PUSH Strategic Flood Risk Assessment – 2016 Update

Guidance Document: Southampton City Council

Flood Risk Overview

Sources of Flood Risk

The city and unitary authority of Southampton is located in the west of the PUSH sub-region. It covers a total area of approximately 50 km². The city has 35 km of tidal frontage including the Itchen estuary, the tidal influence of which extends almost up to the administrative boundary of the city. Additionally there is 15 km of main river in Southampton. The Monks Brook stream joins the River Itchen at Swaythling and the Tanner's Brook and Holly Brook streams flow through and combine in Shirley in the west of the city, passing under Southampton Docks before discharging into Southampton Water. At present, approximately 13% of Southampton's land area is designated as within Flood Zones 2 and 3 (see SFRA Map: Flood Mapping Dataset).

The SFRA has shown that the primary source of flood risk to Southampton is from the sea. The key parts of the city which are currently at risk of flooding from the sea are the Docks, the Itchen frontage on both sides of the Itchen Bridge, the Northam and Millbank areas, Bevois Valley, St Denys and the Bitterne Manor Frontage.

The secondary source of flood risk to the city is from rivers and streams. The Monks Brook flood outline affects parts to the north of Swaythling and the Tanners Brook and Holly Brook flood outline affects parts of Lordswood, Lord's Hill, Shirley and Millbrook.

Southampton has also been susceptible to flooding from other sources including surface water flooding and infrastructure failure, previous incidents of which although have been isolated and localised, have occurred across the City and are often due to blockage of drains or gulleys. Historically, incidents of groundwater flooding have been noted in the Shirley area.

Key physical characteristics that may constrain development

Approximately 97% of Southampton is currently covered by existing development or protected open space. This figure includes the Common which is an important Site of Special Scientific Interest (SSSI) and along with other areas of environmental designation takes up 10% of the city area. Future development has to occur on brownfield sites, with intensification of dwellings likely.

The topography of Southampton ranges from sea level to approximately 80 metres above ordnance datum (mAOD). The lowest areas are the docks frontage along Southampton Water and the Itchen Valley and Estuary. The majority of the city lies on the higher ground to either side of the River Itchen. The risk of flooding from the sea is isolated to the two frontages, while the limited amount of fluvial flood risk suggests that development in locations outside of areas of flood risk should be possible in Southampton.

Geologically, Southampton is underlain by moderately permeable bedrock formations with the exception of bands of low permeability bedrock in the north of the city and along the waterfront. Moderately permeable superficial deposits overlie the bedrock in the majority of the city, but less permeable deposits are present along the waterfront and in the Itchen valley reducing the permeability of those areas not covered by artificial surfaces in terms of surface water runoff

generation. This can potentially make the installation of Sustainable Drainage Systems (SUDS) difficult in attempting to reduce the flood risk to 'downstream' sites when promoting new development.

Vulnerability to Climate Change

The SFRA has generated predicted tidal outlines for a number of years up to 2115 (see SFRA Map: *Flood Mapping: Climate Change* Dataset). These outlines account for the most up-to-date predicted rises in sea-level over the coming century due to climate change and they therefore allow the identification of locations that will be most vulnerable to this change due to their topography.

In Southampton, the areas most vulnerable to rising sea levels are the Docks near Millbrook and Redbridge, Northam, Bitterne Manor and St Denys. In addition to this effect of rising sea levels, it is anticipated that climate change will result in an increase in fluvial flood flows. This may put additional pressure on settlements which are adjacent to the fluvial River Itchen and the Tanners, Holly and Monks Brooks.

Existing defence assets and likely future investment

Although much of Southampton's coast is formalised by quay walls and river and coastal retaining structures, many of these provide a coastal defence function but it is not their main purpose. The residual life and standard of protection provided by these structures against tidal flooding therefore varies substantially.

The frontage from Redbridge along the docks and around to the Itchen Bridge is entirely protected by defences which offer a high enough level of protection to prevent inundation by a present day 1 in 1000 year tidal flood. For the remaining frontages, there is a mixed standard of protection, with some areas such as the frontages both sides of the River Itchen south of Cobden Bridge not offering protection from a 1 in 20 year tidal flood.

The coastal defences in Southampton are, however, likely to be susceptible to climate change. 100 years of predicted sea level rise would mean that most man-made defences would fail, at their current level, to offer protection from a 1 in 20 year tidal flood. The only areas that won't become susceptible along the River Itchen in 100 years are where the topography provides the protection, not existing defences. Significant investment in flood defences will be required in the future to maintain current development and allow future development in those areas of Southampton that are at risk of flooding from the sea. (see SFRA Map: Infrastructure Dataset). In order to consider the sustainability of investing in improved defences, the 'danger to people from breaching' index (see SFRA Map: Infrastructure: Danger to Public/ Property Dataset) will provide indications as to where the residual risk due to breaching may remain unfavourably high following improvements to defences to protect from extreme tidal floods.

Sequential and Exception Test

National Planning Policy Framework (NPPF) and The Planning Practice Guidance sets out the Government's objectives for achieving sustainable development through the avoidance and management of flood risk. The NPPF aims to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas of flood risk where consistent with the wider aims of sustainable development. Where this is not possible, it must be demonstrated that the wider sustainable benefits of the development outweigh the flood risk; and the development is safe.

To achieve this, the Planning Practice Guidance provides a decision making tool to ensure sites with a low probability of flooding are developed in preference to areas at higher risk where appropriate. The Sequential Test is the decision process which Local Authorities must demonstrate when developing their Local Development Frameworks and Local Development Documents. This SFRA has developed a suite of mapping outputs to assist Local Authorities applying the Sequential Test.

When applying the Sequential Test, The *Flood Mapping* Dataset of the SFRA will provide all the necessary information required upon which to base decisions regarding the location of future development in relation to flood risk. Within The *Flood Mapping* Dataset, the key map required for applying the Sequential Test is the Environment Agency's Flood Map for Planning, shown as Flood Zone 2 and Flood Zone 3 in conjunction with the Historic Flood Map.

The *Flood Mapping* Dataset also contains 4 other Mapsets which provide useful information to support Local Authorities when applying the Sequential Test, these include:

- *Hazard Map* – Undefended Flood Hazard
- *Flooding from Other Sources* – including Surface Water, Groundwater, Sources of Overland Flow
- *Flood Warning Areas*
- *Climate Change* - Outlines for years 2025, 2055, 2085 and 2115

In the original SFRA published in 2007 these guidance documents included specific advice on how to apply the PPS25 Sequential and Exception Tests. This advice has since been updated and incorporated into other guidance notes. For the purpose of efficacy and ensuring this text remains contemporary, it will not be reproduced here and instead signposted from the key guidance below:

- The National Planning Policy Framework
- Planning Practice Guidance: Flood Risk and Coastal Change
- Flood risk assessment for planning applications
- Flood risk assessment: standing advice

It is requested that if in applying any of this guidance that links are found to be broken or require updating that contact is made with the SFRA helpdesk through contact details on the mapping webpage.

Planning Policy

Paragraph 100 of the National Planning Policy Framework (NPPF) seeks to direct development away from areas at highest risk of flooding. Local Plans should be supported by SFRA and develop policies to manage flood risk from all sources.

Local Plans should apply a sequential, risk based approach to the location of development. Development should not be permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding.

If, following application of the sequential test, it is not possible (consistent with wider sustainability objectives) for the development to be located in zones with lower probability of flooding, the exception test can be applied if appropriate. The exception test should demonstrate that there are wider benefits to the community which outweigh flood risk. It should also demonstrate, through a site specific flood risk assessment, that the development will be safe for it's lifetime.

Chapter 10 of the NPPF provides full guidance on climate change, flooding and coastal change.

SFRA Mapping Outputs

The table below summarises the most relevant mapping outputs and their purpose, for each of the key users of the PUSH SFRA.

Key Users	Relevant SFRA Mapping Dataset	Purpose
Planning Policy	***Flood Mapping:*** NPPF Sequential Test and Relevant Supporting Information	***Flood Mapping Dataset*** provides all the necessary information to help planners apply the Sequential Test and Exception Test when allocating new sites for development. ***Flood Mapping Dataset*** also allows planners to identify sites with the lowest probability of flooding and lowest flood hazard / danger and how the extent of flooding is likely to change in the future due to climate change.
Development Control	***Flood Mapping:*** NPPF Sequential Test and Relevant Supporting Information	***Flood Mapping Dataset*** helps Development Control personnel to: o Prepare specifications for site specific FRAs. o Review site specific FRAs for new development sites and check for compliance with NPPF.
Risk Management	***Flood Mapping:*** NPPF Sequential Test and Relevant Supporting Information	***Flood Mapping Dataset*** helps Flood Risk Managers to identify variations in flood hazards / dangers to existing development. The data also provides mapping to show how the extent of flooding is likely to increase over time due to climate change.
	Infrastructure: Appropriate Defence Standards and Levels of Investment	***Infrastructure Dataset*** helps Flood Risk Managers to: o Identify shortfalls in existing defences in providing appropriate standards of defence, now and in the future. o Identify indicative levels of investment required to provide the appropriate standards, now and in the future.
Emergency Planning	***Flood Mapping:*** NPPF Sequential Test and Relevant Supporting Information	***Flood Mapping Dataset*** can provide emergency planners with information on the variation of flood probability and hazard across the sub region. Such information can aid in the development of emergency plans and evacuation routes during flood events.
	Infrastructure: Appropriate Defence Standards and Levels of Investment	***Infrastructure Dataset*** can help Emergency Planners to: o Identify indicative standards of defence, now and in the future.

Recommendations for Site Specific Flood Risk Assessments

Whilst the information presented in this SFRA will inform Local Authorities and facilitate their strategic allocation of sites for future development, it should not preclude the need for developers to undertake site specific flood risk assessments (FRAs). A SFRA, by its very nature, is a high level assessment of flood risk at the local authority level. It does not provide sufficiently detailed information to satisfy all of the requirements of a site specific FRA as outlined in the National Planning Policy Framework.

To improve the efficiency of disseminating general guidance, the Environment Agency has produced a suite of standing advice and guidance on producing Flood Risk Assessments.

- Flood Risk Assessment: Guidance for completing flood risk assessment to accompany a planning application
    - When you need an assessment
    - When you don't need an assessment
    - When to follow standing advice
    - How to do an assessment
    - Get information to complete an assessment

- Flood Risk Assessment: Guidance for planning authorities on review of flood risk assessments submitted as part of planning applications
    - Check if you need to consult
    - Flood zone 1
    - Flood zone 2
    - Flood zone 3
    - What you need to check in an assessment
    - Extra flood resistance and resilience measures

The following sections provide additional specific guidance for assessing flood risk at the site specific level within Southampton City Council and indicate how the outputs from the SFRA can inform such assessments.

Tidal Flooding

Flooding from tidal sources is one of the primary sources of flood risk within Southampton and the areas at risk are predicted to increase significantly by 2115. The *Flood Mapping* Dataset shows the existing areas at risk of tidal flooding and the associated undefended flood hazard. The index of flood hazard represents a gradation of hazard within the Flood Zones based on a combination of the depth of flood water and the velocity of the water (indicative ranges for which have been assumed based on distance from the coastline). It should also be noted that this dataset was derived during the evolution of the 2007 work package and the mapping has not been updated as part of the 2015 review. For this reason in areas where there have been flood mapping updates since 2007, there may be discrepancies in the data presented. Where this occurs it is recommended that further advice is sought from the SFRA Helpdesk team or local Environment Agency office.

The frontages where existing defences provide the minimum standards required for new development (i.e. 1 in 200 years for tidal flooding), are identified in the *Infrastructure: Overview* Dataset by a purple line. Indicative Areas Benefiting from Defences (ABDs) are also shown in this dataset. The Indicative ABDs have been defined as areas where the crest levels of the existing defences are consistently equal to or higher than the present day 1 in 200 year extreme sea level.

If small lengths of defences have crest levels which fall below the 1 in 200 year extreme sea level (even for a short length), the area behind the defence has not been classed as an Indicative ABD. The frontage of Ocean Village is an example of where this study has not been able to define an Indicative ABD due to small lengths of defence where the crest levels fall below the 1 in 200 year extreme sea level. The gaps in the defence level can also be viewed in more detail using *Infrastructure: Defence Level*. It should be noted that other areas may potentially be classified as ABDs if more detailed modelling assessments of the defences, which is beyond the scope of this SFRA, are carried out.

The *Flood Mapping: Hazard Map* Dataset shows the flood hazard (in terms of danger to people) associated with a hypothetical breach in the defences for the whole of the tidal frontage. The Indicative ABDs shown in *Infrastructure: Overview* define which of the hazard maps is most appropriate for consideration. Hazard Map for Flood Zone 2 is only appropriate for considering present day flood hazards within an ABD. To aid interpretation, the areas where this index is not appropriate for present day analysis are hatched out. The benefit of showing hazard information in the hatched out areas is to allow planners and developers to understand the likely residual risks that would remain if they were to invest in defending an area to a 1 in 200 year standard. The Hazard Map for Flood Zone 2 (Undefended Flood Hazard) should be used to assess the variation of flood hazard within the Flood Zones for all areas outside the Indicative ABDs.

The benefit of both the undefended flood hazard maps and the danger from breaching maps is that the gradation of flood hazard within the Flood Zones can facilitate both planners and developers to ensure that development is steered away from the areas of highest hazard. The hazard mapping presented in *Flood Mapping: Hazard Map*, however, should only be applied when appropriate consideration has been taken of alternative sites at a lower probability of flood risk (i.e. within Flood Zone 1) have been considered.

The flood hazard information, for both the undefended and breach scenario, developed as part of this SFRA, has been undertaken at a strategic level and is therefore at an appropriate level of detail to allow Local Authorities to strategically allocate sites for development. The hazard data has been classified into 4 categories to illustrate the gradation of flood hazard within Flood Zones 2 and 3 in line with best practice guidance as set out in Defra/ EA Guidance FD2320. The hazard data has not been calculated using modelling or other detailed numerical methods and is therefore not appropriate for identifying design parameters as part of site specific FRAs. It is therefore recommended that FRAs for sites located within the flood hazard zones should still include a quantitative assessment of flood hazard based on more detailed assessments of defence standards, defence failure scenarios and overland conveyance of flood flow.

The impact of climate change on increasing sea levels has a significant effect on the extents of Flood Zones 2 and 3 by 2115, especially along parts of the Itchen frontage. The NPPF expects consideration to be given to both current and future flood zones at the site specific level, taking account of climate change. The climate change flood extents presented should be used when undertaking a site specific FRA to inform the assessment of the long term sustainability of developments currently within Flood Zone 1 and the likely increases in flood risk in Flood Zones 2 and 3.

The defence information provided in the *Infrastructure Dataset* can provide developers undertaking site specific FRAs with an indication of the equivalent tidal return period of the crest level of the existing defences in the present day and an indicative level of investment that may be required to raise defence standards to the minimum required for new development. Such investment could be secured through the development process by Community Infrastructure Levy or Section 106 agreements.

Wave Overtopping

The Wave Energy mapset included within *Flood Mapping: Flooding from Other Sources*, shows how exposure to wave energy varies along the frontage of the study area. Such information can be used to assess, at a high level, the risk of flooding caused by extreme wave overtopping. The coastal frontages in Southampton, along the Rivers Test and Itchen, are sheltered from the wave energy in the open sea and are not vulnerable to extreme wave overtopping. No recorded historic incidents of extreme wave overtopping in the city have been identified through this SFRA update.

Fluvial Flooding

Southampton is at risk of fluvial flooding from the Tanner's and Holly Brooks and the lower reaches of the Monks Brook before it joins the tidal Itchen. This is shown in the *Flood Mapping* Dataset.

Across Southampton, gaps in available fluvial flood risk data exist, which are being addressed by the Environment Agency's ongoing Strategic Flood Risk Mapping programme. Therefore, for the purposes of this SFRA, Flood Zone 3b (defined by NPPF as the 'functional floodplain') has been defined as the entire extent of Flood Zone 3, in line with the Planning Practice Guidance precautionary approach and should be tested by site specific FRAs, where required.

Unlike the tidal Flood Zones, flood levels associated with the fluvial Flood Zones have not been identified as part of this SFRA. The variations in previous modelling approaches for the rivers within the PUSH sub-region, coupled with the spatial variation on flood levels along the river valleys, meant that it was not possible to provide a consistent approach to identifying fluvial flood levels without re-modelling a number of rivers. Such detailed assessments were outside the scope of this SFRA.

Developers undertaking a FRA for a site within the fluvial Flood Zones should obtain the most up to date flood risk data from the Environment Agency. If no further information is available then a site specific FRA may need to include a numerical assessment to refine the understanding of fluvial flood risk, and agree the form of this assessment with the Environment Agency.

Undefended flood hazard information, has also been developed for the fluvial Flood Zones 2 and 3. This information can provide developers with an indication of the varying degree of flood hazard within the Flood Zones which can facilitate the design and layout of development sites to avoid areas of high hazard. As with the tidal flood hazard data, this dataset was derived during the evolution of the 2007 work package and has not been updated as part of the 2015 update. For this reason in areas where there have been flood mapping updates since 2007, there may be discrepancies in the data presented. Where this occurs it is recommended that further advice is sought from the SFRA Helpdesk team or local Environment Agency office.

It is recommended that FRAs for sites located within the flood hazard zones to undertake a more detailed quantitative assessment of flood hazard based on an improved understanding of defences and flow routes.

Surface Water/Overland Flow Flooding

The dataset *Flood Mapping: Flooding from Other Sources* show both maps for potential surface water flooding and the variation in the potential source of overland flow across the PUSH region. The areas shown in red and orange relate to areas of very high and high potential for generating overland flow. Notably, the urban areas are indicated as red or orange due to the high runoff potential from urban land uses.

Due to the highly urbanised nature of the city, almost all areas in Southampton are shown as having a high or very high potential for overland flow. It is recommended that all site specific FRAs within the city boundary, especially if the local topography places the site at a lower elevation than the surrounding land and hence downstream of overland flow sources, should consider the impacts and management of flooding due to overland flow both to and from sites.

The data shows that new development located on the small amount of greenfield Land in Southampton is likely to have either a low or moderate impact on the surface water runoff regime. Site specific FRAs should therefore carefully consider the impact of development on the local surface water runoff regime and should investigate SUDS options to manage surface water where achievable.

Groundwater Flooding

Within the PUSH region the key areas at risk of groundwater flooding lie to the north of Southampton in Eastleigh, Test Valley, Winchester and East Hampshire where highly permeable geology meets lower permeability geology as shown in *Flood Mapping: Flooding from Other Sources: Groundwater,* which has been verified by inspection of the historical incident records.

There have been observed incidents of groundwater flooding in Southampton, notably in parts of the Tanner's Brook catchment. Low lying areas adjacent to the tidal frontages can also be susceptible to a tidal/groundwater interaction. Other parts of the City have perched water tables due to the underlying geology. Site specific FRAs within Southampton should seek to ascertain

whether a site has been previously affected by groundwater flooding if it lies adjacent to the Tanner's or Holly Brooks.

Flooding from Infrastructure

Historically, a number of parts of Southampton have recorded incidents of flooding caused by problems relating to drainage infrastructure as shown in Dataset *Flood Mapping: Flooding from Other Sources*. When undertaking a site specific FRA for a large development site, consultation with Southern Water should always be undertaken to investigate whether the proposed development will have an adverse impact on the local drainage system.

Sustainable Urban Drainage Systems (SUDS)

Conventional surface water drainage systems have traditionally used underground pipe networks to efficiently convey water away from sites. In the past this has led to problems of downstream flooding, reductions in groundwater recharge and waste pollution incidents associated with surface water overwhelming combined sewers. Both 'Making Space for Water' and the 'Water Framework Directive' have highlighted the need for an improved understanding and better management of how our urban environments are drained. The SUDS management train approach, as shown in Figure 2, is the principle that a range of SUDS which feed into each other can often offer benefits to the delivery of a successful surface water system/strategy.

NPPF states that Local Authorities should prepare and implement planning strategies that help to deliver sustainable development, by using opportunities offered by new development to reduce the causes and impacts of surface water flooding. By implementing polices to encourage developers to incorporate SUDS wherever possible, Local Authorities can help to mitigate the impacts that development has on surface water runoff rates and volumes.

Emergency Planning

As well as informing the development control process, the outputs of the SFRA can also be used by the Local Authority to inform their Emergency Planning Polices. The Flood Mapping Datasets are particularly useful when considering the feasibility and sustainability of key access routes within their administrative boundaries. The benefit of producing such outputs on a sub-regional scale mean that the Local Authority can also consider access beyond their administrative boundary where key access routes (e.g. M27) cross a number of Local Authorities.

Additional Guidance

- Flood risk assessment for planning applications; Environment Agency
- Flood risk assessment: standing advice; Environment Agency
- National Planning Policy Framework; DCLG
- National Planning Policy Framework Quick Guide; Environment Agency
- Planning Practice Guidance – Online web-based resource: DCLG
- Flood and coastal risk guidance: climate change allowances: Environment Agency
- Development and Flood Risk: Guidance for the Construction Industry CIRIA (2004)
- Flood Risk Assessment Guidance for New Development: FD2320/TR2 Environment Agency / DEFRA
- Susdrain online resource: The community for sustainable drainage CIRIA
- Southampton City Council emergency planning flooding – online resource
- Southampton City Level 2 SFRA – online resource
- Local Flood Risk Management Strategy, Southampton City Council
- Southampton Surface Water Management Plan, Southampton City Council
- Test and Itchen Catchment Flood Management Plan, Environment Agency