

Borough Council of King's Lynn & West Norfolk Level 2 Strategic Flood Risk Assessment

Final Version 3.0

21 March 2019

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Revision history

Revision Ref/Date	Amendments	Issued to
13/07/2018	Draft Report v1.0	Peter Jermany
27/07/2018	Draft Report v2.0 - Addition of Appendix B.	Peter Jermany
21/03/2019	Final Report v3.0	Peter Jermany

Contract

This report describes work commissioned by Peter Jermany, on behalf of King's Lynn and West Norfolk Borough Council, by a letter dated 23rd February 2018. Roberta Whittaker, Freyja Scarborough and Hannah Coogan of JBA Consulting carried out this work.

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Purpose

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Acknowledgements

We would like to acknowledge the assistance of:

- Anglian Water
- Borough Council of King's Lynn & West Norfolk
- Downham Market Group of IDBs
- Environment Agency
- Middle Level Commissioners
- Water Management Alliance
- Norfolk County Council

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Executive summary

SFRA objectives

The objectives of this Level 2 SFRA update are to:

- Provide a community-based assessment of flood risk across identified communities within the Borough of King's Lynn and West Norfolk.
- Inform the Sequential Test
- Serve as guidance for developers to complete the Exception Test
- Provide an assessment of residual risk and climate change
- Where flood risk information is unavailable or limited, conduct appropriate hydraulic modelling where possible to determine the flood risks to the proposed sites.
- Using available data, provide information and maps presenting flood risk from all sources for each proposed site.
- Take into account the most recent national and local policy and guidance documents, update information on the requirements for site-specific FRAs, considerations for suitable surface water management methods and opportunities to reduce flood risk to existing communities through new development.

Level 2 SFRA outputs

The Level Two assessment includes detailed assessments of the proposed communities. These include:

- An assessment of the highest risk flooding mechanism and most likely flooding type for each community.
- An assessment of all sources of flooding including fluvial flooding, tidal flooding, surface water flooding, mapping of the functional floodplain and the potential increase in fluvial, tidal and surface water flood risk due to climate change.
- An assessment of existing flood warning, including an assessment of whether there is safe access and egress during an extreme event.
- Advice and recommendations on the likely suitability of sustainable drainage systems (SUDS) for managing surface water runoff.
- Advice on appropriate policies for communities which could satisfy the first part of the Exception Test and on the requirements necessary for a site-specific Flood Risk Assessment, supporting a planning application to pass the second part of the Exception Test.

As part of the Level 2 SFRA, detailed community summary tables have been produced for the proposed communities, covering the above. To accompany each community summary table, there is an Interactive Geo-PDF map, with all the mapped flood risk outputs. These have easy-to-use 'tick box' layers down the right-hand side and bottom of the mapping, to allow the user to view different combinations of data.

In addition, this report includes more detailed guidance for:

- Planners and developers on how to use the Level 2 assessment information to inform the Sequential and Exception Test
- Developers on how to use the information in both the Level 1 and Level 2 SFRAs to apply the Sequential and Exception Tests at the planning application stage. This will be particularly useful for windfall sites, where the Sequential Test has not been applied at a strategic allocation stage.

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Glossary of Terms and Abbreviations

Term	Definition
AEP	Annual Exceedance Probability – The probability (expressed as a percentage) of a flood event occurring in any given year.
Areas Benefitting from Defences (ABD)	The Areas Benefitting from Defences is a dataset that shows areas which would flood in the 1% AEP fluvial or 0.5% AEP tidal event if the defences were not present. Some defences are designed to protect against a smaller flood with a higher chance of occurring in any year, for example a flood defence which protects against a 5% AEP. Areas protected from these defences are not shown on the ABD dataset.
Brownfield	Previously developed parcel of land
CC or Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions.
EA	Environment Agency
Exception Test	A planning test set out in the NPPF and applied where necessary after the Sequential Test, depending on the flood risk to a site and the vulnerability of the proposed development. The test has two parts, one regarding flood risk and the other demonstrating the site provides wider sustainability benefits that outweigh the flood risk constraints.
Flood Alert Areas	Flood Alert Areas are geographical areas where it is possible for flooding to occur from rivers and the sea. The Environment Agency issued Flood Alerts to these areas based on flood forecasts and weather conditions. Flood Alerts are generally considered to be less serious than Flood Warnings.
Flood defence	Infrastructure used to protect an area against floods e.g. flood walls and embankments. They are designed to a specific standard of protection (often called the design standard).
Flood Map for Planning	The Environment Agency Flood Map for Planning shows river and sea flooding across Flood Zones that have different flood likelihoods. The NPPF tells planners and developers how to use these flood zones to inform planning decisions. The Flood Zones do not take into account the effect of flood defences or the impact of climate change.
Flood Warning Area	Flood Warning Areas are geographical areas where the EA expect flooding may occur. The Environment Agency issued Flood Warnings and Severe Flood Warnings to these areas based on flood forecasts and weather conditions.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a River
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
Greenfield	Undeveloped parcel of land
Ha	Hectare
Highest Risk of Flooding Mechanism	To support the completion of the sequential test a visual comparison of multiple sources of flood risk were assessed per community to find the source of flooding which will have the greatest impact or severity.

Term	Definition
Jflow	2D generalised hydrodynamic modelling software. Models how water flows over a floodplain.
Level	A measure of elevation in m AOD.
LLFA (Lead Local Flood Authority)	Local Authority responsible for taking the lead on local flood risk management (Norfolk County Council)
LPA	Local Planning Authority (Borough Council of Kings Lynn and West Norfolk)
m AOD	metres Above Ordnance Datum
Main River	Legally designated on the 'Main River' map and tend to be the larger rivers. The Environment Agency have permissive powers for flood alleviation.
Most Likely Source of Flooding	To support the completion of the sequential test a visual comparison of multiple sources of flood risk were assessed per community to find the source of flooding which will occur the most frequently.
NPPF	National Planning Policy Framework
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood alleviation.
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.
Residual Risk	The residual risk is that which remains after efforts have been made to reduce the risk. For example, the risk to a town which is protected by a flood defence.
Riparian owner	A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch. They are ultimately responsible for watercourse maintenance.
Risk	In flood risk management, risk is the product of the probability or likelihood of a flood occurring, and the consequence of the flood.
RoFfRS	Risk of Flooding from Rivers and Sea map (also known as the National Flood Risk Assessment)
RoFfSW	Risk of Flooding from Surface Water map (formerly known as the Updated Flood Map for Surface Water (uFMfSW))
Sequential Test	A planning test in the NPPF that seeks to allocate development into the lowest flood risk areas.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.

1 Introduction

1.1 Purpose of the L2 Strategic Flood Risk Assessment

This Level 2 Strategic Flood Risk Assessment (SFRA) document has been prepared for the purpose of:

- Informing the Sequential Test
- Serving as guidance for developers to complete the Exception Test

for communities within the Borough of King's Lynn and West Norfolk.

This document should be considered in conjunction with the Level 1 SFRA (2018).

1.2 Levels of SFRA

The Planning Practice Guidance (PPG) 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 development sites and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test.

Level Two: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all the necessary development creating the need to apply the NPPF's Exception Test. In these circumstances, the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

1.3 SFRA objectives

The objectives of this Level 2 SFRA update are to:

- Provide a community-based assessment of flood risk across identified communities within the Borough of King's Lynn and West Norfolk.
- Inform the Sequential Test
- Serve as guidance for developers to complete the Exception Test
- Provide an assessment of residual risk and climate change
- Where flood risk information is unavailable or limited, conduct appropriate hydraulic modelling where possible to determine the flood risks to the proposed sites.
- Using available data, provide information and maps presenting flood risk from all sources for each proposed site.
- Take into account the most recent national and local policy and guidance documents, update information on the requirements for site-specific FRAs, considerations for suitable surface water management methods and opportunities to reduce flood risk to existing communities through new development.

1.4

Advice to users has been highlighted in amber boxes throughout the document.

1.5 Context of the Level 2 assessment

Following the Borough Council of King's Lynn and West Norfolk's Settlement hierarchy review process, the council wished to conduct a Level 2 SFRA at the community scale to assist with the allocation of sites for the Local Plan and to be able to strategically assess the flood risk of any incoming windfall sites.

The communities within the settlement hierarchy were screened against flood risk information to provide an assessment of flood risk to each of the sites. This screening categorised the settlements into three categories based on this information (Appendix A **Error! Reference source not found.**):

- Green: Settlements filtered out due to low flood risk and or possible to allocate developments to lower risk areas around the settlement.
- Black: Level 2 analysis required based on existing information
- Red: Additional hydraulic modelling required to better assess the flood risk in this community

The latter two categories of communities were then taken forward for the Level 2 assessment.

1.6 Level 2 SFRA outputs

The Level Two assessment includes detailed assessments of the proposed communities. These include:

- An assessment of the highest risk flooding mechanism and most likely flooding type for each community.
- An assessment of all sources of flooding including fluvial flooding, tidal flooding, surface water flooding, mapping of the functional floodplain and the potential increase in fluvial, tidal and surface water flood risk due to climate change.
- An assessment of existing flood warning, including an assessment of whether there is safe access and egress during an extreme event.
- Advice and recommendations on the likely applicability of sustainable drainage systems (SUDS) for managing surface water runoff.
- Advice on appropriate policies for communities which could satisfy the first part of the Exception Test and on the requirements necessary for a site-specific Flood Risk Assessment, supporting a planning application to pass the second part of the Exception Test.

As part of the Level 2 SFRA, detailed community summary tables have been produced for the proposed communities, covering the above. To accompany each community summary table, there is an Interactive Geo-PDF map, with all the mapped flood risk outputs. These have easy-to-use 'tick box' layers down the right-hand side and bottom of the mapping, to allow the user to view different combinations of data.

In addition, this report includes more detailed guidance for:

- Planners and developers on how to use the Level 2 assessment information to inform the Sequential and Exception Test
- Developers on how to use the information in both the Level 1 and Level 2 SFRAs to apply the Sequential and Exception Tests at the planning application stage. This will be particularly useful for windfall sites, where the Sequential Test has not been applied at a strategic allocation stage.

2 Level 2 assessment methodology

The 35 communities taken forward for Level 2 assessment have resulted from the screening process described in Section 1.4. The following sections describe the method used to assess the flood risk to these communities and the outputs provided.

2.1 Hydraulic modelling undertaken

Combined outputs (for flood zones, climate change and residual risk) from detailed hydraulic models have been licensed from the Level 1 SFRA to inform this Level 2 study.

Additional hydraulic modelling has been undertaken to assess:

- Fluvial risk and climate change scenarios along the Heacham River near to the communities of Heacham and Hunstanton using 2D generalised modelling (Jflow).
- The impact of fluvial breach at Southery using the Fenland, 2016 Model provided by the Environment Agency.

It should be noted that limited site visits and no channel survey was undertaken as part of this strategic assessment. It is recommended that developers undertake detailed site-specific work as necessary as part of a site-specific FRA.

2.2 Sequential Test Guidance

The flood risk within the Borough is relatively high from river, sea and surface water flooding. Further guidance has therefore been created to support the application of the Sequential Test. This has considered both the type of flooding likely to cause the most significant consequences the 'highest flood risk mechanism' and the type of flooding that is likely to occur most frequently - 'the most likely flooding type'. Table 2-1 sets out which factors were taken into account.

Table 2-1: Factors to determine the highest risk flooding mechanism and the most likely flooding type.

Flood Frequency	Tidal and Coastal	Fluvial	Surface Water
High	5% AEP	5% AEP	3.3% AEP
Medium	0.5% AEP	1% AEP	1% AEP
Low	0.1% AEP	0.1% AEP	0.1% AEP

Both the 'highest flood risk mechanism' and 'the most likely flooding type' were identified for each community based on:

- Flood type with the highest risk was based on a comparison of the 0.1% AEP events from different flood sources.
- Most likely flooding type was based on a consideration of the most frequent source of flooding (taking into account defences) with the largest extent.

This classification of settlements is presented in summary maps (Appendix B1) for the borough to allow easy visual comparison of flooding mechanisms between communities.

An assessment of residual risk (breach) has also been made using outputs from hydraulic models for the 1% or 1% AEP plus climate change (fluvial) and 0.5% plus climate change (tidal). This information is presented in community summary tables (Appendix B2) and accompanied by an interactive map (Appendix B3) for each community to visually display relevant flood risk mapping information on a community scale. This is displayed centrally, with easy-to-use 'tick box' layers down the right-hand side and bottom of the mapping, to allow navigation of the data.

Flood risk information in the interactive maps includes:

- Main rivers, ordinary watercourses and IDB drains (where available)
- Flood Zones 2, 3a and 3b (functional floodplain)
- The extent of the most likely flooding type and corresponding depth, velocity and hazard grids (where available).
- The extent of the flooding type with highest risk and corresponding depth, velocity and hazard grids (where available).
- Any residual risk runs in the area on the 1% or 1% AEP plus climate change (fluvial) and 0.5% AEP plus climate change (tidal).
- Climate change outputs for fluvial, tidal and surface water climate change scenarios
- Defence layer
- IDB Watercourses (where available)
- Any existing flood alert and flood warning areas

A flow chart (Appendix C) has also been developed to describe how planners should use this information, along with information about the vulnerability of the development to apply the Sequential Test. This can also be used to help apply the Sequential Test to windfall sites.

2.3 Exception Test Guidance

The Community summary tables (Appendix C2) provide information to assist developers to complete the Exception Test for sites within each of the 35 communities. These summary tables provide the following guidance:

- They build on the NPPF requirements for a risk-based approach to assessing development locations to apply the concepts of sustainable development through investment in defences and partnership working.
- By assessing areas at the community level, the Exception Test can be informed by how future developments will be linked to investment e.g. in contribution of developments to existing defences, new defences, emergency planning arrangements.
- They consider the potential for mitigation (i.e. defence areas, areas identified that are not in flood warning or alert areas, any developments currently occurring in an area and their potential for CIL investment for that community).

- They link to existing schemes and development areas to highlight what the Council is hoping for in these areas and how this will relate to site allocation. An example of this is that the council are hoping to develop tourism e.g. Hunstanton Southern Sea Front.
- They signpost developers to both local policy and District, County and National Level Policies.
- They recognise local policy considerations and what these mean for developers e.g. Policy DM18 in the 2016 adopted Site Allocations and Development Management Policies Plan and the 2019 Local Plan consultation policy LP15 - Coastal Change Management Area (Hunstanton to Dersingham) Policy. These seek to prevent any new caravan parks in rapid inundation zones and new ground-floor habitable residential development.
- They recognise the need for site-specific FRAs to inform the Exception Test based on site specific mitigation needs and the co-operation required with Internal Drainage Boards (IDBs) in the area in order to conduct site specific hydraulic modelling.

2.4 RAG Rating of Risk

The summary tables conclude with a RAG analysis which assigns a Red, Amber or Green rating to each community for each flooding mechanism to provide an easy marker of flood risk within that community. This rating is assigned based on the highest frequency of flooding (Table 2-1) within the community for each flooding mechanism ('the most likely flooding type'. Where:

- Red = High frequency
- Orange/ Amber = Medium Frequency
- Green = Low Frequency

The highest frequency contained within the community is assigned as the RAG rating for each flooding mechanism. Additionally, where the community is also at residual risk from a fluvial or tidal breach (excluding reservoir breach) the community is assigned a minimum orange/ amber rating (which will be superseded by a Red rating if the previous criteria are satisfied).

2.5 Guidance for developers for applying the Sequential and Exception Tests

Development Management staff and Developers should refer to the standalone (Appendix C) Figure 1-1 (and Tables 1-1 and 1-2 as necessary) to determine how to apply the Sequential and Exception Tests at an individual site level. The process should be documented by Developers on the Proforma provided in the appendix, which they should submit alongside their Planning Application.

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

- A strategic allocation and the test has already been carried out by the LPA, or
- A change of use (except to a more vulnerable use), or
- 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 SFRAs can be used to identify where there are flooding issues from sources others than larger rivers and the sea.

Developers are required to apply the Exception Test to all sites (including strategic allocations).

Developers should refer to the Community Mapping and Summary Tables in the Level 2 SFRA to inform this exercise and guide the content of any more detailed work and site-specific development requirements that are required. The Level 1 SFRA also contains guidance for developers on Flood Risk Assessments and Surface Water Drainage Strategies.

Should the site not be in one of the Communities assessed in detail for the Level 2 SFRA, the developer should refer to the information that is available in the Level 1 SFRA.

3 Sources of information used in preparing the L2 SFRA

All data used to inform the Level 2 SFRA has been licensed from the Level 1 SFRA (2018) to ensure a consistent assessment. Any differences between the data are stated below.

3.1 River networks

- Main Rivers are represented by the Environment Agency's Statutory Main River layer.
- Ordinary Watercourses are represented by the Environment Agency's Detailed River Network Layer.
- IDB watercourses are represented by information provided by the Middle Level Commissioners, Downham Market Group of IDBs and King's Lynn IDB (managed by the Water Management Alliance).

3.2 Flood Zones

Flood Zones 2, 3a and 3b from the Level 1 SFRA have been amended with the addition of the 2D generalised modelling along the Heacham River described in Section 2.1. There are no changes to Indicative Flood Zone 3b.

The data that comprises the Flood Zones for the assessment of each community is included in the 'Mapping Information' tab of each community summary table.

Important note on Flood Zone information in this SFRA

The Flood Zones presented in the community summary tables and interactive maps may differ from those shown on the Environment Agency's 'Flood Map for Planning' as the most up-to-date modelling has been used in this SFRA. The Environment Agency regularly reviews their 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.

The Flood Zones, whilst generally accurate on a large scale, are not provided for land where the catchment of the watercourse falls below 3km². As such, whilst a location can be shown to be outside of Flood Zones 2 and 3, this does not necessarily mean that it is not at risk of fluvial flooding, as the lack of flood extent is due to a lack of data rather than indicating there is no risk.

In certain areas, hydraulic models were in the process of being updated at the time of preparing the 2018 Level 1 SFRA. It is important that this 2019 Level 2 SFRA and appendices are read in conjunction with the Technical Summary provided in Appendix D of the 2018 Level 1 SFRA. The Technical Summary provides further information on the hydraulic modelling and mapping approaches used in the 2018 Level 1 SFRA.

3.3 Depth, velocity and hazard

Depth, velocity and hazard mapping is presented for the following (where available):

- The most likely flooding type
- The highest flood risk mechanism

These depth, velocity and hazard grids are combined raster grids from the outputs of either Environment Agency hydraulic models or 2D generalised modelling undertaken as part of the Level 2 assessment.

3.4 Climate change

The three fluvial climate change allowances from the Level 1 SFRA have been amended with the addition of the 2D generalised modelling along the Heacham River described in Section 2.1.

There are no changes to the tidal and surface water climate change information from the Level 1 SFRA.

The mapping provides a strategic assessment of climate change risk; developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA, following the guidance set out in the SFRA Level 1 main report.

3.5 Surface Water

Mapping of surface water flood risk in the authority has been taken from the Risk of Flooding from Surface Water (RoFfSW) published online by the Environment Agency.

The RoFfSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas.

Although the RoFfSW offers an 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 required to more accurately illustrate the flood risk at a site-specific scale. Such an assessment will use the RoFfSW in partnership with other sources of local flooding information to confirm the presence of a surface water risk at that location.

3.6 Residual Risk (Breach) Information

A composite layer of fluvial and tidal breach was compiled using supplied breach outputs from the following supplied Environment Agency hydraulic models (Table 3-1). Where breach scenarios were run for climate change these were included. However not all breach scenarios were run for climate change scenarios and hence the AEP for which the outlines were supplied were included in the breach layer to provide an indicative breach extent.

Table 3-1: Hydraulic Models Comprising the Composite Breach Layer

Model	AEP	No. of Breaches Modelled	Fluvial / Tidal
Eastern Rivers MP1, 2016	1%	4	Fluvial
Fenland, 2016	1% (8 scenarios)	34	Fluvial
	1% + CC (26 scenarios)		
Wells-next-the-Sea, 2017	0.5% + CC	4	Tidal
Tidal Great Ouse, 2015	0.5% + CC	1	Tidal
Tidal Hazard Mapping (Lincoln)	0.5% + CC	1	Tidal
Tidal Nene, 2011	0.5% + CC	1	Tidal

3 additional breach scenarios were also run as part of the commission for the Level 2 SFRA using the Fenland, 2016 Model at Southery to provide a complete coverage of breach outputs in this area.

It is important to recognise that it is unlikely that all breaches would occur simultaneously and hence this dataset should be used with this in mind.

Reservoir breach was assessed using the Environment Agency's Reservoir Flood Map Maximum Outline.

3.7 Defences

The influence of defences has been assessed using:

- Spatial data provided by the Environment Agency from their AIMS database.
- Environment Agency 6-year pipeline data
- Environment Agency 'Areas Benefitting from Defences' layer.

3.8 Broad Scale Assessment of SuDS

The hydraulic and geological characteristics for each community were assessed to determine the constraining factors for surface water management. This assessment is designed to inform the early-stage site planning process and is not intended to replace site-specific detailed drainage assessments.

The assessment is based on catchment characteristics and additional datasets such as the British Geological Survey (BGS) Soil maps of England and Wales which allow for a basic assessment of the soil characteristics on a site by site basis. Other datasets were used to determine other influencing factors on potential SuDS. These datasets include the following:

- Historic landfill sites
- Groundwater Source Protection Zones
- Detailed River Network
- Areas Susceptible to Groundwater Flooding (ASStGWf)
- Flood Zones derived as part of this L2 SFRA

This data was then collated to provide an indication of particular groups of SuDS systems which might be suitable at a site. SuDS techniques were categorised into five main groups, as shown in Table 3-2. This assessment should not be used as a definitive guide as to which SuDS would be suitable but used as an indicative guide of general suitability. Further site-specific investigation should be conducted to determine what SuDS techniques could be utilised on a particular development.

Table 3-2: Summary of SuDS Categories

SuDS Type	Technique
Source Controls	Green Roof, Rainwater Harvesting, Pervious Pavements, Rain Gardens
Infiltration	Infiltration Trench, Infiltration Basin, Soakaway
Detention	Pond, Wetland, Subsurface Storage, Shallow Wetland, Extended Detention Wetland, Pocket Wetland, Submerged Gravel Wetland, Wetland Channel, Detention Basin
Filtration	Surface Sand filter, Sub-Surface Sand Filter, Perimeter Sand Filter, Bioretention, Filter Strip, Filter Trench
Conveyance	Dry Swale, Under drained Swale, Wet Swale

The suitability of each SuDS type for the site options has been described in the summary tables, where applicable. The assessment of suitability is broadscale and indicative only; more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. The LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

For more detailed information or further guidance on SuDS please see the King's Lynn and West Norfolk Strategic Flood Risk Assessment Final Report: Level 1, section 2.5 and section 9.

4 How to Use the Level 2 SFRA

4.1 Applying the Sequential Test

The flow chart in Figure 4-1 should be applied to information in the SFRA to inform the Sequential Test. This will aid both planners at strategic allocation stage and developers at planning application stage to allocate land to the areas of lowest flood risk. It should be used alongside information on the vulnerability of different development types to flooding as set out in the National Planning Policy Guidance.

Figure 4-1: Sequential Test Flow Chart

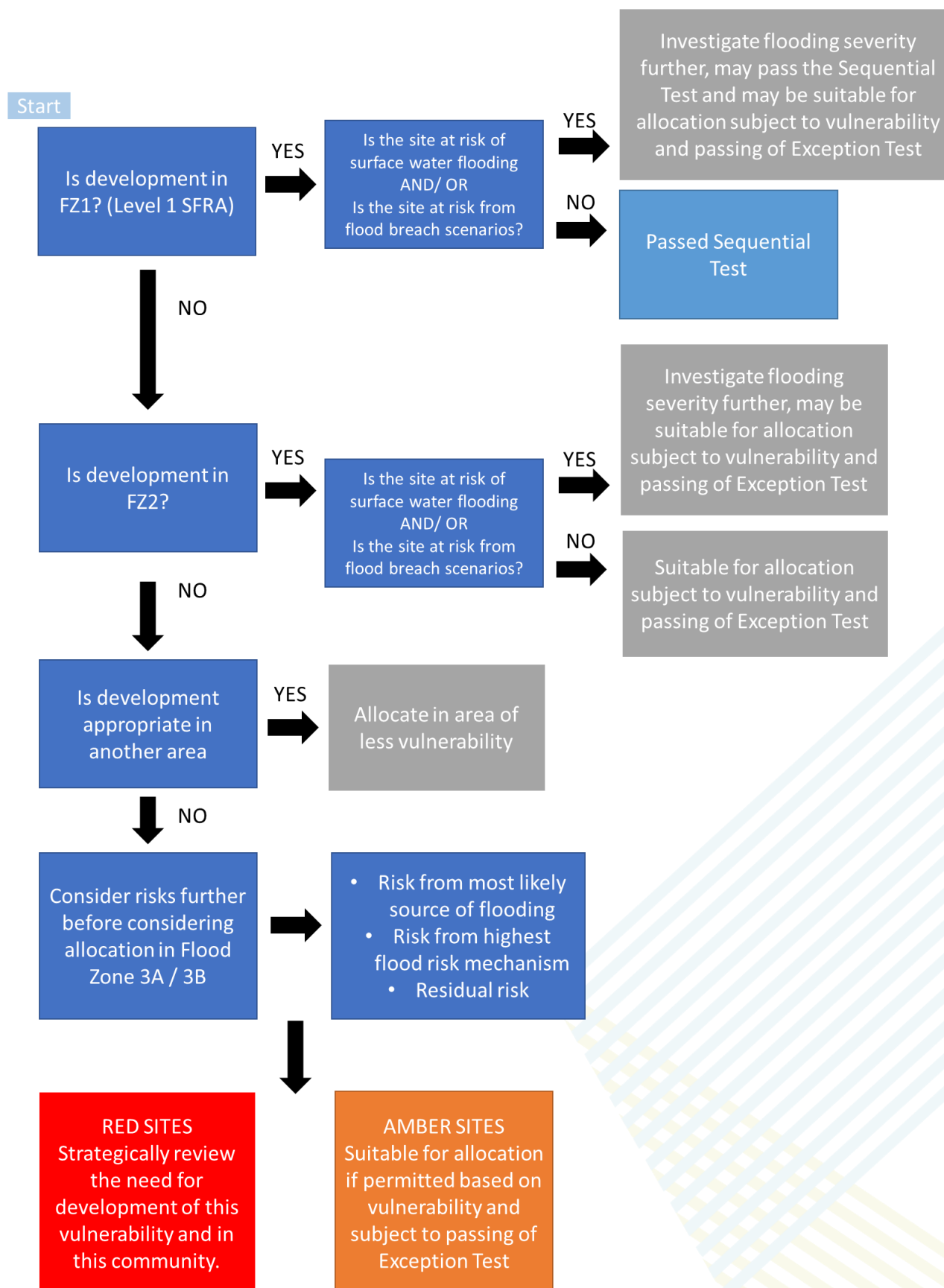


Figure 4-2 explains in further detail the Red and Amber classifications arrived at in the flow chart for sites at higher risk of flooding.

Figure 4-2: Sequential Test RAG Analysis Summary

Red

- Review vulnerability of development to see if permissible in flood zone category.
- Flood depths greater than 0.6m in most likely source of flooding or residual risk scenario
- Access and egress to site is limited (no dry access) in highest flood risk mechanism.

Amber

- Flood depths less than 0.6m in most likely source of flooding or residual risk scenario
- Dry access is available to site in highest flood risk mechanism

The additional information that will need to be considered to inform which category the site is in are the:

- Highest risk flooding mechanism extent and depth layer (flooding type is defined in community summary table and visual extent displayed in community interactive mapping).
- Most likely source of flooding extent and depth layer (flooding type is defined in community summary table and visual extent displayed in community interactive mapping).
- Likely maximum depth of flooding in the event of a breach (shown on the community interactive mapping)

Where detailed flood modelling information is not available for river and sea flooding, the Environment Agency's Risk of Flooding from Rivers and Sea data can be used to help differentiate between degrees of flood risk. This is shown on the community interactive mapping and also available from GOV.uk. It takes into account the presence of defences but does not consider the risk of breach.

Additional Complexities

- Building on the NPPF requirements for a risk-based approach in the assessment of development locations, the community summary tables also present a summary of the opportunities for sustainable development within a community through the identification of regeneration schemes, upcoming development works and future investment opportunities within a community. This is informed by both local and national policy as well as information provided by the Environment Agency pertaining to defences (outlined in Section 3).

- In pumped and drained areas there will be additional risk to be considered. Internal Drainage Boards should be consulted to understand the risk to sites before proceeding.

4.2 Exception Test

The application of the Exception Test will depend on the flood risk to a site and the type of development proposed. Table 4-1 below shows an overview of the type of development that is appropriate by Flood Zone (subject to the Sequential Test being applied).

Table 4-1: Flood risk vulnerability and Flood Zone 'compatibility' from NPPF

Vulnerability Classification		Essential infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zones	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test	✓	✓
	Zone 3a	Exception Test	✓	x	Exception Test	✓
	Zone 3b	Exception Test	✓	x	x	x
Source: Table 3, NPPF Guidance - Flood risk and coastal change						

Information that can be used to inform the Exception Test for planners is presented on the community summary tables and interactive community mapping. Developers should remember that when assessing on a site-specific level that all information provided in the community summary tables is completed at a strategic level and that site-specific FRAs should be carried out to inform the Exception Test (where required).

Additional Complexities

- The community summary tables set out opportunities for sustainable development. These can help to identify for high flood risk areas where developments could make a financial and/ or in-kind contribution towards the future upkeep or improvement of flood defences. This could be used (in agreement with the Council) to help demonstrate that the development could be made safe from flooding in line with the Exception test.
- To demonstrate the Exception Test has been passed, flood resilient design and emergency planning must be accounted for. Developers will need to demonstrate that any residual risk can be safely managed and that there are safe access and escape routes where appropriate, as part of an agreed emergency plan. The Borough Council has an agreed Flood Risk Design Guidance that should be applied to the design of developments in high flood risk areas.
- Owing to the nature of the Borough, there are a large number of Internal Drainage Board drains which will need specific mitigation and hydraulic modelling. Therefore, it is strongly recommended that developers engage with Internal Drainage Boards early.
- The Flood Zones presented as part of the Level 2 SFRA are strategic assessments of fluvial and tidal risk, and not always informed by detailed

modelling (where it is not available). Fluvial and tidal risk need to be confirmed in a site-specific FRA as some watercourses may not appear to have an associated floodplain (watercourses with a catchment area less than 3km² are not represented in Environment Agency flood maps) or some flooding outlines may be too conservative and therefore detailed hydraulic modelling is required to more accurately assess fluvial and tidal risk.

- A broadscale assessment of suitable Sustainable Drainage Systems (SuDS) options has been provided giving an indication where there may be constraints to certain sets of SuDS techniques. This assessment is indicative and more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. It may be possible that those SuDS techniques highlighted as possibly not being suitable can be designed to overcome identified constraints.
- SuDS should ensure that post-development run-off rates are attenuated to reduce existing downstream risk, in line with the National Standards for SUDs and Local Guidance for SUDS produced by Norfolk County Council.
- Developments should be sustainable and support adaption to climate change, which may involve flood resilience and resistance measures.

4.3 Flood Risk Assessments

The Level 2 SFRA is not intended to replace site-specific Flood Risk Assessments (FRAs). 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. Part b requires a FRA to '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 FRA is required for all developments:

- in Flood Zone 2 and 3
- over 1ha in Flood Zone 1
- less than 1ha in Flood Zone 1 including a change of use in development type to a more vulnerable class where they could be affected by a source of flooding other than rivers and sea
- in an area within Flood Zone 1 which has critical drainage problems as notified by the Environment Agency

Detailed guidance on FRAs is available in the 2018 Level 1 SFRA. In summary, a FRA should involve:

- Consultation with the Local Authority, LLFA, Environment Agency and relevant IDB (if applicable) at an early stage.
- Identification and detailed analysis of all sources of flooding at a site-specific scale. Whilst the SFRAs can be used as a starting place to identify the risk, further investigation will often be needed at a site level.
- More detailed hydrological and hydraulic assessments of watercourses/ coastal flooding/ surface water flooding impacting a site to verify flood extent (including the latest climate change allowances), inform master planning and prove whether Part b of the Exception Test can be passed.

- Development of suitable and sustainable mitigation measures to manage the actual risk of flooding to a site (taking into account any existing flood defences and their sustainability over the lifetime of the development).
- An assessment of the residual risk where developments may be at risk of infrastructure failure e.g. culverts becoming blocked and breaches in flood defences. Depending on the site of site and vulnerability of the development, Developers may be required to undertake more detailed hydraulic modelling to understand the risk from a breach to inform a FRA. This should be agreed with the Environment Agency.
- To account for residual risk, site specific emergency plans should be prepared. FRAs should demonstrate how the Borough Council Flood Risk Design Guidance has been applied to the design of developments in high flood risk areas.
- An assessment of the local topography, geology and drainage systems (including sewer capacity) to inform the design of SUDs.

4.4 Windfall Sites

The Borough Council of King's Lynn and West Norfolk would like to encourage applications from windfall sites within settlement boundaries. The standalone Appendix C provides detailed guidance on how to apply the Sequential and Exception Test at a Planning Application stage.

The principles outlined in this Chapter will also be helpful to guide Developers in:

- Using Figure 4-1 and 4-2 to support the demonstration sequentially of how reasonably available alternative sites have been considered in lower flood risk areas
- Using the additional guidance regarding the Exception Test at a community level in the consideration of both the flood risk to and from the site and wider sustainability benefits that a new development could bring in terms of reducing flood risk in a wider area and contributing to wider sustainability initiatives, such as regeneration.

4.5 Use of SFRA data and future updates

It is important to recognise that the SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding and the potential impacts of climate change.

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 site-specific FRA.

The SFRA is a strategic document and is not intended to replace the need for Developers to obtain detailed and site-specific flood risk information to inform Flood Risk Assessments. Rather it should be used to help apply the Sequential Test at an early stage and to scope and guide the contents of site specific Flood Risk Assessments and the Exception Test if it is required.

The SFRA should be periodically updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. It is recommended that the SFRA is reviewed internally on a quarterly basis, in line with the Environment Agency's Flood Zone map updates to ensure latest data is still represented in the SFRA. Checks should also be made with the LLFA, as well as the Highways Authority, Water Companies and IDBs for any new information.

A Screening of communities for Level 2 SFRA

The Proposed Local Plan review (2016 -2036) Settlement Hierarchy		
1. Sub-Regional Centre (1)		
King's Lynn, including West Lynn (tidal and small watercourses/ surface water)		
2. Main Towns (2)		
Downham Market (tidal and small watercourses/ surface water)	Hunstanton (coastal and small watercourses/ surface water)	
3. Settlements Adjacent to King's Lynn and the Main Towns (4)		
North Wootton (tidal and small watercourses/ surface water)	West Winch (tidal and small watercourses/ surface water)	
South Wootton (tidal and small watercourses/ surface water)	Wisbech Fringe (Inc. Walsoken) (tidal)	
4. Growth Key Rural Service Centres (2)		
Marham	Watlington	
5. Key Rural Service Centres (23)		
Brancaster with Brancaster Staithe/Burnham Deepdale (coastal)	Feltwell with Hockwold-cum-Wilton	Stoke Ferry
Burnham Market (small watercourses/ surface water)	Great Massingham	Southery (fluvial)
Castle Acre	Grimston/Pott Row with Gayton (small watercourses/ surface water)	Terrington St Clement (tidal)
Clenchwarton (tidal)	Heacham (coastal and small watercourses/ surface water)	Terrington St John with St Johns Highway/Tilney St Lawrence (tidal)
Dersingham (small surface water)	Methwold with Northwold	Upwell/Outwell/Three Holes
Docking	Marshland St James/St John's Fen End with Tilney Fen End (tidal)	Walpole St Peter/Walpole St Andrew/Walpole Marsh (tidal)
East Rudham (small surface water)	Middleton	West Walton (tidal)
Emneth (tidal)	Snettisham (small surface water)	

Green – settlements filtered out due to low flood risk and/ or possible to allocate developments to lower risk areas around settlement

Red – further modelling needed

Black – Level 2 analysis based on existing information

B Strategic Sites Level 2 Assessment

B.1 Borough Wide Summary Maps

B.2 L2 Site Summary Tables

B.3 Interactive Community Mapping (also known as Geo-PDF Mapping)

- On the GeoPDF, you turn data layers on and off by checking and unchecking the tick boxes adjacent to the relevant data layer.
- Where tick boxes are enabled but no data is displayed upon ticking the boxes, this is where data is not present in this area.
- Where the tick boxes are disabled, this is where data is outstanding.

C Guidance for Developers on applying the Sequential and Exception Tests

This is a standalone document that will be published on the Councils website.

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