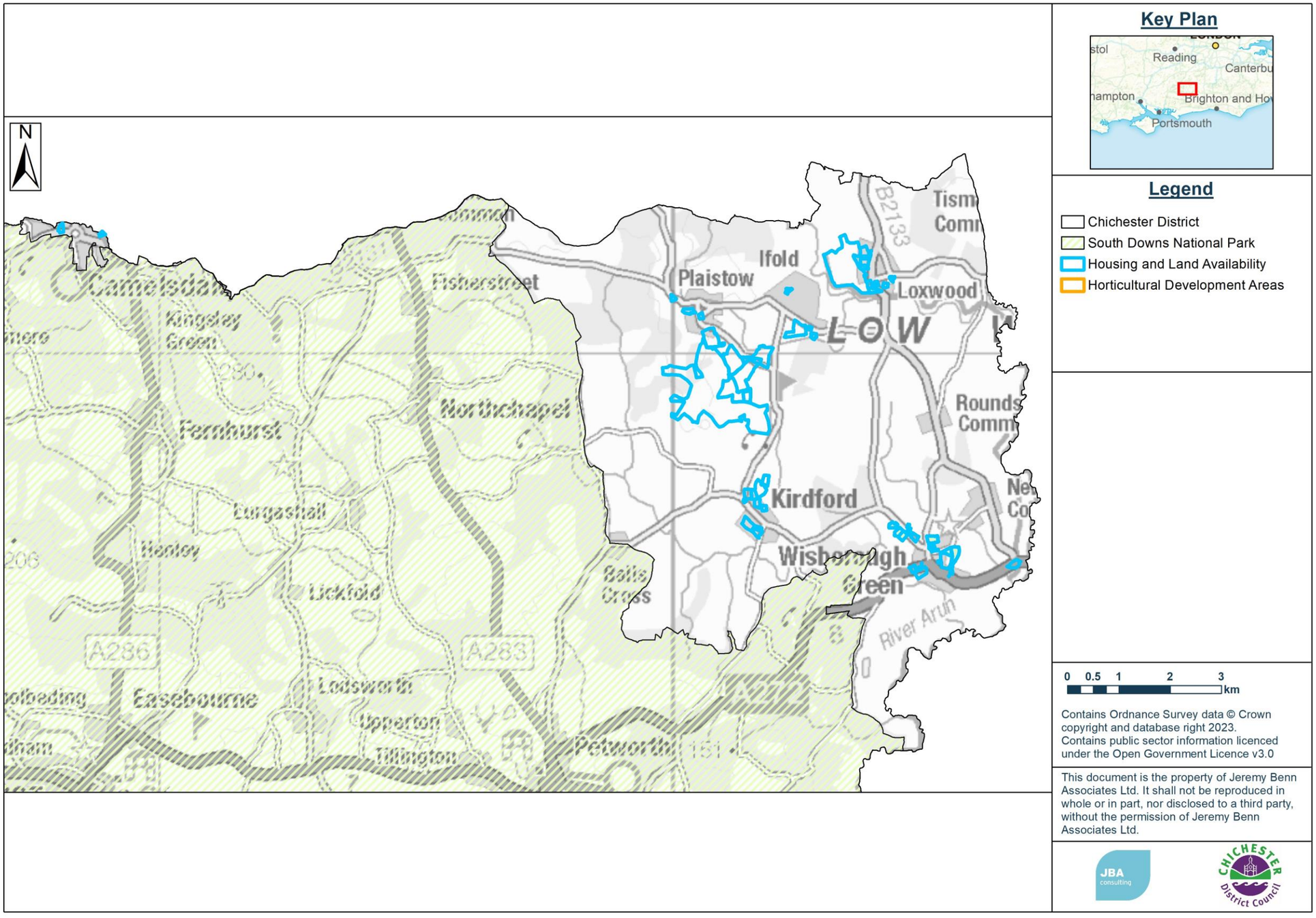
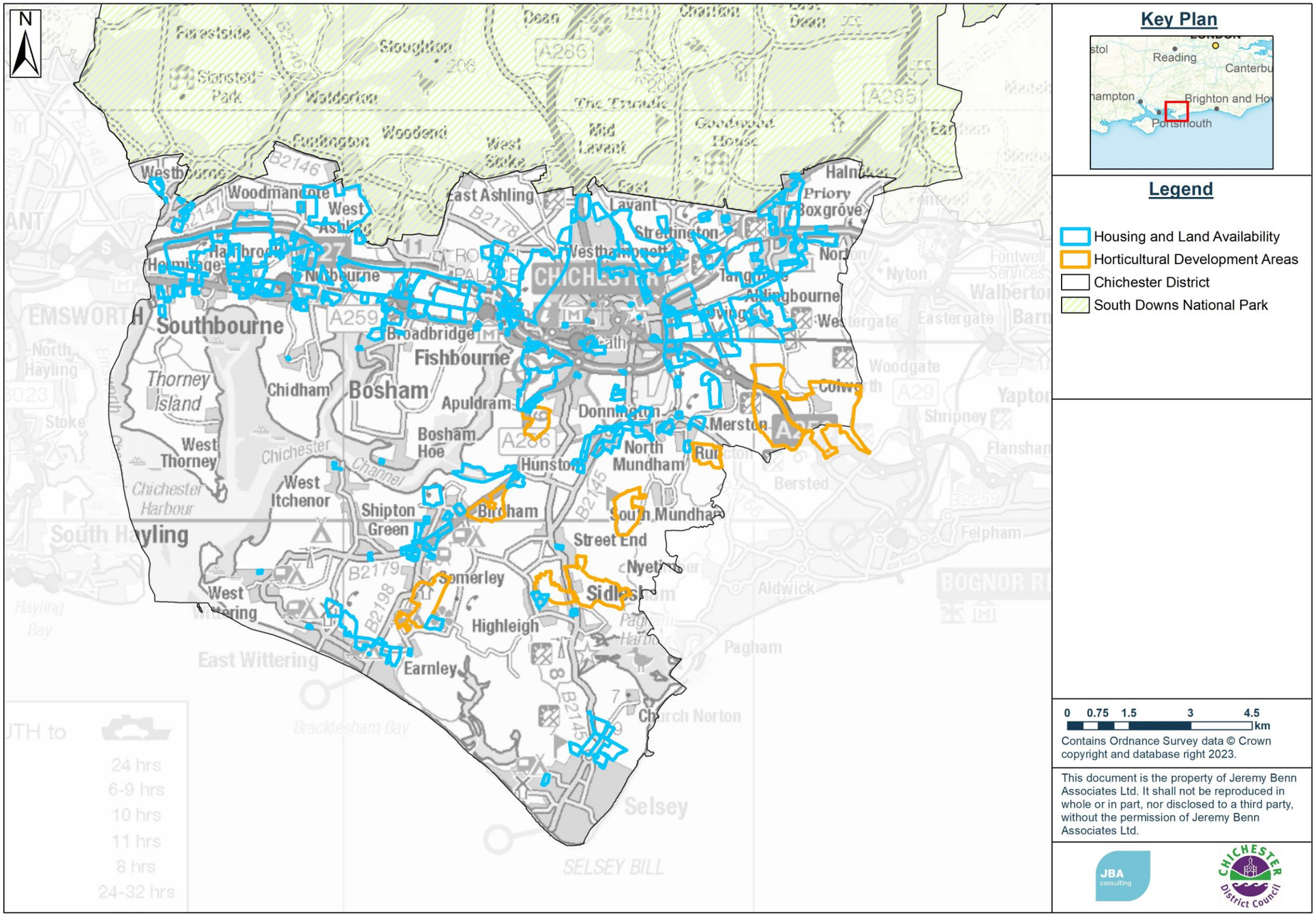


Figure 13-2: Southern sites screened



13.2 Overview of risk at identified sites

A summary of flood risk at each of the sites in light of the screening above is provided below:

- Flood Zone composition is varied across the sites. However, the majority of the sites have Flood Zone 1 comprising the largest proportion of the study area.
- 56 sites are partially located within Flood Zone 2
- 28 sites are partially located within Flood Zone 3a
- 41 sites are partially located within Flood Zone 3b
- 24 sites are predicted to be at risk from fluvial flooding (1% AEP higher central allowance) in the future due to climate change
- 47 sites are predicted to be at risk from tidal flooding (2121 0.5% AEP upper end allowance) in the future due to climate change
- 16 sites intersect the Environment Agency's historic flood outlines.
- 62 sites fall within 50m of West Sussex County Council's recorded flood incidents.
- 225 sites are predicted to be within the high surface water flood zone (0.1% AEP).
- 1 site is outside of Flood Zone 2 but predicted to be at risk from reservoir inundation (wet day).
- All sites are potentially vulnerable to groundwater flooding.

13.3 Sequential Testing

The SFRA does not include the Sequential Test of the development sites that were screened. However, Appendix K summarises the flood risk to the potential and confirmed development sites and provides evidence for use in the completion of the Sequential Test.

The assessments undertaken for this SFRA will assist Chichester District Council in the preparation of the Sequential Test as outlined in the methodology in Appendix L.

13.4 Cumulative impacts of development on flood risk

Cumulative impacts are defined as the effects of past, current and future activities on the environment. Under the 2021 NPPF, strategic policies and their supporting SFRAs, are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (para 160).

When allocating land for development, consideration should be given to the potential cumulative impact on flood risk within a catchment. Development increases the impermeable area within a catchment, which if not properly managed, can potentially result in loss of floodplain storage, increased volumes and velocities of surface water runoff, and contribute to heightened downstream flood risk. Whilst individual development with appropriate site mitigation measures should not result in measurable local effects with respect to hydrology and flood risk, the cumulative effect of multiple development may be more severe at downstream locations in the catchment. Locations where there are existing flood risk issues with people, property or infrastructure will be particularly sensitive to cumulative effects.

The cumulative impact should be considered throughout the planning process, from the allocation of sites within the Local Plan, to the planning application and development design stages.

The cumulative impacts will be considered in more detail on an individual site basis within the Level 2 SFRA, if this is required. In addition, site-specific FRAs must consider the cumulative impact of the proposed development on flood risk within the wider catchment area if there are potentially material effects.

As part of the Level 1 SFRA, an assessment of the cumulative effects within catchments in the Chichester Borough has been undertaken.

13.4.1 Approach and methodology

The approach is based on providing an assessment of catchments where the allocation of more than one site could result in effects that increase the flood risk to third parties. At a strategic level this involves comparison of catchments, to assess the quantum of proposed development and the sensitivity of the catchment to changes in flood risk. Historic flooding incidents are also included in the assessment, as these are an indicator of the actual sensitivity of locations within a catchment to flood events.

The methodology deploys a range of metrics to assess the potential for cumulative impacts to be experienced, which provide a balance between predicted and observed flooding data recorded by West Sussex County Council and the Environment Agency.

13.4.2 Datasets

Catchments

The WFD river catchments defined in the River Basin Management Plans and LIDAR data were used to divide Chichester District and surrounding local authorities into manageable areas on which to base a cumulative impact assessment. The surrounding local authorities included in the CIA are:

- Arun District Council
- East Hampshire District Council
- Hampshire County Council
- Havant Borough Council
- Horsham District Council
- South Downs National Park
- Surrey County Council
- Waverley Borough Council
- West Sussex County Council

The catchments are shown in Figure 13-3.

Current developed area

OS OpenMap data buildings layer was used to assess the current developed area in each catchment.

Proposed level of growth

To understand areas of the Chichester District that are likely to experience the greatest pressure for future growth, all potential future development sites identified in the Local Plan process have been analysed. This data was collated from shapefiles directly provide by Local Authorities and existing Local Plan documents. In cases where existing local plans were used the quality of the future development extracted was in some cases was low quality, however a general understanding of potential development area and location could be obtained.

This allowed the calculation of the overall increase in development from the existing scenario to identify catchments likely to be under the greatest pressure for

development. The context for this being that in circumstances where the proportion of proposed new development is greater, then it is more likely to give rise to cumulative effects.

It should be noted that for the purposes of the assessment it has been assumed that all sites will be developed, and that the entire site footprint would be developed.

Historic Flood Risk

A historic flood risk score was derived for each catchment within the study area using the total area of 'buildings' from the OS Open Zoomstack data within the Environment Agency's historic flood map extent for each catchment.

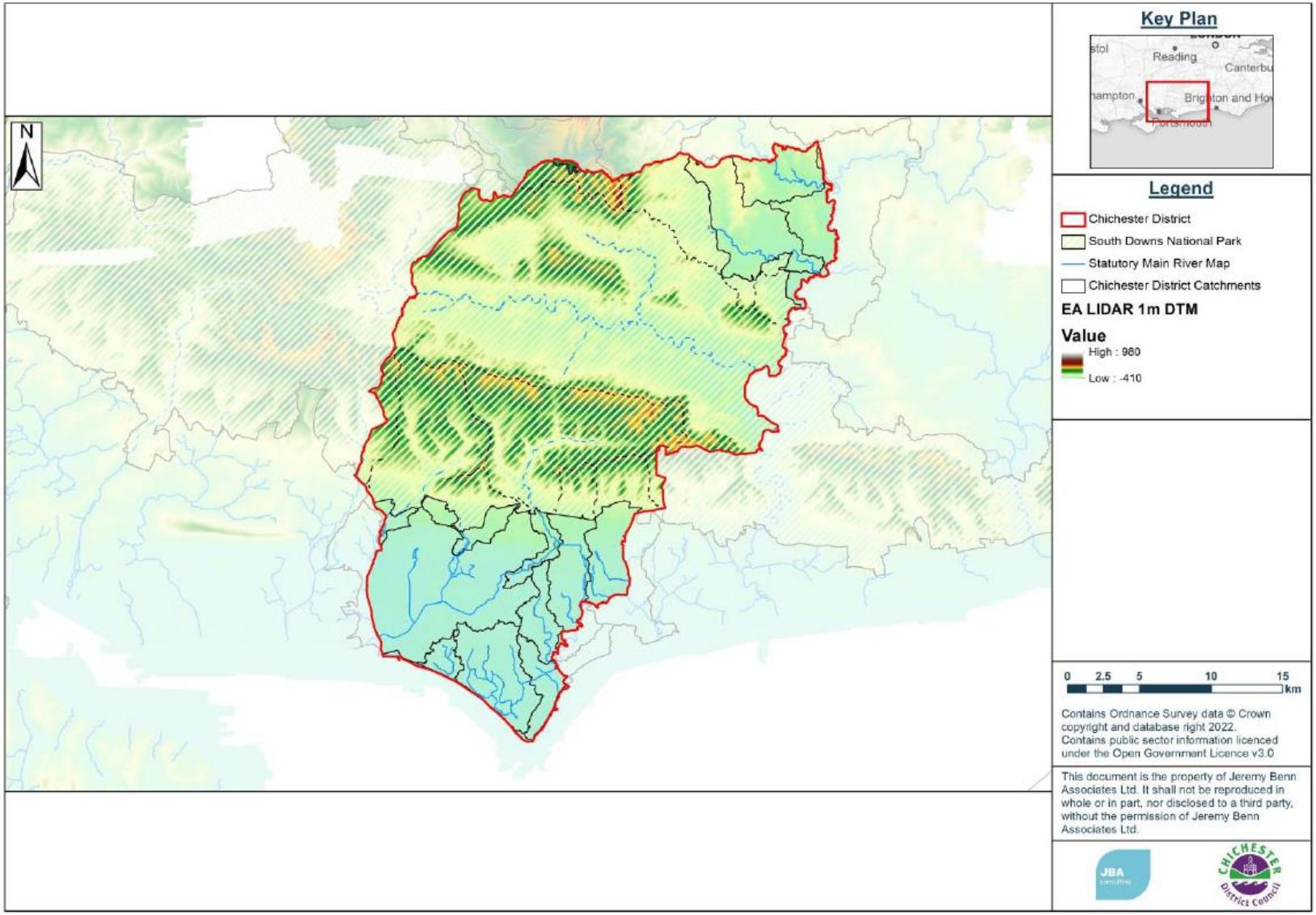
Properties sensitive to increased flood risk

It is important to understand which catchments are most sensitive to increases in flood flows which may theoretically be caused by new development. Predicted flood risk was assessed using the following datasets:

- Total number properties within the merged 1% AEP surface water flooding extent and Flood Zone 3a for each catchment
- Total number properties within the merged 0.1% AEP surface water flooding extent and Flood Zone 2

The difference in the number properties at risk in these two datasets has then been used as an indicator to identify which catchments are more sensitive to increases in flood flows.

Figure 13-3: Chichester District catchments



13.4.3 Ranking of catchments

To identify which catchments are more sensitive to cumulative impacts, each catchment was given a ranking for each of the three metrics (proposed level of growth, historic flood risk and properties sensitive to growth). These rankings were then combined to give an overall ranking which was divided into three categories - high, medium, and low according to how sensitive each catchment is to cumulative impacts relative to one another.

13.4.4 Conclusions of the Cumulative Impact Assessment

A summary of the Cumulative Impacts Assessment results is shown in Figure 13-4. The Cumulative Impact Assessment highlights areas where there is a greater chance of encountering cumulative effects from planned development. In these catchments this should potentially be considered by developers and specifically addressed within FRAs for proposed development.

Including consideration of cumulative effects requires that FRAs should assess:

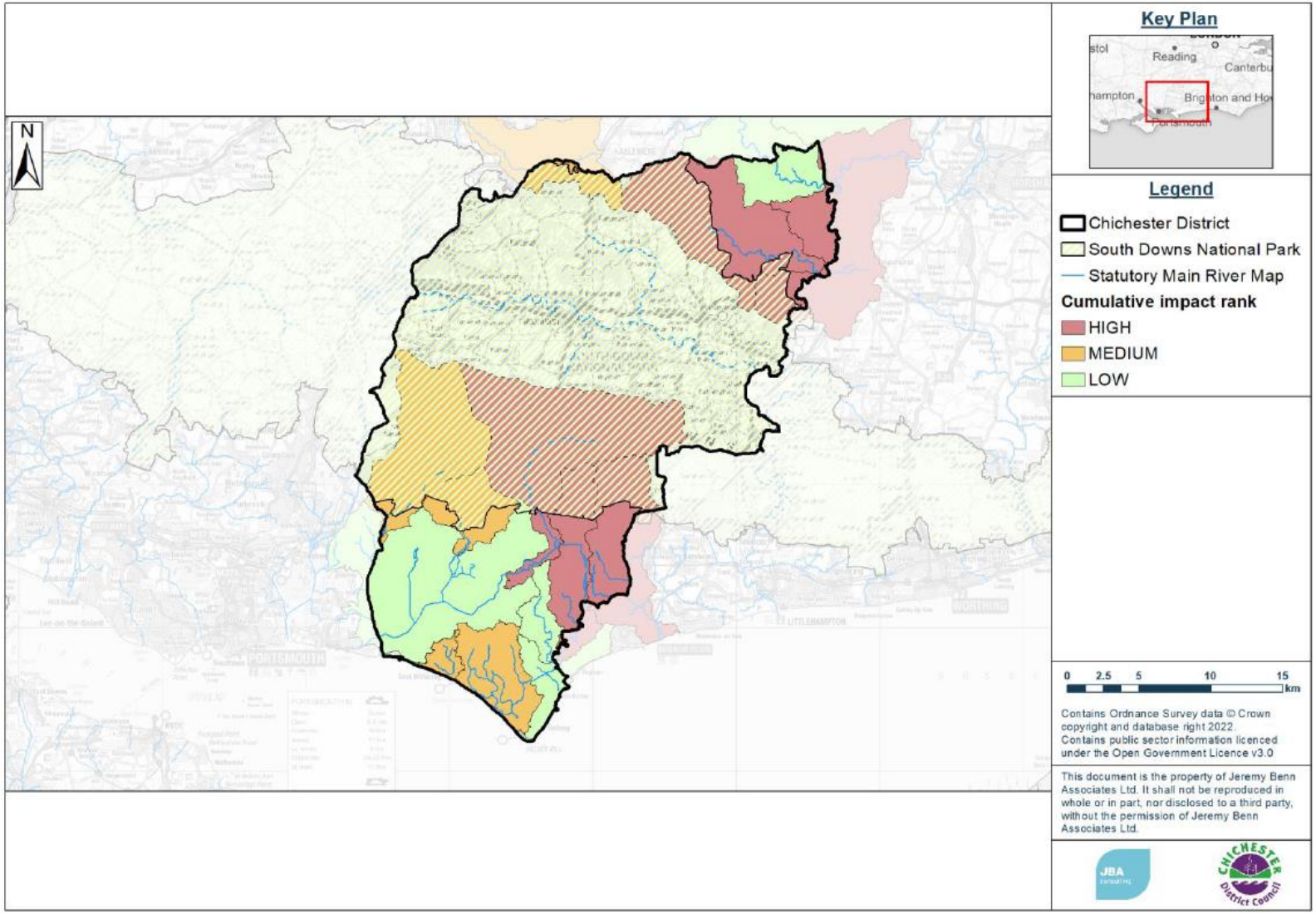
- The location and sensitivity of receptors to cumulative effects and the mechanisms that potentially result in flooding (e.g. locations that are reliant on the performance of pumped drainage systems to manage flood risk, locations where existing flooding is experienced and can be exacerbated by relatively small changes in flood flow magnitude, volume or flood duration, etc).
- The potential quantum of proposed cumulative development within a River Basin and assessment of the effect on sensitive receptors of the cumulative benefit afforded by piecemeal mitigation at the respective allocation sites.
- The requirement for measures to address potential cumulative effects (these can be both 'on-site' measures and contributions to strategic 'off-site' measures).
- The opportunity to integrate site mitigation measures with strategic flood risk management measures planned in the River Basin.
- The long-term commitments to management and maintenance.

13.4.5 Next steps

The Cumulative Impact Assessment is used in the following ways:

- The assessment highlights the catchments in the Chichester District where the cumulative impacts of development on flood risk could potentially be greatest. Developers and Chichester District Council should take the assessment into consideration when identifying appropriate sites for development.
- For sites in catchments identified as being at high or medium risk of cumulative impacts FRAs should contain an assessment of the potential cumulative impacts of development further.
- If sites are taken forward to a Level 2 SFRA, the cumulative impacts of relevant development will be considered in further detail.

Figure 13-4: Cumulative impact assessment classification



14 Summary

14.1 Overview

This Level 1 SFRA delivers a strategic assessment of all sources of flooding in the Local Plan area. It also provides an overview of policy and provides guidance for planners and developers.

The study area comprises the administration area of Chichester District, excluding the area covered by the South Downs National Park.

14.2 Sources of flood risk

14.2.1 Historic flooding

There have been several recorded flood incidents across the study area, from a combination of sources. The most notable flooding incidents occurred in 1974, 1993/1994, 2000, 2012 and 2013/2014.

Based on the West Sussex County Council historic incidents database and the Environment Agency's flood outline database there have been a number of fluvial floods in the Local Plan area including along the River Lavant, the Earnley Rife, River Ems, the Ham Brook, River Lox and River Kird.

Selsey and East Wittering have been susceptible to tidal flooding in the past and surface water flooding has been recorded throughout the Local Plan area.

Groundwater flooding has been recorded in Chichester, Emsworth, Wisbourough Green and Woodmancote.

14.2.2 Fluvial flood risk

There are several watercourses throughout the study area which are identified to contribute to fluvial flood risk. The River Ems, Bosham Stream and Lavant are chalk-fed and their flows can vary seasonally depending on groundwater levels. Flood Zone mapping and climate change mapping of the fluvial flood risk in the Local Plan area has been prepared as part of the Level 1 SFRA.

14.2.3 Tidal flood risk

The study area is bound by the English Channel to the south and as such there is a tidal flood risk. In addition, many of the river networks are tidally influenced. The combination of high tides and high river levels, can result in the tidal locking as the rivers are unable to discharge. There is also the possibility that tidal defences can fail or overtopped. The assessment of the 'residual' risk of defence failure should be considered on a site by site basis.

14.2.4 Coastal flood risk

Coastal erosion is a prominent process along much of the study area's coastline. Defences form an important aspect of the control of the physical coastline

14.2.5 Surface water flood risk

The Risk of Flooding from Surface Water (RoFSW) dataset shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas.

14.2.6 Groundwater flood risk

The JBA Groundwater Flood Map shows that a large proportion of the Chichester Local Plan area is at risk of groundwater emergence and so is potentially susceptible to

flooding. The southern part of the study area is particularly susceptible to the risk of flooding from groundwater, with the city of Chichester and surrounding towns being the most vulnerable areas.

The south of the Local Plan area is at particularly high risk due to the chalk valleys feeding from the South Downs. Rain can infiltrate the chalk through large fissures into the underlying aquifers and is released slowly though springs further downstream in the Local Plan area. The River Ems and Bosham Stream are particularly sensitive to groundwater levels as they are fed by the chalk springs to the south of the South Downs.

14.2.7 Sewer flood risk

Historical incidents of sewer flooding are detailed by the Southern Water SIRF. This database records incidents of flooding relating to public foul, combined or surface water sewers and identifies which postcode areas have suffered from flooding. A total of 272 incidents have been recorded.

The sewer flood risk in the Local Plan area is exacerbated by groundwater infiltrating into the sewer network and outfalls are constrained by the tide which can result in tide locking. In the coastal plains the sewer network relies upon pumping because of the very low relief.

14.2.8 Flooding from reservoirs

Outlines from the Environment Agency's Reservoirs inundation dataset show worst case inundation extents of five reservoirs impacting the Local Plan area.

14.3 Flooding from canals

There are two canals located in the Local Plan area, the Chichester Canal and the Wey and Arun Canal. There are no recorded incidents of breach or overtopping of canals within the study area

14.4 Flood defences

A high-level review of formal flood defences was carried out using existing information to provide an indication of their condition and standard of protection. Details of the flood defence locations and condition were provided by the Environment Agency for the purpose of preparing this assessment.

14.5 Key policies

There are many relevant regional and local key policies which have been considered within the SFRA, such as the CFMPs, RBMPs, the PFRA and LFRMS. Other policy considerations have also been incorporated, such as sustainable development principles, climate change and flood risk management.

14.6 Development and flood risk

The flood risk information used to inform the Sequential and Exception Test procedures for both Local Plan Reviews and FRAs has been documented, along with relevant guidance for planners and developers. A Sequential Test Methodology for the use of flood risk information is outlined in Appendix L. Links have been provided for various guidance documents and policies published by other Risk Management Authorities such as the LLFA and the Environment Agency.

15 Recommendations

A review of national and local policies has been conducted against the information collated on flood risk in this SFRA. Following this, several recommendations have been made for Chichester District Council to consider as part of Flood Risk Management in the study area.

15.1 Development management

15.1.1 Sequential approach to development

The NPPF supports a risk-based and sequential approach to development and flood risk in England, so that development is located in the lowest flood risk areas where possible; it is recommended that this approach is adopted for all future developments within the borough.

New development and re-development of land should wherever possible seek opportunities to reduce overall level of flood risk at the site, for example by:

- Reducing volume and rate of runoff through the use of SuDS, as informed by the **'Water, People, Places: A guide for master planning sustainable drainage into developments'** and Chichester District Council's **Surface Water and Drainage Supplementary Planning Document** (SPD) in the relevant wastewater treatment catchments.
- Relocating development to areas with lower flood risk
- Creating space for flooding
- GI should be considered within the mitigation measures for surface water runoff from potential development and consider using areas at risk of flooding as public open space
- Consideration must be given to the potential cumulative impact of development on flood risk.

15.1.2 Site-specific flood risk assessments

Site specific FRAs are required by developers to provide a greater level of detail on flood risk and any protection provided by defences and, where necessary, demonstrate the development passes part b of the Exception Test.

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), inform development zoning within the site and prove, if required, whether the Exception Test can be passed. The assessment should also identify the risk of existing flooding to adjacent land and properties to establish whether there is a requirement to secure land to implement strategic flood risk management measures to alleviate existing and future flood risk. Any flood risk management measures should be consistent with the wider catchment policies set out in the CFMP, FRMPs and LFRMS.

Developers should consult with Chichester District Council, West Sussex County Council, the Environment Agency and Southern Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

15.1.3 Sequential and Exception tests

The SFRA has identified that areas of the study area are at high risk of flooding. Therefore, it is expected that several proposed development sites will be required to pass the Sequential and, where necessary, Exception Tests in accordance with the NPPF. Chichester District Council should use the information in this SFRA when

deciding which development sites to take forward in the Local Plan Review. It is the responsibility of Chichester District Council to be satisfied that the Sequential Test has been satisfied.

15.1.4 Council review of planning applications

The Council should consult the Environment Agency's '**Flood Risk Assessment: Local Planning Authorities**', last updated February 2022, when reviewing planning applications for proposed developments at risk of flooding.

The Council will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases, also contact non-statutory consultees (e.g. Southern Water) that have an interest in the planning application.

15.1.5 Drainage strategies and SuDS

Planners should be aware of the conditions set by the LLFA for surface water management and ensure development proposals and applications are compliant with the Council's **Surface Water and Drainage Supplementary Planning Document** (SPD) for the relevant wastewater treatment catchment.

15.1.6 Cumulative impact of development and cross-boundary issues

The cumulative impact of development should be considered at the planning application and development design stages and the appropriate mitigation measures undertaken to ensure flood risk is not exacerbated, and in many cases the development should be used to improve the flood risk

15.1.7 Residual risk

Residual risk is the risk that remains after mitigation measures are considered. The residual risk includes the consideration of flood events that exceed the design thresholds of the flood defences or circumstances where there is a failure of the defences, e.g. flood banks collapse. Residual risks should be considered as part of site-specific Flood Risk Assessments

Further, any developments located within an area protected by flood risk management measures, where the condition of those defences is 'fair' or 'poor', where the standard of protection is not of the required standard or where the failure of the intended level of service gives rise to unsafe conditions should be identified.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage. They should seek to contact the reservoir owner to obtain information and should apply the sequential approach to locating development within the site. Developers should also consult with relevant authorities regarding emergency plans in case of reservoir breach.

Any development within the vicinity of either of the canals flowing through the borough should consider the residual risk from the canal, including the possibility of breach. Consideration should be given to the potential for safe access and egress in the event of rapid inundation of water due to a breach with little warning.

15.1.8 Safe access and egress

According to the government's guidance on **'Preparing a flood risk assessment: standing advice'** minimum finished floor levels for vulnerable development should normally be above whichever is higher of the following:

- a minimum of 300mm above average ground level of the site.
- a minimum of 300mm above the adjacent road level to the building.
- 300mm above estimated river or sea flood level.

Construction materials that have low permeability up to at least the same height as finished floor levels should be used. If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency will be required to determine alternative approaches. This includes replacement dwellings.

Safe access and egress will need to be demonstrated at all development sites. Emergency vehicular access should be possible during times of flood.

Where development is located behind, or in an area benefitting from, defences, consideration should be given to the potential safety of the development, finished floor levels and for safe access and egress in the event of rapid inundation of water due to a defence breach with little warning.

Resilience measures will be required if buildings are situated in the flood risk area, and opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought.

15.1.9 Future flood management

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted.

The information provided in the SFRA should be used as a basis for investigating potential strategic flood risk solutions within the study area. Opportunities could consist of the following:

- Catchment and floodplain restoration;
- Flood storage areas;
- Opening up culverts, weir removal, and river restoration;
- The Regional Habitat Creation Programme; and
- Green infrastructure.

For successful future flood risk management, it is recommended that local planning authorities adopt a catchment partnership working approach in tackling flood risk and environmental management.

15.2 Requirements for Level 2

Following the application of the Sequential Test, where sites cannot be appropriately accommodated in low risk areas, Chichester District Council will apply the NPPF's Exception Test. In these circumstances, a Level Two SFRA may be required, to assess in more detail the nature and implications of the flood characteristics.

15.3 Technical recommendations

15.3.1 Potential modelling improvements

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

15.3.2 Updates to SFRA

SFRAs are high level strategic documents and, as such, do not go into detail on an individual site-specific basis. This SFRA has been developed using the best available information, supplied at the time of preparation.

The Environment Agency regularly reviews its hydrology, hydraulic modelling and flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA. It should be noted that the Environment Agency's Flood Zones, on their Flood Map for Planning website, may differ to the maps in the SFRA for a short period of time, whilst new modelling is incorporated into the Environment Agency's flood maps. When using the SFRA to prepare FRAs it is important to check that the most up to date information is used, as is described in amendments to the flood mapping prepared and issued by the Environment Agency at regular intervals.

Other datasets used to inform this SFRA may also be periodically and following the publication of this SFRA, new information on flood risk may be provided by Risk Management Authorities.

Annex 1 - Updates to the Planning Practice Guidance

The Planning Practice Guidance on Flood Risk and Coastal Change was updated on the 25 August 2022, triggered by: revisions to the NPPF in 2018, 2019 and 2021; practice experience since the PPG was first published in 2014; Policy review of development in flood risk areas; and other stakeholder and committee reviews.

Key Details of the changes included in the PPG update of 25 August 2022:

General

- 'Design flood' includes Climate Change and surface water risk
- Hierarchical approaches prioritises avoidance and passive approaches, which also applies to residual risk.
- Safety of development now accounts for impact of flooding on the services provided by development
- Inappropriate to consider likelihood of defence breach
- Functional floodplain "starting point" for extent uplifted to the 3.3% AEP from 5% AEP
- Lifetime of non-residential development now has a 75yrs starting point
- New culverting and building over culverts is discouraged
- Defra FD2320 research referenced for calculating flood hazard to people

Sequential Test

- Removal of reference to Flood Zones (Diagram 2) when performing Sequential Test and requirement must now consider whether development can be located in the lowest areas (high – medium – low) of flood risk both now and in the future (the test applies to all source of flood risk – whereas previously the test was only performed for present day flood risk for the "Flood Zones" i.e. river and sea flood risk).
- Improved clarity about when test needs to be applied. Potential confusion about 'minor' development has been clarified.
- Clearer roles and responsibilities, with emphasis on the LP to define the area of search and decide if the test is passed.
- Key terms defined (e.g. 'reasonably available')
- Suggests approaches to improve certainty and efficiency
- Clarification about when it's appropriate to move onto the Exception Test
- Explicit statement that Table 2 (was Table 3) cannot be used to support performance of Sequential Test

Exception Test

- Key terms defined (e.g. 'wider sustainability benefits to the community')
- New section on how to demonstrate development has reduced flood risk overall
- Table 2 (was Table 3) shows flood zone ***incompatibility***, NOT whether 'development is appropriate'.

Integrated approach to flood risk management

- Catchment based approaches
- Improved connectivity with other strategies e.g. water cycle studies and drainage and wastewater management plans

- Encourages measures which deliver multiple benefits – including those which unlock sustainable development

Impact of development on flood risk elsewhere

- FRA's must detail any increase in risk elsewhere
- Guidance on compensatory flood storage – requirement for level-for-level storage
- Guidance on mitigating cumulative impacts
- Clarification that stilts/voids should not be relied upon for compensatory storage

Safeguarding land and relocation

- Guidance on how to safeguard land needed for future FCERM infrastructure
- Definition included for unsustainable locations
- Guidance for control of developments in unsustainable locations
- More detail and expectation on requirement to exercise Plan process to relocate development that is susceptible to frequent flood risk or coastal erosion.

Sustainable Drainage Systems (SuDS)

- Clearer definition of what SuDS are – this must meet the '4 pillars'
- Clearer requirement for SuDS Strategy
- Better recognition of wider SuDS benefits e.g. BNG, carbon sequestration, urban cooling
- Encouragement for earlier consideration in the design process
- Encourages policies setting out where SuDS would bring greatest benefits
- Highlights the need to check the need for other permits for SuDS

Reducing the causes & impacts of flooding

- Whole new section – links to all the EA's latest NFM tools, maps and research
- Support for river restoration such as culvert removal and other 'slow the flow' approaches
- Support for making space for river geomorphology e.g. meander migration

Coastal Change

- Encourages more precautionary designation of Coastal Change Management Areas (CCMAs)
- Allows more flexibility for existing buildings/land-use to adapt to change
- Clearer requirement for a 'coastal change vulnerability assessment' with apps for development in CCMAs
- Highlights need to consider removal of some Permitted Development rights in CCMAs

Other changes

- Guidance on how to consider flood risk in LDOs
- More detailed framework for local design code preparation
- Approach to article 4 in relation to flood risk
- Greater clarity on the application of the call-in direction process
- Guidance on development that might affect existing reservoirs
- Updated links to the latest tools and guidance

Impacts on the SFRA

The most relevant points to consider in relation to updating the SFRA process relate to the changes to the Sequential Test requirements and Exception Test requirements, particularly the requirement for updated Climate Change modelling for all sources of flood risk and the functional floodplain starting point at 3.3% AEP. Consideration also needs to be made to the changes to Table 2 (was Table 3) and the flood zone incompatibility. This should be considered during the screening phase prior to the Level 2 SFRA being undertaken.

For more information on the PPG updates, please visit the **gov.uk website**.

APPENDICES

A SFRA appendix grid map

B Historic flooding

C Watercourses

D Fluvial and tidal Flood Zones

E Fluvial and tidal climate change flood risk map

F Surface water flood risk map

G JBA Groundwater Flood Map

H Reservoir inundation map

I Flood defences

J Flood Alert and Flood Warning Areas

K Level 1 site screening table

L Sequential Test Methodology

M Fluvial and tidal climate change model reports

N Southern Water DWMP review

Interactive maps can be found on the Chichester District Council's website.

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