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Wisbech Level 2 SFRA Fenland District Council

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Executive Summary

- A1. Fenland District Council have commissioned WSP to undertake a Level 2 Strategic Flood Risk Assessment (SFRA) in accordance with the National Planning Policy Framework (NPPF) and the accompanying Technical Guide.
- A2. This Level 2 SFRA for Wisbech, builds on the findings and recommendations made in the Level 1 SFRA (2011) produced by URS Scott Wilson consultancy for Fenland District Council. This Level 2 report also supersedes the previous Level 2 SFRA report produced by JBA Consulting (2009).
- A3. The aims and objectives of the Level 2 SFRA are as follows:
- To provide a sound and robust analysis of flood risk in and around Wisbech in order for Fenland District Council to make informed decisions about the formulation of policies for the inclusion in its Local Development Framework Plan Documents.
 - To provide an increased scope for assessing flood risk in line with the NPPF and associated Technical Guide.
 - To consider the beneficial effects of flood risk management infrastructure in reducing the extent and severity of flooding when compared to the Flood Zones on the Environment Agency's latest Flood Maps.
 - It should, in particular, facilitate the application of the Sequential Test and Exception Test as set out in Paragraphs 101 and 102 of the NPPF.
 - It should consider the detailed nature of flood hazards and take into account flood defences. It should be sufficiently detailed to allow a Sequential Approach to be adopted within a flood zone (in line with Paragraph 8 of the Technical Guidance to the NPPF).
 - It should make provision for the policies and practices required to ensure that development in such areas satisfies the Exception Test, and that these subsequently be incorporated in Local Development Documents (LDDs).
- A4. In order to provide the necessary level of detail, the study area has been divided up into six sub locations. These are shown graphically in Appendix A.
- A5. This Level 2 SFRA provides a sound framework with an appropriate level of detail required at this stage for making consistent and sustainable future planning decisions.
- A6. Both the Great Ouse CFMP and the Nene CFMP are key policy documents that provide a key strategic insight into the sustainable management of flood risk within the Wisbech study area.
- A7. A large proportion of the study area would flood without defences, as shown on the Environment Agency's Flood Map illustrated for this SFRA in Appendix G. The flood risk management measures include defences, hydraulic structures and water level management systems provided by the Environment Agency and the Internal Drainage Boards.
- A8. A key piece of information that has been used in the production of this Level 2 SFRA is the mapping resulting from the Environment Agency's Tidal Nene Hazard Mapping Study (2011) between Ring's End and Sutton Bridge. This newly released information helps to provide a detailed analysis of the study area's overall sustainability, in terms of development and flood risk.

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- A9. Flood Maps and Flood Hazard maps have been provided in this Level 2 SFRA in order to help assess fluvial and tidal flooding within the study area. Other sources of flooding will need to be assessed on a site-by-site basis.
- A10. One of the key aspects of this Level 2 SFRA is that the entire study area is well defended from fluvial and tidal flood risk issues. This defence is provided by the Environment Agency and other land owners through a combination of raised flood defences along the River Nene, pumping stations and other assets owned and maintained by the various Internal Drainage Boards. Providing these defences are well maintained and upgraded when necessary, sustainable development could occur in defended flood risk areas subject to the Sequential and Exception tests being passed, assessment of residual risk and consideration of the implications of the Hazard Mapping.
- A11. A key reason for the production of the SFRA is to allow Fenland District Council to undertake further analysis that provides the evidence base for the Sequential and Exception Tests. This Level 2 SFRA focuses on parts of the study area where there is a potential development pressure in zones of medium to high flood risk, and where there are no other suitable alternative areas for development after applying the Sequential Test. This level 2 SFRA should be used by Fenland District Council to assist in performing the Sequential and Exception tests.
- A12. The SFRA evaluates the current flood risk situation and the future flood risk situation over a 109 year timeframe (2115), incorporating the impacts of climate change in line with the NPPF. The current situation has been assessed based on data derived in 2006 which is the best available data at the time of writing.
- A13. An FRA Toolkit has been provided for the study area in Appendix J. This will allow Fenland District Council to consider appropriate flood risk issues affecting future development proposals. Where necessary, mitigation measures should be implemented in order to achieve sustainable development at both a site specific and strategic scale.
- A14. Completion of the Level 2 SFRA will provide the Council with the necessary level of information for understanding flood risk at the local level. This will allow the Council to give full consideration of flood risk issues when preparing planning policies and making planning decisions.
- A15. The Level 2 SFRA is a living document and should therefore be reviewed in line with the production of the Council's Local Development Plan or at least every five years, to reflect any amendments in future growth proposals.

GLOSSARY

Annual Exceedance Probability (AEP)	Annual Exceedance Probability is the estimated probability of a flood of given magnitude occurring or being exceeded in any year. Expressed as, for example, 1 in 100 chance or 1 per cent.
Breach Flood Hazard Map	The breach flood hazard map shows the level of flood hazard to people (called a hazard rating) if the flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater.
Brownfield Land	Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building; for example a house and its garden would be considered to be previously developed land.
Catchment	An area drained by a specific river / watercourse.
Catchment Flood Management Plan (CFMP)	A Catchment Flood Management Plan is a strategic planning tool through which the Environment Agency seeks to work with other key decision-makers within a river catchment, to identify and agree policies for sustainable flood risk management.
Core Strategy	The Development Plan Document within the Council's Local Development Framework which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to sustainable development.
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
Environment Agency (EA)	The Environment Agency is an Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs and an Assembly Sponsored Public Body responsible to the National Assembly for Wales.
Floodplain	Any area of land over which water flows or would flow or be stored in the absence of flood defences.
Flood Map	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency. Shows the areas at risk of flooding based on various AEP events, as defined in the following sections.

Flood Zone 1 Low Probability	This zone comprises land assessed as having less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
Flood Zone 2 Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.
Flood Zone 3a High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>0.1%) or a 1 in 200 or greater annual probability of flooding from sea (>0.5%) in any year.
Flood Zone 3b Functional Floodplain	Local planning authorities should identify in their SFRA areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.
Flood Defence	A structure built and maintained specifically for flood defence purposes.
Fluvial	Relating to a watercourse (river or stream).
Green Infrastructure	A network of multi-functional green space for the promotion of natural and ecological processes set at a strategic planning level.
Greenfield Site	Land that is usually agricultural and has not been previously developed.
Groundwater	Water occurring below ground in certain geological formations.
Hydraulic Model	A computer simulation of the water level and flows of water within a watercourse.
Internal Drainage Board (IDB)	An Internal Drainage Board (IDB) is a type of operating authority which is established in areas of special drainage need in England and Wales with permissive powers to undertake works and secure water level management within a drainage district.

J-Flow	J-Flow is a raster modelling software developed by JBA and is used by the Environment Agency for the national generalised flood mapping. J-Flow modelling is considered indicative and does not produce velocities so is not suitable for hazard mapping. JBA have developed a new version of J-Flow in recent years which is detailed under J-Flow GPU.
J-Flow GPU	J-Flow GPU is a 2D modelling software which has been developed by JBA, which solves the 2D Diffusion Wave equations (which are the same equations as solved in TUFLOW but with the acceleration term neglected) in a finite difference methodology. JFLOW-GPU is considered indicative but calculates depth, velocities and flood levels and is able to produce generalised hazard mapping as well as flood mapping.
Light Detection and Ranging (LiDAR)	A method of detecting distant objects and determining their position by analysis of pulsed laser light reflected from their surfaces.
Local Development Framework (LDF)	Will comprise of a portfolio of local development documents which will provide the framework for delivering the spatial strategy for the area.
Main River	These are all watercourses shown on the statutory main river maps held by the Environment Agency and DEFRA listed as a 'Main River'. This may include any structure or appliance for controlling or regulating the flow of water into a channel; the Environment Agency has permissive powers to carry out works of maintenance and improvement on these rivers.
National Planning Policy Framework (NPPF)	The Department for Communities and Local Government current planning guidance for development sites. The NPPF was released in March 2012 and superseded a number of Planning Policy Statements, including Planning Policy Statement 25: Development and Flood Risk. The NPPF is accompanied by a Technical Guide.
Overtopping Flood Hazard Map	The overtopping flood hazard map shows the level of flood hazard to people (called a hazard rating) if the flood defences are overtopped for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater.
Planning Policy Statement	A series of statements issued by the Government, setting out policy guidance on different aspects of planning. They have replaced Planning Policy Guidance Notes. A number, but not all, of the Planning Policy Statements have been replaced by the National Planning Policy Framework.
Pluvial Flooding	Flooding that is directly derived from surface water run-off. It is usually localised in its effects and is caused by rainfall flowing over ground.

Preliminary Flood Risk Assessment (PFRA)	The PFRA is a high level exercise based on existing and available information. It should bring together information from a number of available sources such as the Environment Agency's national information (such as the Flood Map for Surface Water) and existing local products such as Strategic Flood Risk Assessments (SFRAs) and Surface Water Management Plans (SWMPs) in England and Strategic Flood Consequence Assessments (SFCAs) in Wales.
Planning Policy Statement 25 (PPS25)	Planning Policy Statement 25: Development and Flood Risk Department for Communities & Local Government, 2006. PPS25 has been superseded by the National Planning Policy Framework.
Residual Risk	An assessment of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the review process.
Strategic Flood Risk Assessment (SFRA)	The National Planning Policy Framework requires that the evidence base for the Local Development Framework includes a Strategic Flood Risk Assessment (SFRA).
Standard of Protection	The design event or standard to which a building, asset or area is protected against flooding, generally expressed as an AEP.
Source Protection Zone (SPZ)	This is an area where groundwater recharge is captured by an abstraction borehole. SPZs are designated by the Environment Agency so as to protect potable water supplies against polluting activities.
Sustainable Drainage Systems (SuDS)	These are management practices and control structures designed to minimise the impact of surface water on flood risk and the environment. The overall aim is to imitate the natural hydrological cycle.
Sustainable Development	"Development that meets the needs of the present without comprising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987).
Surface Water Management Plan (SWMP)	SWMPs have an important role in developing a coordinated strategic approach to managing surface water drainage and reducing flood risk. They should reflect the future proposals of all key stakeholders and provide a clear delivery plan. They may also provide a way to integrate the requirements of forthcoming River Basin Management Plans. SWMPs should focus on managing flood risk and optimising the provision of SUDS.

TUFLOW	TUFLOW is a commercially available, fully hydrodynamic 2D modelling software package which implements the Two-Dimensional Unsteady flow equations using a finite difference methodology. The 2D modelling package can be integrated with either ESTRY or ISIS 1D modelling software to produce 1D/2D models which incorporate 1D modelling (generally for culverts and open channels/river) and 2D methodology (floodplain). TUFLOW calculates depth, velocities and flood levels and is suitable for producing flood hazard maps as well as flood maps.
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ABBREVIATIONS AND ACRONYMS

AEP	Annual Exceedance Probability
CFMP	Catchment Flood Management Plan
DCLG	Department for Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FDC	Fenland District Council
FEH	Flood Estimation Handbook
FDS	Flood Defences Scheme
FRA	Flood Risk Assessment
FSR	Flood Studies Report
FWD	Floodline Warnings Direct
IDB	Internal Drainage Board
LiDAR	Light Detection And Ranging
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NFCDD	National Flood and Coastal Defence Database
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Policy Guidance
PPS25	Planning Policy Statement 25 (Development and Flood Risk)
RSS	Regional Spatial Strategy
SAB	SuDS Approval Body
SFRA	Strategic Flood Risk Assessment
SPZ	Source Protection Zone
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
WCS	Water Cycle Strategy / Water Cycle Study
WFD	Water Framework Directive
WMA	Water Management Alliance

1 Introduction

1.1 BACKGROUND

1.1.1 Fenland District Council is currently in the process of preparing their Core Strategy for the Local Development Framework; the Core Strategy is due to be adopted by the autumn of 2012. As part of their Core Strategy, the Council are seeking to allocate development in Wisbech. For the purposes of this Strategic Flood Risk Assessment (SFRA) the study area has been divided up into the following sub locations (See Appendix A);

- Sub location A - East;
- Sub location B - South;
- Sub location C - West;
- Sub location D - North West;
- Sub location E - North;
- Sub location F - Centre.

1.1.2 These sub locations have been assessed in detail as part of the Level 2 SFRA.

1.2 OBJECTIVES

1.2.1 The overall objectives of the Level 2 Strategic Flood Risk Assessment are to:

- Provide a sound and robust analysis of flood risk in and around Wisbech in order for the Council to make informed decisions about the formulation of policies for inclusion in its Local Development Framework (LDF) Development Plan Documents;
- Provide an increased scope for assessing flood risk in line with the National Planning Policy Framework and associated Technical Guide;
- Consider the beneficial effects of flood risk management infrastructure in reducing the extent and severity of flooding when compared to the Flood Zones on the Environment Agency's latest Flood Map;
- Facilitate the application of the Sequential Test and Exception Test as set out in Paragraphs 101 and 102 of the NPPF;
- Consider the detailed nature of flood hazards and take into account flood defences. It should be sufficiently detailed to allow a Sequential Approach to be adopted within a flood zone (in line with Paragraph 8 of the Technical Guidance to the NPPF).
- Make provision for the policies and practices required to ensure that development in such areas satisfies the Exception Test, and that these can subsequently be incorporated in the Local Development Documents.

1.3 SCOPE

1.3.1 This Level 2 SFRA focuses on the identification and assessment of the principle sources of flood risk associated with the study area in Wisbech (see Appendix A). All aspects of surface water, ground water and fluvial/tidal flooding have been assessed in line with the requirements of a Level 2 SFRA as detailed in the NPPF. Flood Risk and Flood Hazard mapping have been provided where available, in order to assess both fluvial and tidal flooding in the study area. Recommendations on the application of various SuDS techniques have also been provided.

1.3.2 The SFRA is essentially a planning tool. It provides an assessment of flood risk intended to inform the spatial planning process and therefore the level of detail and accuracy relates to this strategic objective. The SFRA will help to steer future land use in a sequential and holistic manner, taking into consideration sustainability and the requirements of the NPPF and the Technical Guidance to the NPPF (March 2012).

2 Legislation and Planning Context

2.1 NATIONAL PLANNING POLICY

The National Planning Policy Framework (NPPF)

2.1.1 Since 1988 the Government has been issuing national guidance in the form of Planning Policy Guidance Notes (PPG's). The Department for Communities and Local Government's (DCLG) Planning Policy Statement 25: Development and Flood Risk (PPS25) replaced PPG25 in December 2006 and was revised in March 2010. The National Planning Policy Framework replaced Planning Policy Statement 25 in March 2012.

2.1.2 Paragraph 100 of the NPPF states:

Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary making it safe without increasing flood risk elsewhere. Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:

- *Applying the Sequential Test;*
- *If necessary, applying the Exception Test;*
- *Safeguarding land from development that is required for current and future flood management;*
- *Using opportunities offered by new development to reduce the causes and impacts of flooding; and*
- *Where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations.*

2.1.3 The NPPF Technical Guidance published alongside the NPPF provides further detail on how this policy should be implemented.

2.1.4 The DCLG aims to reduce the risks to people and the developed and natural environment from flooding by discouraging further built development within floodplain areas and by promoting best practice for the control of surface water runoff.

2.1.5 As part of best practice and in line with Environment Agency guidance, Fenland District Council have commissioned a Level 2 SFRA for Wisbech in order to define areas suitable for development from a flood risk perspective. This study also provides a reference and policy document to assist consideration of development proposals.

2.1.6 This SFRA has been prepared based on the guidance set out in the NPPF and the associated Technical Guidance. The study also builds on the findings of the Level 1 SFRA (2011) produced by URS Scott Wilson consultancy, which assessed the entire Fenland District.

2.2 REGIONAL AND LOCAL PLANNING CONTEXT

East of England Regional Flood Risk Appraisal

2.2.1 The overarching aim of the East of England Regional Flood Risk Appraisal (2009) (RFRA) was to inform the Regional Spatial Strategy (RSS) of flood risk issues. It is the intention for the Government to revoke the RSS East of England Plan (2008) as set out in the Localism Bill. However, until the Localism Act comes in to effect the RSSs should still be used by decision makers, although the intention to revoke it should be a material consideration in assessing development proposals. The East of England Plan highlighted that:

"Strategic Flood Risk Assessments should be carried out to refine information on areas that may flood from rivers or sea flooding or other sources of flooding such as groundwater and sewers, and assess local flood risk. Strategic Flood Risk Assessments should take into account the impacts of climate change. They provide the basis from which to apply the sequential test and exception test in allocating areas for development and for preparing policies for flood risk management and sustainable urban drainage."

2.2.2 One of the key objectives of the East of England Plan is to reduce the risk of the adverse impact of flooding on people, property and wildlife habitats.

2.2.3 As previously stated, Fenland District Council are currently preparing a Local Development Framework (LDF) to replace the existing Local Plan. A Fenland Neighbourhood Planning Vision Study has been undertaken and the associated documents will be used to inform the Council's emerging LDF work.

2.2.4 Fenland District Council is currently in the process of preparing their Core Strategy for the LDF; the Core Strategy is due to be adopted by the autumn of 2012. A draft version of the Core Strategy is currently available and was out for consultation from 29 July to 23 September 2011. The Core Strategy will set out proposed planning policies to guide future development. The policies will take into account all up-to-date government guidance including the Level 1 and Level 2 SFRA's. Both these documents provide an important evidence base for the Local Development Documents.

2.2.5 Flood risk is a key issue that needs to be taken into consideration, when making sustainable land use planning decisions within the Wisbech study area.

2.3 FLOOD AND WATER MANAGEMENT ACT

2.3.1 The Flood and Water Management Act 2010 provides duties on the Environment Agency, Local Authorities, Developers and other bodies to manage flood risks. The Act establishes a SuDS Approving Body (SAB) at county or unitary local authority level.

2.3.2 The Act sets out the requirements for local flood risk for England and defines the Lead Local Flood Authority for an area as the Unitary Council or County Council.

"A lead local flood authority for an area in England must develop, maintain, apply and monitor a strategy for local flood risk management in its area (a local flood risk management strategy)."

The Lead Local Flood Authority for Fenland is Cambridgeshire County Council.

2.3.3 The Lead Local Flood Authority will be responsible for ensuring the strategy is put in place however local partners can agree how to develop it. Local flood risk, as quoted above, takes into consideration all forms of flooding including surface runoff, groundwater and ordinary watercourses (including lakes and ponds).

2.3.4 Further information on the act with regard to SuDS is listed in section 7.5.

2.3.5 The Act received Royal Assent on the 8th April 2010. The Act is being put through commencement in parts and not as a whole document and therefore some parts of the act have already been implemented. Summaries of the current status of the Act (as in significant enactment) are listed below (note this is not intended to be a complete list and relates to Legislation Status as of the start of May 2012). The measures implemented are as follows:

- Commencement Order Number 1: This order brings in new powers and duties on national and local strategies and reporting on flood and coastal erosion risk management and amends certain roles and responsibilities under the Coastal Protection Act 1949, Land Drainage Act 1991, and Water Resources Act 1991;
- Commencement Order 2: Brings into force provisions of the Flood and Water Management Act to provide power for Ministers to work orders and regulations to give effect to the Act.
- Commencement Order Number 3: This Includes amongst other things, most of the duties and powers for Lead Local Flood Authorities (LLFA). It also gives the Environment Agency and the LLFAs the 'Power to request information' to fulfil their flood risk management functions. The three sets of regulations relate to the creation of Regional Flood and Coastal Committees, Environment Agency Levies, and Scrutiny Committees;
- Commencement Order Number 4: Includes the following:
 - Requires the Environment Agency to develop, maintain, apply and monitor a National Strategy for flood and coastal erosion risk management in England;
 - Requires Risk Management authorities in England (EA, LLFAs, LPAs and IDBs) to carry out flood and coastal erosion risk management functions in line with the national flood and coastal erosion management strategies;
 - Amends the Land Drainage Act 1991 (LDA), Coastal Protection Act 1949, Water Resources Act 1991 (WRA), and the Environment Act 1995 to use the same terms as within the Flood Water Management Act (2010). The amendment to the LDA allows the EA to pass land drainage obligations (not related to main rivers) to the IDBs where they exist and to the LLFA for any other area.
 - Provides LLFA with the power to carry out flood risk management works as long as this work is desirable, takes into account the local flood risk management strategy, and manages flood risk from surface run-off or groundwater;
 - Requires LPA's to carry out drainage works in accordance with the local flood risk management strategies and without direct supervision of the EA;
 - Broadens the circumstances that the risk management authorities can make bylaws;
 - Provides EA with new provisions to carry out flood and coastal risk management works.

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- Gives the EA the responsibility for providing guidance regarding the application of strategy (particularly for English risk management authorities) on how to comply with the duties to operate and provide information.
 - Commencement Order 5: This order requires all flood risk management authorities to contribute towards sustainable development when exercising their flood and coastal erosion risk management functions. It instigates new legal definitions relating to reservoirs and amends the Reservoir Act 1975 to introduce a risk-based approach to reservoir safety.
 - Commencement Order 6: Covers an amendment to the LDA and relates to flood defence consents and the management of water courses.

2.3.6 Further information on the Flood and Water Management Act can be found on the DEFRA website at <http://www.defra.gov.uk>.

2.4 LOCALISM BILL

2.4.1 The Government has introduced the Localism Bill, which proposes to change the way that many parts of government are run. The Bill shifts many aspects of power from central government to local authorities, allowing local councils more freedom in what they do. The Bill also allows individuals to have more influence over their councils; it will also reform aspects of the planning system.

2.4.2 The ramification of this Bill is that it will empower local communities to have a greater influence over proposed growth within their area. Communities will be given the opportunity to influence planning decisions to a greater extent. This Level 2 SFRA is a key piece of technical evidence that seeks to inform Fenland District Council and residents within the study area, of the main issues in relation to sustainable development and flood risk.

2.5 THE SEQUENTIAL TEST

2.5.1 The Sequential Test, as set out in the NPPF and associated Technical Guidance, aims to steer vulnerable development towards areas of lower flood risk. The Sequential Test should demonstrate where there are sites available in areas of a lower probability of flooding. Following on from the Level 1 SFRA, a key reason for the completion of the Level 2 SFRA is to provide supporting evidence for Fenland District Council to undertake this test in more detail in relation to land allocations in the study area (see Appendix A). The Level 2 SFRA should also assist the sequential approach within a specific site to prevent inappropriate development in areas of high flood risk.

2.6 THE EXCEPTION TEST

2.6.1 The NPPF outlines the use of the Exception Test for testing whether particular development is suitable even within areas vulnerable to flooding. Following application of the Sequential Test, if it is not possible consistent with wider sustainability objectives for the development to be located in zones of lower probability of flooding, the Exception Test can be applied.

2.6.2 The Exception Test provides a mechanism for managing flood risk while still allowing necessary development to occur. It should not, however, be used to justify 'highly vulnerable' development in Flood Zone 3a, or 'less vulnerable', 'more vulnerable' and 'highly vulnerable' development in Flood Zone 3b.

2.6.3 For the Exception Test to be passed it must be demonstrated that:

- the development provides wider sustainability benefits to the community that outweigh flood risk, informed by an SFRA where one has been prepared;
- a site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.

2.6.4 Both parts of the Exception Test must be passed for development to be acceptable.

2.6.5 As highlighted in the East of England Regional Flood Risk Appraisal:

"where local authorities have identified that it is necessary for development to be located in Flood Zones 2 and 3 then a more detailed Level 2 SFRA should be prepared."

2.6.6 This Level 2 SFRA provides supporting information for the Exception Test to be undertaken for any potential development sites that fall within areas of medium to high probability flood risk. This SFRA takes no account of other socio-economic or sustainability factors other than flood risk and drainage infrastructure. These wider issues are to be considered by Fenland District Council as part of their Sequential Test and Exception Test procedures.

2.7 LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

2.7.1 A Level 1 Strategic Flood Risk Assessment (SFRA) for Fenland District Council was published in 2005. This was prepared in full accordance with the flood risk management guidance set out in Planning Policy Guidance 25 (PPG25) Development and Flood Risk.

2.7.2 A Level 1 SFRA has been produced by URS Scott Wilson for the whole of the Fenland District as part of a joint Water Cycle Study with East Cambridgeshire District Council. This has been commissioned by Cambridgeshire Horizons. The final version dated July 2011 has been used to inform this study. The document incorporates guidance based on PPS25 and identifies local flooding constraints, sufficient to assist Fenland District Council with the formulation of planning policies, and the variation in flood risk across Fenland District Councils administrative area for current climatic conditions and accounting for the predicted effects of climate change.

2.8 CATCHMENT FLOOD MANAGEMENT PLANS

2.8.1 The key objective of Catchment Flood Management Plans (CFMPs) is to set policies across the whole catchment which will achieve long-term sustainable flood risk management. The western half of the study area is covered by the River Nene CFMP, with the eastern half covered by the Great Ouse CFMP. A plan showing the extent of these CFMPs within the study area is included in Appendix B of this report.

2.8.2 CFMPs act as high level strategic documents which assess the sustainable management of flood risk within the catchment over the next 50 to 100 years.

River Nene Catchment Flood Management Plan

2.8.3 The River Nene Catchment Flood Management Plan (CFMP) was issued in December 2008 and impacts on the majority of the western part of the study area (see Figure 1 in section 3.1.8 and Appendix B).

2.8.4 The overall role of the CFMP is to establish flood risk management policies that will deliver sustainable flood risk management for the long term within the River Nene CFMP area.

2.8.5 The Environment Agency has divided the River Nene catchment into sixteen distinct Policy Units which have similar physical characteristics, sources of flooding and levels of risk. The western and central part of Wisbech falls into The Fens Policy Unit. Flood management policy options have been identified by the Environment Agency to manage flood risk within these sub areas. These five policies are listed below:

- Policy Option 2 - Reduce current levels of flood risk management;
- Policy Option 3 - Continue with existing or alternative actions to manage flood risk at the current level;
- Policy Option 4 - Take further action to sustain flood risk now/and or in the future;
- Policy Option 5 - Take further action to reduce flood risk; and
- Policy Option 6 - Take action with others to store water or manage runoff in locations that provide overall risk reduction or environmental benefits locally or elsewhere in the catchment. Applying P6 indicates that there is potential to store water somewhere within the policy unit to achieve benefits either locally or elsewhere.

2.8.6 For The Fens, Policy Option 4 (see above) was chosen. The reason why this Policy Option was chosen is that it will allow present actions to control flood risk to be continued and enhanced, avoiding an increase in the serious residual risks arising from defence failure. Some further reductions in potential damage may be gained from other related measures such as improved flood warning, development control decisions and emergency response planning. It is envisaged that a cross-catchment approach to find the most suitable way of sustaining the high level of flood defence will be the most appropriate.

2.8.7 Adopting Policy Option 4 for The Fens supports economic, social and environmental sustainability by sustaining the high standard of protection. It aims to offset future impacts from climate change and development. The objectives which are met by this policy (1% AEP future flood impact, compared to current baseline) are:

- To minimise flood related risk to the population (defence standard maintained, no change in people at risk);
- To minimise the risks to critical infrastructure and community facilities (major assets protected);
- To minimise community disruption from flooding (defence standard maintained, no change in properties at risk);
- To minimise economic impacts of flooding (no change in property damage);
- Ensure future investment in the catchment is proportional to the risks (estimated £4 million cost of works, reduction in property damages likely to be accrued as a result of breaching);
- Protect and enhance significant historic environment assets and their settings (no change);
- Enhance the biodiversity of the catchment by improving the quality of the river environment, contributing to UK Biodiversity Action Plan targets (no change); and

-
- Support the achievement of good status/potential of surface and groundwater bodies under the Water Framework Directive (likely reduction in pollutants resulting from enhanced land management).

Great Ouse Catchment Flood Management Plan

2.8.8 As shown in Figure 1 in section 3.1.8 and Appendix B, the eastern part of the study area falls into the area of the Environment Agency's Great Ouse CFMP.

2.8.9 The overall aim and scope of the CFMP is to develop sustainable policies for managing increased flood risk in the long term that may result from climate change and changes in land use and land management. In order to achieve the aims and objectives of the CFMP it aims to:

- Present and improve an understanding of flood risk issues in the Great Ouse CFMP and allow the Environment Agency to further analyse the flooding processes within the catchment;
- Finalise the Environment Agency's future scenarios for the Great Ouse and assess possible changes in flood risk compared to current conditions;
- Identify the opportunities for, and constraints to, flood risk management that the Environment Agency have in the Great Ouse Catchment and finalise the overall CFMP objectives;
- Allow the Environment Agency to select their preferred flood risk management policies for the Great Ouse through a policy appraisal process. This will involve assessing flood risk under different future scenarios with different management options, and assessing the potential effect of different options on the CFMP objectives; and
- Agree an action plan to manage flood risk in the Great Ouse catchment and assign responsibility to the Environment Agency, other operating authorities, local authorities, water companies or other organisations.

2.8.10 The CFMP highlights the broad areas of the Great Ouse where the Environment Agency needs to take specific actions; these are known as Policy Units. There are 25 in total. For each Policy Unit the Environment Agency will define a specific policy for managing flood risk. The Environment Agency will implement policies by carrying out specific actions, and working with other organisations responsible for flood risk management. The six Policy Options (one of which is chosen for each Policy unit), are as follows:

- Policy Option 1 - No active intervention (including flood warning and maintenance). Continue to monitor;
- Policy Option 2 - Reduce existing flood risk management actions (accepting that flood risk will increase over time);
- Policy Option 3 - Continue with existing or alternative actions to manage flood risk at the current level;
- Policy Option 4 - Take further action to sustain current scale of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change);

-
- Policy Option 5 - Take further action to reduce flood risk (now and/or in the future); and
 - Policy Option 6 - Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment (which may constitute an overall flood risk reduction, for example habitat inundation).

2.8.11 The eastern part of Wisbech, as shown in Appendix B, falls into Policy Unit 24- The Fens. The Policy Option chosen for this unit is Policy 4 (see section 2.8.10). The CFMP highlights that the main risk to the Fens is from overtopping or breaching of embankments along high-level watercourses.

2.8.12 The justification for adopting Policy 4 is to focus efforts on sustaining the current level of flood risk into the future, avoiding any rise in risk to the Fens Policy Unit. Policy 4 will allow present actions to control flood risk to be continued and enhanced (for example maintaining the washlands, maintenance of the watercourse and other defences and flood warning). The resulting future flood risk then remains at the current level. By adopting Policy 4, the Environment Agency will be able to develop a flood risk management plan for the Fens to investigate how flood risk varies across the area and the best approach to manage this risk. The objectives which are met by this policy (1% AEP future fluvial flood impact and 0.5% AEP future tidal flood impact, compared to current baseline) are:

- To minimise flood related risks to the population;
- To minimise risks to critical infrastructure;
- To minimise community disruption from flooding;
- Manage flood risk to sites of cultural heritage and landscape;
- To minimise economic impacts of flooding;
- Ensure future investment in the catchment is proportional to the risks;
- Manage flood risk to habitat and species;
- Protect and improve hydro morphology and geomorphology in accordance with the objectives in the WFD; and
- Protect and improve water quality in accordance with the objectives of the Water Framework Directive.

2.8.13 Both the Great Ouse CFMP and the Nene CFMP are key policy documents that provide a key strategic insight into the sustainable management of flood risk within the Wisbech study area.

2.9 THE WASH SHORELINE MANAGEMENT PLAN

2.9.1 The Wash Shoreline Management Plan is of no direct relevance to the Level 2 SFRA, as this plan does not cover the Wisbech study area which, although is at risk of tidal flooding (and hence at risk from sea level changes), is not impacted by coastal processes.

2.10 SURFACE WATER MANAGEMENT PLANS (SWMP)

2.10.1 As defined by DEFRA, a SWMP is a framework through which key local partners with responsibility for surface water drainage in their area work together to understand the cause of surface water flooding. This also allows local partners to agree the most cost effective way of managing surface water flood risk. The overall purpose of a SWMP is to make sustainable urban surface water management decisions that are evidence based, risk based, future proofed and inclusive of stakeholder views and preferences.

2.10.2 A SWMP should allow Local Planning Authorities to:

- Undertake a comprehensive assessment of surface water flooding as part of their SFRA and predict where it could happen;
- Make informed land use planning decisions on the basis of such an assessment;
- Clarify responsibilities and co-ordinate investment in drainage systems to manage the risk more effectively and with greater use of sustainable drainage systems; and
- Improve emergency plans for surface water flooding; this approach is pro-active and risk-based, and therefore delivers resources where they are most needed.

2.10.3 The SWMP has been produced for Cambridgeshire and a detailed SWMP is being prepared for the market town of March. It is intended that a SWMP will be provided for Wisbech in the future. The Kings Lynn SWMP is also due to be completed in the summer of 2012.

2.11 CAMBRIDGESHIRE GREEN INFRASTRUCTURE STRATEGY

2.11.1 The Cambridgeshire Green Infrastructure Study contains details of the proposed green infrastructure such as country parks and other green aspects of the landscape.

2.11.2 The area of the study includes Wisbech as part of the Wisbech, Whittlesey and March target area, which is part of Strategic Area 1:River Nene.

2.11.3 Strategic area projects include the Fens Adventurers Partnership: Green Fen Way, and the Fens Waterways Link.

2.11.4 Wisbech has a specific target area project of a Wisbech Country Park, details of which are provided in Appendix 15 of the Green Infrastructure Strategy.

2.11.5 Specific guidance on the Wisbech target area is provided in section 4.2.4 of the Green Infrastructure Strategy document. Opportunities within the target area are provided under specific headings, with an overall focus to address the existing shortage of open space within and around parts of the town, and to develop and enhance the existing provision.

2.11.6 Wisbech is shown as a focus for the River Nene strategic area for providing significant influence to promote sustainable growth and economic development, and support healthy living and wellbeing; a moderate influence to mitigate and adapt to climate change; and a limited influence to reverse the decline in biodiversity.

2.12 EAST CAMBS AND FENLAND DISTRICT OUTLINE AND STAGE 2A WATER CYCLE STRATEGY (WCS)

2.12.1 The overall aim of the East Cambridgeshire and Fenland District Outline Water Cycle Strategy (WCS) is to identify a clear programme of required water services infrastructure and its implementation to support the sustainable delivery of growth up to 2031. The outline Water Cycle Strategy was completed in early 2011.

2.12.2 The specific aims and objectives stated by the stakeholders of the Water Cycle Strategy are:

- Provision of infrastructure timelines up to 2031;
- Policy pathway for achieving Water Neutrality in a practical and achievable manner;
- Identification of local solutions for proposed development;
- Strong evidence base to support Core Strategy Submission;
- Mitigation for downstream control of surface water discharge and the identification of the responsibility for funding and maintenance of control mechanisms and structures;
- Identification of constraints to growth and potential solutions (strategic at Phase 1 and detailed site specific at Phase 2);
- The WCS must meet with the Water Framework Directive and Habitats Directive policy;
- Protection of designated sites and measures to maintain and improve (where possible) biodiversity; and
- Integration with blue/green infrastructure.

2.12.3 The definition of the baseline capacity of the water environment and water services infrastructure is stated in order to identify the key environmental and infrastructure constraints, to identify the allowable development in each area before new infrastructure or mitigation measures are required. Sustainable solutions and mitigation measures are then provided to allow development to proceed. The study acts in a strategic manner due to specific growth areas not being available at the time of completion.

2.12.4 Following the publication of the outline WCS in early 2011 a Stage 2a Water Cycle Strategy was published in September 2011. This looked at how the water cycle constraints identified in the outline WCS relate to potential settlement growth areas. It also provides guidance on a more sustainable approach to the management of surface water.

2.12.5 The Stage 2a Study has been undertaken so that a full Stage 2 Detailed WCS can be later produced which is not yet possible without preferred development locations being identified in the District.

2.12.6 Further detailed assessment work was required to inform the development of the emerging LDF and the potential locations for growth identified. Once the preferred potential allocation sites are determined, following the development of the Core Strategy, the Stage 2b detailed WCS can commence.

2.13 NORFOLK COUNTY COUNCIL

2.13.1 The north east portion of the study area falls within Norfolk County, being part of King's Lynn and West Norfolk Borough Council. As such this area is affected by specific policy documents such as the Green Infrastructure Study, Water Cycle Strategy and Surface Water Management Plan (SWMP) for the area. The SWMP for this area was not published at the time of writing this SFRA.

2.13.2 A summary of these documents is provided below, in context to the SFRA. The documents generally do not reference Wisbech specifically, and focus on King's Lynn and the surrounding area. The resulting policies that affect the Wisbech area are generally broad policies that affect the whole borough.

2.14 KING'S LYNN AND WEST NORFOLK BOROUGH COUNCIL DOCUMENTS

Green Infrastructure Study

2.14.1 A Green Infrastructure Study was published for the Borough in May 2010. The study was produced in two stages. The stage one study provides an initial assessment of existing green infrastructure along with development of a vision for a network of new green infrastructure. The second stage provides targets for implementation of new green infrastructure based on the stage one study.

2.14.2 The stage two aims to provide a plan to inform the structure and future development of green infrastructure in the Borough. The stage two report has an associated action plan which specifies high, medium and low priority projects. The projects focus primarily on the three major towns/cities in the region (King's Lynn, Downham Market and Hunstanton), although there are some more general Borough level projects too. There are no specific projects which directly affect the portion of the study area which falls within the Borough of King's Lynn and West Norfolk.

2.14.3 The Green Infrastructure Study also sets out a number of policies which cover a wide range of issues, such as planning and development, maintenance and management, climate change, and biodiversity. Where new development is planned within the Borough these policies should be reviewed to ensure that the proposals are in line with these policies.

Water Cycle Strategy

2.14.4 A Water Cycle Strategy (WCS) for the Borough was published in December 2009. The WCS covers all aspects of water use within the Borough, including a summary of flood risk informed by the 2005/2008 SFRA for the Borough.

2.14.5 The key issues that are addressed within the WCS are:

- Assessing the capacity of the current water infrastructure to accommodate growth without adversely affecting the environment;
- Identification of constraints to planned growth and commentary on where development may be best located to minimise such constraints;
- Determination of the potential impact of proposed development in the context of requirements of environmental legislation;
- Identification of the infrastructure necessary to achieve the proposed growth within the constraints of the environment and legislation; and
- Development of a strategy for a phased approach to development that allows key growth targets to be met whilst providing sufficient time for the identified infrastructure to be adopted.

3 Study Area

3.1 DESCRIPTION OF THE STUDY AREA

3.1.1 The full extent of the Level 2 SFRA study area is illustrated in Appendix A. As previously stated, the study area has been divided up into six sub-locations which are set out below;

- Sub location A - East: (435 ha)
- Sub location B - South: (266 ha)
- Sub location C - West: (425 ha)
- Sub location D - North West: (378.5 ha)
- Sub location E - North: (333.5 ha)
- Sub location F - Centre: (792 ha)

3.1.2 The study area is centred on the town of Wisbech; the River Nene runs through Wisbech and is tidal at this point. The River Nene is a Main River. Historically Wisbech has evolved and adapted to the flood risk issues associated with the Fens and the River Nene. An extensive network of raised defences (such as walls, sheet piling, and embankments) exists along the Nene, through the centre of the town. Wisbech is located in a fenland area which today can typically be described as generally flat, low lying and consisting of high grade agricultural land. The Wash is located approximately 16km to the north. Figure 1 shows the study area in the context of the surrounding area.

3.1.3 Most of the western half of the study area falls within the River Nene CFMP, whilst the eastern part falls within the Great Ouse CFMP. These two catchments bisect the study area. The Great Ouse is approximately 12km to the east of Wisbech.

3.1.4 As part of their LDF process Fenland District Council produced a Core Strategy Issues and Options 1 Document in October 2006. In September 2007 the Council produced a Core Strategy Options 2 document indicating broad locations for growth in and around the market town of Wisbech. Due to possible flood risk implications the Environment Agency raised concerns about the proposals, particularly to those on the western side of Wisbech. This necessitated further work to be undertaken by the Council to ascertain the extent of flood risk and the implications for future growth in these areas and therefore a Level 2 SFRA was instructed.

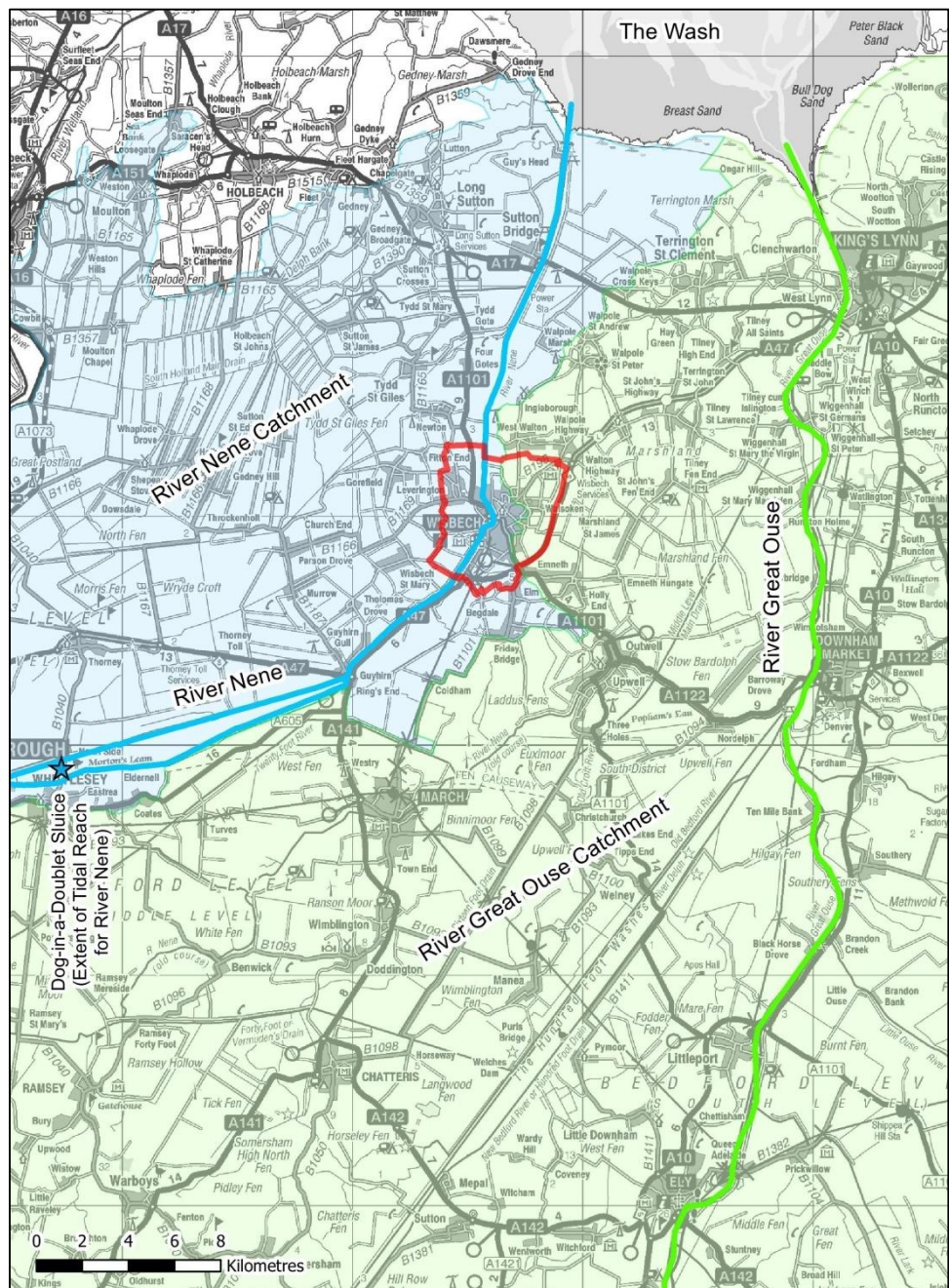
3.1.5 A large part of the study area is made up of greenfield land. The majority of the central Zone F area (see Appendix A) covers the town of Wisbech and is predominantly urban. The River Nene runs through this sub-location. The five other surrounding sub-locations are generally green field in nature, except sub location D in the North West where the village of Leverington is situated.

3.1.6 As highlighted in the watercourses plan in Appendix D, the study area is served by an extensive network of ditches and drains which have transformed the marshy ground of the original fen into high grade agricultural land. These ditches and drains are administered by the various Internal Drainage Boards (IDBs) which cover the study area. Sub-locations A and E fall within the Kings Lynn IDB jurisdiction; sub-locations D and C fall within the jurisdiction of North Level District IDB; sub-location B falls within the control of the Hundred of Wisbech IDB.

3.1.7 Lighting Detection and Ranging Data (LiDAR) is available within the Level 1 SFRA for the study area. LiDAR data is an airborne survey technique that uses a laser to measure the distance between an aircraft and the ground surface. The LiDAR technique records elevations accurate to $\pm 0.3\text{m}$ every 2m.

3.1.8 Based on information extracted from LiDAR data, the topography of the study area ranges from approximately minus 2 to plus 6.5m (Above Ordnance Datum). The centre of Wisbech shows the highest ground levels with the lower areas radiating out from the centre. Development within the centre of the town over the centuries would have contributed to the higher elevations in this area.

Figure 1 – Study Area Overview



3.2 FLOOD RISK REVIEW IN WISBECH

3.2.1 In accordance with the NPPF, Strategic Flood Risk Assessments are required to consider all sources of flooding. This section provides an overview of the different sources of flooding within the study area.

OVERVIEW

3.2.2 The mechanism of flooding at Wisbech can be as a result of a series of sources and not one standalone event. The primary source of flooding in Wisbech is tidal, resulting from the River Nene, however other sources of flooding may pose a risk to both existing and proposed development.

3.2.3 The general topography of Wisbech is low lying and therefore without any form of maintained defences would be at risk from both tidal and fluvial flooding.

3.2.4 Wisbech is a complex area and the mechanisms that are likely to contribute to flooding and rises in water level are as follows:

- Water in existing channels resulting in surcharging of upstream drainage (from tidal effect, fluvial and pluvial contributions);
- Soil types (increase runoff from poor infiltrating soils, saturation of ground);
- Pumping volumes (volumes of storage affected during high water levels);
- Weather conditions (can cause overtopping of defences, contributed to the 1978 flood); and
- Poor Maintenance and Sedimentation (reduce available storage capacity and affects flow routes).

FLOODING FROM RIVERS

3.2.5 The River Nene is a potential source of tidal and fluvial flooding to the study area with the main threat being tidal.

3.2.6 Tidal flooding is most likely to occur during storm surge conditions caused by either one or a combination of the following:

- High tide;
- Low atmospheric pressure; and
- Wind driven waves.

3.2.7 Tidal flood risk within the Wisbech area occurs from the River Nene. The River Nene is tidal from the Wash to the "Dog-in-a-Doublet" sluice near Whittlesey. The River Nene has a series of raised defences along its length (such as walls, sheet piling and embankments) to protect the surrounding area from flooding. Further information on the defences along the River Nene which protect the study area are detailed in section 5.3 and Appendix D of this report.

3.2.8 The Tidal Nene Hazard Mapping Study (2011) has been undertaken along the Tidal River Nene from Rings End to Sutton Bridge, which includes overtopping and breach modelling. Refer to section 4.3 and Appendix E for further information.

3.2.9 Fluvial flood risk is caused by the River Nene and is primarily caused by high rainfall and groundwater levels.

3.2.10 The River Nene is one of several large rivers which drain part of the east of England to The Wash. The catchment of the River Nene extends from The Wash as far west as Daventry and includes the main urban centres of Northampton, Wellingborough, Kettering, Corby and Peterborough.

FLOODING FROM THE SEA

3.2.11 Sea banks (grassed earth banks) along with areas of salt marsh protect the area at risk from flooding around the Wash. Further information on the defences at the Wash can be found in the Wash Shoreline Management Plan.

FLOODING FROM LAND

3.2.12 Intense rainfall, often of short duration, that is unable to soak into the ground (due to urbanisation, poor soil infiltration and/or saturated ground) or enter drainage systems can quickly run off land and result in flooding.

3.2.13 In the summer of 2007 major flooding occurred in the UK, affecting 55,000 properties and over 7000 people needed to be rescued. To understand the likely causes and the lessons learnt, The Pitt Review report "*Learning lessons from 2007 floods*" (2008) was produced. This concluded that a significant proportion of flooding was the result of surface water runoff.

3.2.14 The Environment Agency have undertaken modelling of surface water flooding at a national scale, allowing the production of a Flood Map for Surface Water, which give an indication of the broad areas likely to be at risk of surface water flooding.

3.2.15 The Flood Map for Surface Water does not show flooding that occurs from overflowing watercourses, drainage systems or public sewers caused by catchment-wide rainfall events or river flow. Refer to section 6.4 of this report for further information.

3.2.16 The Flood Map for Surface Water is shown in Appendix G of this report for the study area. This gives an overview only and it is recommended that local knowledge and the SWMP, when available, is referred to.

3.2.17 The majority of surface water drainage in Wisbech is managed by the Internal Drainage Boards (IDBs) through a series of watercourses, which are then pumped in to the River Nene or River Great Ouse.

FLOODING FROM GROUNDWATER

3.2.18 Groundwater flooding occurs when water levels rise above the surface elevations. It is most likely to occur in low-lying areas underlain by permeable rocks.

3.2.19 The River Nene CFMP states there are a number of water-bearing rocks in the River Nene catchment, which could lead to flooding, although few incidents of flooding are recorded.

3.2.20 The Environment Agency has confirmed that they have no record of groundwater flooding incidents within the study area and groundwater levels were unavailable. However, groundwater levels should still be addressed within a site specific FRA. Refer to the toolkit in Appendix J for further information.

FLOODING FROM SEWERS AND OTHER SOURCES

3.2.21 The majority of surface water drainage in Wisbech is managed by the IDBs through a series of watercourses, which are then pumped into either the River Nene or the River Great Ouse. Flooding within the study area could occur if these systems fail. Refer to Section 5.7 for further information on the IDB assets.

3.2.22 Parts of Wisbech outfall directly into the River Nene, and these outfalls may become surcharged (i.e. water cannot free flow out of the outfall structure) when water levels are high. This causes the water to back-up within the drainage system eventually resulting in flooding if no allowance for a surcharged outfall has been made within the drainage design.

3.2.23 Poor maintenance will eventually result in increased sedimentation, blockages or reduced flow capacity, causing water to back-up within the system and eventually result in flooding.

3.2.24 All of these flood risk sources and mechanisms combine to create an overall picture of flood risk for the study area.

3.3 FLOOD RISK MANAGEMENT INFRASTRUCTURE

3.3.1 Details of hydraulic structures such as sluices, weirs and defences within the study area from the National Flood and Coastal Defence Database (NFCDD) have been provided in Appendix D. Details of the hydraulic structures maintained by the Internal Drainage Boards are illustrated on the watercourses plan and listed in Appendix D.

3.3.2 A key requirement of a Level 2 SFRA is to assess the probability and consequences of overtopping or failure of flood risk management infrastructure. Flood breach and overtopping outlines from the River Nene for the study area have been provided in Appendix E as taken from the Environment Agency's Tidal Nene Hazard Mapping Study (2011).

3.4 GEOLOGY, HYDROGEOLOGY AND ENVIRONMENT

Geological Maps

3.4.1 The British Geological Survey classifies the geology of the study area as "Tidal Flat Deposits - Clay and Silt" over a bedrock of "Amphill Clay Formation".

3.4.2 Sustainable Drainage Systems (SuDS) infiltration feasibility plans are shown in Appendix F. These have been provided for the study area based on information taken from the Level 1 SFRA. These plans indicate the potential suitability for SuDS infiltration techniques based on the permeability of ground conditions, although this is not the only factor affecting the choice of SuDS. Infiltration methods rely on discharging to ground, where suitable ground conditions allow. A detailed site specific FRA will need to assess the permeability of the underlying soil through ground investigations. The plan in Appendix F provide an initial indication of the suitability of these methods; the plan shows that the entire study area has a low infiltration potential.

Source Protection Zone Maps

3.4.3 Source Protection Zones (SPZ's), relate to groundwater supplies used for drinking and the risk of contamination through pollution. The Environment Agency classify them into four main zones; Zone 1 (Inner Protection Zone), Zone 2 (Outer Protection Zone), Zone 3 (Total Catchment) and Zone of Special Interest. Based on information provided by the Environment Agency, there are no Source Protection Zones within the study area.

Contaminated Land Issues

3.4.4 Information on potential land contamination issues has been provided by Fenland District Council. An assessment has been provided in Section 7.3 of this SFRA in relation to application of infiltration SuDS techniques and ground contamination issues. A detailed site specific FRA will need to assess these issues in greater detail.

3.5 ADMINISTRATIVE BOUNDARIES

Water Level/Flood Risk Management

3.5.1 The Environment Agency (Anglian Region) covers the entire Wisbech study area. The Wisbech study area also falls within the jurisdiction of the following IDB's; Hundred of Wisbech IDB, North Level District IDB and Kings Lynn IDB (see Appendix D). As shown in Appendix G, Environment Agency flood warning areas cover the central and western part of the study area.

Sewerage

3.5.2 Sewerage records were provided by Anglian Water and reviewed for the study area. Sewerage records for the study area can be viewed through the website DigDat at <http://www.digdat.co.uk>.

3.5.3 All sub locations within the Wisbech study area fall within the Anglian Water sewer network. Anglian Water have confirmed the West Walton Sewage Treatment Works would process foul and combined sewer flows from properties within the study area.

3.5.4 For capacity flow information reference should be made to the latest East Cambridgeshire and Fenland Water Cycle Study and where applicable the Kings Lynn and Norfolk Borough Water Cycle Strategy.

3.6 ROLES AND RESPONSIBILITIES

Fenland District Council

3.6.1 Fenland District Council is the local Planning Authority for the study area and has due regard for drainage and flood risk in accordance with local and national guidance and responses from consultees. The Council's responsibilities with regard to drainage and flood risk include the following:

- Development Management (planning) to ensure new development is not at risk of flooding or exacerbates existing issues;
- Emergency Planning;
- Planning Policy (i.e. LDF), to allocate land to provide a spatial framework for development management decisions taking in to account Strategic Flood Risk Assessments and Surface Water Management Plans;
- Where appropriate to reduce flood risk from ordinary watercourses and from land drainage problems; and
- Fenland District Council own and operate a surface water pumping station in Nene Parade Wisbech, which serves part of the adjacent industrial area.

Environment Agency

3.6.2 The Environment Agency is a governmental organisation whose overarching objective is to protect and enhance the environment in England and Wales. The Environment Agency has permissive and statutory duties to:

- Maintain or improve any watercourses which are designated as Main Rivers;
- Maintain or improve any sea or tidal defences;
- Install and operate flood warning equipment; and
- Control actions by riparian owners and occupiers which might interfere with the free flow of Main Rivers.

3.6.3 Additionally, following the amendment to the Town and Country Planning Act in October 2006, the Environment Agency became a statutory consultee for the LPA for all planning applications within areas of flood risk (except minor developments). The Environment Agency's Standing Advice sets out when the Environment Agency should be consulted on planning applications (consultation matrix), it includes the following planning application scenarios:

- Householder development and alterations within 20m of the top of a bank of a Main River and/or includes culverting or control of flow of any river or stream;
- Non-residential extensions with a footprint of less than 250m² that is within 20m of the top of bank of a Main River and/or includes culverting or control of any river or stream;
- Change of use FROM 'water-compatible' TO 'less vulnerable' development within 20m of the top of bank of a Main River AND if the site falls within Flood Zone 3;
- Change of use RESULTING IN 'highly vulnerable' development within 20m of the top of bank of a Main River AND if the site falls within Flood Zone 2 or 3; and

-
- Operational development of 1 hectare or greater if the development includes culverting or control of flow of any river or stream and/or the development is within Flood Zone 2 or 3.

Internal Drainage Boards (IDBs)

3.6.4 The role of the drainage boards is to maintain a network of watercourses within the study area and to provide drainage. The IDB's operate a series of pumping stations and other assets which are key in managing the water levels within the various IDB watercourses. This responsibility is brought about through Acts of Parliament (Land Drainage Acts) to provide flood protection and water level management services. All drainage boards have the power to undertake works on any watercourse within its district, other than Main Rivers which are maintained by the Environment Agency. Further details on the IDB pumping stations within the study area have been provided in Section 5.7 and Appendix D.

3.6.5 The Land Drainage Acts of 1991 and 1994 require IDBs to provide for:

- General supervision over all aspects of land drainage within its District;
- Improving and maintaining the drainage system, including the operation of pumping stations;
- Regulating activities in and alongside the drainage system, other than on those waterways designated as main rivers and under the Environment Agency's control;
- Duties to conservation; and
- Raising income to support land drainage works.

3.6.6 Under Section 66 of the Land Drainage Act, 1991 and Byelaws approved by the Department for Environment Food and Rural Affairs, the Board have specific requirements that must be complied with when planning or operating near an IDB asset. Permission to carry these works must first be consented by the Board, this will avoid contravention of the Byelaws and enforcement action.

Kings Lynn IDB

3.6.7 The Board's drainage and water level management infrastructure consists of watercourses, pumping stations and a number of other water level control structures. Their infrastructure can be viewed and downloaded from the maps available on the Water Management Alliance (WMA) website. Detailed listings and photographs are also available by clicking on the link shown on the Board's Area webpage.

3.6.8 Not all of the defences within the Drainage District are controlled by the Board: the Environment Agency look after the Main Rivers and Coastal Defences and Kings Lynn IDB has permissive powers to manage the other infrastructure in their Drainage District.

3.6.9 The Board actively maintains only the most critical watercourses that are not classed as Main River, which equates to around 25% of the total length of watercourse in the Drainage District. It is therefore vitally important that these critical watercourses are regularly maintained to design levels, to properly convey flows to the pumps and other water level control structures. For further information please go to the WMA website at <http://www.wlma.org.uk>

Middle Level Commissioners (Hundred of Wisbech IDB / Waldersley IDB)

3.6.10 The Middle Level Commissioners are a statutory corporation with powers and duties under general and local legislation relating to flood risk management and navigation. The Commissioners maintain an arterial system of watercourses and associated apparatus not within the study area. Within and adjacent to the Middle Level area are a number of associated IDBs for whom the Commissioners provide a consultancy service. The Commissioners act as consultants for both the Waldersley and Hundred of Wisbech Internal Drainage Boards.

3.6.11 The Hundred of Wisbech and Waldersley Internal Drainage Boards are autonomous public bodies responsible for the supervision of all aspects of water level management within their districts (other than Main River). They have regulatory powers over land comprised within and adjacent to drainage systems and undertake improvements, maintenance and operation of their flood management assets. The Hundred of Wisbech IDB has some 30km of ordinary watercourses and 3 water control structures. The Board's area extends to some 1,419 hectares and includes part of Wisbech, the villages of Elm and Friday Bridge and the hamlet at Begdale. The Waldersley IDB has some 27km of ordinary watercourses, 2 pumping stations and 2 other water control structures, and provides an outfall from the adjacent Hundred of Wisbech IDB. The Board's area extends to some 2,137 hectares to the south of Wisbech, and provides the outfall from the adjacent Hundred of Wisbech IDB.

3.6.12 For further information please go to the Middle Level Commissioner website at <http://www.middlelevel.gov.uk>

North Level District IDB

3.6.13 The North Level District Internal Drainage Board is a land drainage authority responsible for supervision over all aspects of land drainage and water level management within their district (other than Main River). The Board has permissive powers under the Land Drainage Act 1991 in and adjacent to its designated drainage systems and undertakes improvements, maintenance and operation of their flood management assets. The Board's area extends to some 33,000 hectares of land and the Board is responsible for the improvement and maintenance of some 613 kilometres of watercourse within the area and for the operation of 12 pumping stations.

3.6.14 For further information please go to the North Level IDB website at <http://www.northlevelidb.org>

Anglian Water

3.6.15 Sewerage undertakers are responsible for any sewers adopted under the requirements of the Water Industry Act 1991. They work closely with other stakeholders on the production of planning documents such as Strategic Flood Risk Assessments, Water Cycle Strategies and Surface Water Management Plans.

3.6.16 Anglian Water will consider the adoption and maintenance of Sustainable Drainage Systems (SuDS) in public open spaces, subject to verification of design, construction and maintenance requirements set out within the Anglian Water Sustainable Drainage Systems (SuDS) adoption manual. Anglian Water may also consider the adoption and maintenance of SuDS in development where surface water features integrate with public open space, subject to verification of design, construction and maintenance requirements set out within the Anglian Water SuDS adoption manual.

3.6.17 For further information please go to the Anglian Water website at <http://www.anglianwater.co.uk>.

Cambridgeshire County Council (Lead Local Flood Authority)

3.6.18 Cambridgeshire County Council has a number of specific responsibilities as the Lead Local Flood Authority for part of the study area:

- To develop, maintain and apply a strategy for local flood risk management, including preparation of Surface Water Management Plans;
- To investigate flood events and determine which relevant authorities are involved and whether they have, or have not, discharged their responsibilities;
- To maintain a register of assets (flood defences, drainage infrastructure etc.), including ownership and state of repair;
- Responsibility for flood defence consents and enforcement powers;
- Under the Flood Risk Regulations, to carry out an assessment of flood risks, map risks and hazards and publish a risk management plan in response to identified risks and hazards within a set timescale set out in the EU Floods Directive;
- To approve sustainable drainage systems (SuDS) as part of new development and, ultimately, to be responsible for their adoption and maintenance in perpetuity;
- To use powers to regulate flows of "non main rivers" outside the area of Internal Drainage boards; and
- To plan for, and manage, any flood emergencies which may occur.

3.6.19 In conjunction with these, Cambridgeshire County Council and the partner organisations have further responsibilities including sharing relevant information and co-operating to facilitate the management of flood risk.

Norfolk County Council

3.6.20 Norfolk County Council provides an advisory role to Fenland District Council and acts as the Lead Local Flood Authority for part of the study area.

3.6.21 The north east portion of the study area falls within Kings Lynn and West Norfolk Borough Council, as such both the borough and county council should be included in any pre-discussions and local planning policy requirements adhered to.

4 Methodology

4.1 DATA SOURCES

4.1.1 Data sources used during production of this Level 2 SFRA have been drawn from information provided in the Fenland District Council Level 1 SFRA, produced by URS Scott Wilson consultancy, and the Environment Agency's Tidal Nene Hazard Mapping Study (2011). Additional information was provided by the Environment Agency and the various other stakeholders involved in the production of the study.

4.1.2 Findings and recommendations within the River Nene and the Great Ouse Catchment Flood Management Plans have been key in providing recommendations within the SFRA. This specifically relates to flood defence maintenance and upgrades within the study area.

4.1.3 Information provided in this Level 2 SFRA has also been drawn from the findings provided in the Outline Water Cycle Strategy for East Cambridgeshire and Fenland, produced by URS Scott Wilson consultancy (2010) and the Kings Lynn and West Norfolk Borough Council Water Cycle Strategy by Entec.

4.1.4 Refer to the Data Source Register in Appendix I for a full list of the information received for the production of this Level 2 SFRA.

STAKEHOLDER INFORMATION

Fenland District Council

4.1.5 Information relating to the SFRA was provided by officers at Fenland District Council; disciplines ranging from planning through to Emergency Management were consulted.

Environment Agency

4.1.6 Extensive liaison with the Environment Agency has helped to ensure that the correct information has been provided based on a schedule of data requirements. Key pieces of information have been the Environment Agency's provision of their Tidal Nene Hazard Mapping Study (2011) and data relating to flood defences within the study area.

4.1.7 Further information is available from the Environment Agency upon request.

Internal Drainage Boards

4.1.8 Information was obtained from the following Internal Drainage Boards, which impact on the study area; North Level District IDB; Kings Lynn IDB and Hundred of Wisbech IDB. The jurisdictions of each of these IDBs are illustrated in Appendix D.

Anglian Water Services

4.1.9 Information was provided by Anglian Water Services Ltd relating to sewage treatment works and historical flooding within the study area.

4.2 APPROACH AND METHODOLOGY

4.2.1 This Level 2 SFRA has been conducted in line with the Department for Communities and Local Government (DCLG's) National Planning Policy Framework (NPPF) (March 2012), the Technical Guidance to the NPPF (March 2012), and Fenland District Council's Level 2 SFRA Invitation to Tender document (September 2010).

4.2.2 This section outlines the purpose and deliverables associated with the Level 2 SFRA. In line with the NPPF, the Level 2 SFRA contains the following requirements:

1. *An appraisal of the current condition of flood defence infrastructure and of likely future flood management policy with regard to its maintenance and upgrade;*
2. *An appraisal of the probability and consequences of overtopping or failure of flood risk management infrastructure, including an appropriate allowance for climate change;*
3. *Definition and mapping of the functional floodplain in locations where this is required;*
4. *Maps showing the distribution of flood risk across all flood zones from all sources of flooding taking climate change into account;*
5. *Guidance on appropriate policies for sites which satisfy both parts of the Exception Test, as set out in the NPPF;*
6. *Guidance on the preparation of FRA's for sites of varying risk across the flood zones, including information about the use of SuDS techniques;*
7. *Identification of the location of critical drainage areas and identification of the needs for Surface Water Management Plans;*
8. *Meaningful recommendations to inform policy, development control and technical issues.*

4.2.3 This Wisbech Level 2 SFRA provides clear guidance on appropriate risk management measures for adoption in the parts of the study area which fall within Flood Zones 2 and 3. The SFRA uses Flood Risk and Flood Hazard mapping to illustrate the variation of risk within flood zones. The application of these detailed Flood Risk and Flood Hazard maps allows the SFRA to provide recommendations in terms of the sustainable development of each of the six sub locations.

4.2.4 This Level 2 SFRA seeks to provide a reference for Fenland District Council to help to steer future development within the study area towards areas at a lower risk of flooding and is to be used as a technical base to influence policy with Fenland District Council's Core Strategy and Local Development Framework documents. This is over the lifetime of any proposed development. The SFRA also seeks to set out general guidance on requirements for site specific Flood Risk Assessments within the study area. The Flood Risk and Flood Hazard maps provided in this SFRA (see Appendices E and G), are the basis for assessing development and flood risk issues.

4.2.5 It is acknowledged that one of the key outputs of the Level 2 SFRA is to provide an assessment of the possible impact of a relief road to the western side of the River Nene and the main part of the town. Further information on the potential for a western relief road can be found in section 5.9 of this report.

4.3 ENVIRONMENT AGENCY TIDAL NENE HAZARD MAPPING STUDY (2011)

4.3.1 The Environment Agency have undertaken the Tidal Nene Hazard Mapping Study (2011). The extent of the study area is from Ring's End which is approximately 8km upstream of Wisbech down to Sutton Bridge which is approximately 9.5km downstream of Wisbech. The Tidal Nene Hazard Mapping Study involves both overtopping and breach modelling and mapping along this stretch of the Nene. Thirty six breach locations were modelled in total; out of these thirty six, twenty one fall within the study area.

4.3.2 The flood risk scenarios considered for the overtopping and breach modelling are set out below:

- 0.5% chance (1 in 200);
- 0.5% plus climate change chance (1 in 200 plus climate change);
- 0.1% chance (1 in 1000); and
- 0.1% plus climate change chance (1 in 1000 plus climate change).

4.3.3 The model constructed was a combination of ISIS-TUFLOW software; this model includes IDB drains and pumping stations and any significant floodplain features such as elevated roads. Climate change scenarios cover the period up to 2115. The various mapping output in relation to the study area can be seen in Appendix E.

4.3.4 The various modelling outputs provide a combination of depth and velocity which give a hazard rating in accordance with DEFRA Guidance FD2320 TR2 (see Appendix H for relevant extract).

4.4 CLIMATE CHANGE

4.4.1 The NPPF takes into account the impacts that climate change may have on flooding issues and sustainable development. Global sea levels will continue to rise, depending on greenhouse gas emissions and the sensitivity of the climate system. The allowances for the relative sea rise shown in Table 4 of the Technical Guidance to the NPPF (as shown overleaf) should be used as a starting point for considering flooding from sea, along with the sensitivity ranges for wave height and wind speed shown in Table 5 of the Technical Guidance to the NPPF (as shown overleaf). These effects will need to be incorporated into site specific Flood Risk Assessments (FRAs) (see FRA Toolkit in Appendix J). When assessing climate change, the NPPF encourages an integrated approach across various sectors such as land use, water resources and biodiversity.

4.4.2 Table 4 of Technical Guidance to the NPPF provides the recommended contingency allowances for net sea level rise until 2115. The contents of Table 4 are reproduced overleaf.

Recommended contingency allowances for net sea level rise (from Table 4 of The Technical Guidance to the NPPF):

	Net Sea Level Rise (mm/yr) Relative to 1990			
	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, East Midlands, London, SE England (South of Flamborough Head)	4.0	8.5	12.0	15.0
South West	3.5	8.0	11.5	14.5
NW England, NE England (North of Flamborough Head)	2.5	7.0	10.0	13.0

Notes from the Technical Guidance to the NPPF:

- a) For deriving sea levels up to 2025, the 4mm per year, 3mm per year and 2.5mm per year rates (covering the three groups of administrative Regions respectively), should be applied back to the 1990 base sea level year. From 2026 to 2055, the increase in sea level in this period is derived by adding the number of years on from 2025 (to 2055), multiplied by the respective rate shown in the table. Subsequent time periods 2056 to 2085 and 2086 to 2115 are treated similarly.
- b) Refer to Department for Environment, Food and Rural Affairs *FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities - Climate Change Impacts*, October 2006, for details of the derivation of this table. In particular, Annex A1 of the NPPF Technical Guide shows examples of how to calculate sea level rise.
- c) Vertical movement of the land is incorporated in the table and does not need to be calculated separately.

4.4.3 The predicted increase in sea level from 2011 to 2115 is 1.1m. For Wisbech, this could result in 1.1m higher water levels through the town.

4.4.4 Table 5 of the technical Guidance to the NPPF gives a direction on how impacts of climate change should be calculated and applied. The contents of Table 5 from the Technical Guidance to the NPPF are reproduced below.

Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights (From Table 5 of the NPPF Technical Guidance):

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

Notes from the Technical Guidance to the NPPF:

- a) Refer to DEFRA FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities - Climate Change Impacts. October 2006 for details of the derivation of this table.
- b) For deriving peak rainfall, for example between 2025 and 2055, multiply the rainfall measurement (in mm/hour) by 10 per cent between 2055 and 2085 multiply the rainfall measurement by 20%. Therefore, if there is a 10mm/hour event, this would equate to 11mm/hour for the '2025-2055' period; and for the '2055-2085' period, this would equate to 12mm/hour. Other parameters in Table 5 are treated similarly.

4.4.5 Climate change extents were provided for the Flood Hazard mapping for both breaching and overtopping scenarios (see Appendix E).

4.5 IMPACT OF CLIMATE CHANGE ON THE STUDY AREA

4.5.1 The Technical Guidance to the NPPF takes into account the impacts that climate change may have on flooding issues and sustainable development. Table 5 of the NPPF Technical Guidance (see paragraph 4.4.4 of this SFRA) provides indicative sensitivity ranges for different parameters affecting the likely severity of projected flooding.

4.5.2 Site specific climate change flood outlines have been provided for the 0.5% (1 in 200) and 0.1% (1 in 1000) events for the Tidal Nene Hazard Mapping Study (2011). In line with the requirements of the NPPF Technical Guidance, hydraulic modelling has taken into consideration an increase in peak river flows up to the year 2115. This timescale incorporates the proposed lifetime of a development which is 75 years for commercial and 100 years for residential. The climate change predictions for the Hazard mapping have assumed that the crest levels of the defences remain as they are.

4.5.3 The data provided by the Environment Agency data for the Flood Maps does not have the 'with climate change' outlines and therefore the Flood Zone 3 extent has been based on the Flood Zone 2 extent.

4.5.4 Impacts from climate change will need to be taken into consideration as part of a detailed site specific Flood Risk Assessment within the study area. One of the key objectives of the East of England Plan (2008) is to reduce the region's impact on and exposure to, the effects of climate change by;

"reducing the risk of adverse impact of flooding on people, property and wildlife habitats".

4.5.5 It is important to note that climate change parameters may change from those currently used. This will impact on climate change flood outlines by possibly increasing them. SuDS systems implemented now based on current climate change criteria may not meet the required standards as climate change parameters are altered in the future.

4.5.6 The Government's Flood and Water Management Act (2010), reinforces the need to adapt to climate change. The Act takes into consideration the recommendations made in the Pitt Review (2007). One of the principle aims of the Act is to deliver greater sustainability by helping people and their communities adapt to the increasing likelihood of severe weather events due to climate change. The Act also highlights that in order to respond to the challenges of climate change, bodies with direct responsibilities for managing flood and coastal erosion will need to work together to assess and manage these future risks.

4.5.7 This Level 2 SFRA should be used by Fenland District Council to assist in performing the Sequential and Exception Test. However, it is important to note that this study does not replace the need for these tests to be undertaken where necessary. The principle aim of the Sequential Test is to steer development towards sites of least flood risk (Flood Zone 1, as shown on the maps in Appendix G). The Exception Test is undertaken where more detailed information is provided and where there is deemed to be development pressure in areas that are at medium or high flood risk and there are no other suitable alternative areas for development after applying the Sequential Test. Section 7 of this study takes the Flood Hazard climate change outlines into consideration in relation to providing guidance on the above.

4.5.8 This SFRA is key in helping Fenland District Council to understand the full impact of climate change within the study area.

5 Flood Defence Infrastructure

5.1 FLOOD DEFENCE INFRASTRUCTURE

5.1.1 In line with the NPPF Technical Guidance, an SFRA is required to:

- Consider the beneficial effects of flood risk management infrastructure in generally reducing the extent and severity of flooding when compared to the flood zones on the flood map; and
- Enable the production of mapping showing flood outlines for different probabilities, impact, speed of onset, depth and velocity, variance of flooding taking account of the presence and likely performance of flood risk management infrastructure.

5.1.2 The second of these two objectives is not directly relevant due to tidal hazard mapping already having been carried out incorporating overtopping and breaching of the defences. This section of the SFRA reviews the flood defence assets and provides details about how the study area is protected from all sources of flooding. The following section of this report (section 6) then outlines the flood risk to the area, incorporating information about how the area is defended.

5.2 STANDARD OF PROTECTION OF FLOOD DEFENCES

5.2.1 Information has been provided by the Environment Agency on the structures and defences in the study area from the National Flood and Coastal Defence Database (NFCDD) and the IDB's have also supplied information on their assets. This has been supplemented by data regarding the recent upgrade works on the flood defences through the centre of Wisbech.

5.2.2 It should be noted that the Environment Agency is working on a new asset management system as part of their Creating Asset Management Capacity (CAMC) project to replace the NFCDD. The aim of this project is to produce an easier to use system that will allow linear watercourse features to be easily recorded on a database. Alongside fixed point assets such as pumping stations, weirs, sluices and other flood defences. This system is due to go live in August 2012.

5.2.3 Plans included in Appendix D show the Environment Agency's structures and defences with tables detailing each structure or defence referenced by the NFCDD within the study area.

5.2.4 Flood defences were originally built along the sides of the River Nene in Wisbech during the early to mid 1980s following the 1978 flood event and are formed of steel sheet piles, reinforced concrete and brick construction. These defences provide a standard of protection against the 0.5% (1 in 200) AEP tidal flood event for both banks of the river. The historical outline of the 1978 flood event is shown in Appendix C.

5.2.5 A large proportion of the study area would flood without defences, as shown on the Environment Agency's Flood Maps illustrated for this SFRA in Appendix G. The defences within the study area are maintained to provide a very good standard of protection against flooding.

5.2.6 Failure of the defences can occur as a result of breach. Breach is where the defence has a crest level above adjacent land levels and the failure is as a result of high flood waters or due to an indirect source such as failure through damage or when flood gates are left opened. Overtopping of a defence in an extreme event is not a failure in itself, but it can lead to a breach. Overtopping occurs when water passes over a flood defence, when water levels exceed the defence level. Water will then spill over the defence onto adjoining land.

5.2.7 If a breach were to occur then the area close to the breach would be rapidly inundated with flood waters, causing a high hazard to nearby areas. During overtopping events there will also be a significant hazard to the area behind the overtopping point.

5.2.8 The Tidal Nene Hazard Mapping Study (2011) has provided hazard outlines for both overtopping and breaching scenarios. These hazard outlines are shown on the maps in Appendix E of this report. The hazard maps indicate the locations where breaches are assumed to occur in the model.

5.3 WISBECH FLOOD DEFENCE SCHEME

5.3.1 Wisbech Flood Defence Scheme (FDS) was constructed in the early to mid 1980s. The Tidal Nene Strategy (2005), identified the need for a separate study to look at flood risk and re-appraise the defences through Wisbech. The Wisbech FDS Appraisal Report assessed different options for the area, as to whether the existing scheme falls into 'do nothing'; maintain the current defences; sustain the current level of protection; or improve the level of protection. The report concluded that sustaining the current level of protection against 0.5% (1 in 200) AEP events within Wisbech was the most economical way forward, whilst still providing a high standard of protection against flooding.

5.3.2 Due to numerous problems with the original defences, primarily caused by age as they approach the end of their design life, the Environment Agency has planned for upgrading/replacement of the defences located within Wisbech to ensure that they still provide protection against a 0.5% (1 in 200) AEP event. The first phase of this work was completed in 2010. A further two phases of defence raising is planned for 2025 and 2045 to sustain the 0.5% (1 in 200) AEP standard of protection.

5.3.3 A proactive maintenance system has been implemented to ensure that the defences continue to provide protection against a 0.5% (1 in 200) AEP event, in line with sea level rises over the next 50 years. This involves both replacement of old, worn out assets and increasing the height of the current defences in line with projected sea level rise. The Appraisal Report states that work will be needed in years 1-5, year 15 and year 35 of the scheme. The initial work for years 1-5 has been completed at the time of this SFRA being produced. The first phase / package of works involved replacement of 2km of steel sheet piles, painting of a further 2km of piles and replacement/improvement of sections of the flood wall.

5.3.4 The Environment Agency River Nene Tidal Hazard Mapping Study (2011) has modelled the defences through Wisbech including the first phase of work carried out as part of the FDS. The flood hazard outlines in Appendix E show that there is no overtopping of the current defences in a 0.5% (1 in 200) AEP event. There is only very minor overtopping in a 0.1% (1 in 1000) AEP event, where a small area of land at the north of the study area is affected. The 0.5% (1 in 200) AEP event modelling for the 2115 scenario shows some overtopping in the centre of Wisbech.

5.3.5 All but four of the defences from the NFCDD within the study area are maintained by the Environment Agency. The left and right abutments of the Town Bridge are maintained by Cambridgeshire County Council. Two stretches of defences on the eastern bank to the north of Wisbech are privately maintained. These private defences to the north of the centre of Wisbech border sub location E on the east bank of the Nene.

5.3.6 The Internal Drainage Boards provide water level management systems which act as defences for the area. These systems are maintained to ensure a high standard of protection.

5.4 SUMMARY OF HYDRAULIC STRUCTURES WITHIN STUDY AREA

5.4.1 Hydraulic structures are man-made objects which affect water within the study area. Some of these structures contribute to or form part of the flood defences for the town. Some hydraulic structures may not form a part of the flood defence infrastructure, but still have an effect on flood risk indirectly.

5.4.2 The majority of hydraulic structures within the study area are flood gates and outfalls. Flood gates are provided to allow access to areas within the defences, and are then shut through strict procedures during the lead up to a potential high water level event to complete the flood defence line. Outfalls are from drainage systems in the surrounding area; the majority are flapped to stop water flowing back up them during times of high water level within the channel.

5.4.3 Fenland District Council, Cambridgeshire County Council, the Environment Agency and where relevant the IDBs are responsible for the maintenance of most of the structures in the study area, with a small number of structures being privately owned.

5.5 NFCDD FLOOD DEFENCES WITHIN EACH SUB-LOCATION

5.5.1 Each sub-location within the study area has been individually reviewed for flood defences located within them, as set out below. Information from the National Flood and Coastal Defence Database (NFCDD) has informed the findings.

Sub-location A - East;

5.5.2 There are no formal raised flood defences within this sub-location although the area does benefit from surrounding defences of other sub-locations.

Sub-Location B - South;

5.5.3 The Environment Agency's Wisbech Defence Scheme report (2006) states defences have been maintained along the Nene through this sub-location. A single flood defence is located along the river edge at this location, formed by a flood bank reinforced with steel sheet piling. The work proposed along this defence is to grit blast and paint the existing sheet piles.

Sub-Location C - West;

5.5.4 The Environment Agency's Wisbech Defence Scheme report (2006) states defence upgrades have been undertaken along the Nene through this sub-location. The work along this stretch replaced the previous piled defence with a new 7m long steel sheet piled defence with timber capping beam.

Sub-Location D - North West;

5.5.5 The NFCDD includes information about flood banks which protect this sub location against flooding from the River Nene (see Appendix D). These flood banks extend along the full length of this sub location boundary with the Nene. These flood banks are purely 'soft' defences, with no additional hard defence systems (such as sheet piles or concrete flood walls).

Sub-Location E - North;

5.5.6 The NFCDD shows there are raised flood banks adjacent to the River Nene within this sub-location (see Appendix D). Information relating to their height was not available. A portion of this flood bank is maintained privately, while the rest is maintained by the Environment Agency.

Sub-Location F - Centre;

5.5.7 The NFCDD and the Environment Agency's Wisbech Defences Scheme report (2006) show there are extensive raised defences through this sub-location. Most of these defences were implemented or improved following the 1978 flood event. The Environment Agency's Wisbech Defences report highlights where upgrades have been undertaken in recent years. As described above, these defences are to be sustained on a rolling basis to ensure that Wisbech continues to be protected against a 0.5% (1 in 200) AEP event when taking climate change in to account. The upgrades carried out and proposed include raising of an existing brick clad reinforced concrete flood wall, replacement of an existing flood defence wall with a piled reinforced concrete wall, and repairs to existing concrete and brick walls.

5.6 FENLAND DISTRICT COUNCIL ASSET WITHIN STUDY AREA

5.6.1 Fenland District Council also operate a surface water pumping station in Nene Parade which discharges directly to the river. Unfortunately a catchment plan for this pumping station is not available but it does serve sub-location F of the study area.

5.7 INTERNAL DRAINAGE BOARD (IDB) ASSETS

5.7.1 The Internal Drainage Boards surrounding Wisbech regulate the water level in their systems through a network of pumping stations. These ensure any flood waters are fed back to the rivers. No pumping stations are located within the study area, however refer to Appendix D for pumping station catchments. The pumping stations that affect the study area are:

- Mouth Lane pumping station (North Level District IDB, Sub locations C and F);
- Willow Holt / Poplars pumping stations (North Level District IDB, Sub locations B, D and F);
- Tydd pumping station (North Level District IDB, Sub locations D, C and F);
- Ingleborough pumping station (King's Lynn IDB, Sub locations E and F);
- Islington pumping station (King's Lynn IDB, Sub locations A, E and F); and
- South Brink pumping station (Waldersey IDB, Sub locations B and F).

5.7.2 King's Lynn IDB has confirmed that they have modelled their watercourses within the study area and as a result no flooding is shown up to a 1% (1 in 100) AEP event. The assessment takes into consideration flood alleviation measures.

5.7.3 North Level District IDB have carried out an assessment of the Mouth Lane catchment, and have noted that without major improvement works, any increase in run-off would require full attenuation. Alternatively a new pumping station could be provided for this area to outfall to the River Nene. The IDB offers a standard of protection greater than 2% (1 in 50) AEP to the North Level District IDB area. They also own a water retention structure to the north of sub-location C, further details on this can be found in the IDB assets table and watercourse overview plan in Appendix D.

5.7.4 Middle Level Commissioners have stated that The Commissioners and Boards monitor, in accordance with its respective policy statement, the condition of their respective pumping stations, structures and watercourses, particularly those watercourses, over spilling from which could affect urban property. Consistent with the established need, a routine maintenance programme is in place to ensure that the condition of the Commissioners' and Boards' assets is commensurate with the Standard of Protection which is sought. Where standards are not at the policy level, improvement works are considered and undertaken where it is appropriate to do so. The Board actively maintains and undertakes improvements to its systems to ensure that it is able to serve the urban area.

5.8 FLOOD DEFENCE INFRASTRUCTURE POLICY

River Nene Catchment Flood Management Plan

5.8.1 The River Nene Catchment Flood Management Plan (CFMP) was issued in December 2008 by the Environment Agency. Further general details for the CFMP can be found in section 2.8 of this report.

5.8.2 The River Nene CFMP divides the area that the River Nene flows through in to 16 distinct areas which it calls Policy Units. The River Nene CFMP covers the western and central parts of the study area, encompassing sub locations B, C and D, most of sub location F, and half of sub location E. A plan showing the extent of the River Nene CFMP is included in Appendix B.

5.8.3 The Wisbech area falls into the Policy Unit covering the Fens (Policy Unit 16), which is a Policy Option 4 category. Section 5 of the River Nene CFMP provides more detail on this Policy Option, stating:

Policy Option 4 - Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change). We may select this policy where the risk from flooding is currently managed appropriately, but that risk is expected to increase significantly in the future. In these circumstances, we would need to do more in the long term to offset those increases in flood risk.

5.8.4 The objectives met by this policy have been previously provided in Section 1.2 of this report.

5.8.5 The River Nene CFMP also mentions Wisbech specifically where it states:

Wisbech

Infill and re-development proposals characterise development in this town. It is not affected by any growth or sub-regional strategies. Re-development is proposed on the waterfront and we have approved a scheme to upgrade flood defences in this area.

5.8.6 The approved scheme is the Wisbech Flood Defence Scheme (detailed in Section 5.3 of this report) has been implemented to sustain the current level of protection. Further summaries of the flood defences provided in Wisbech and details on the flood risk management scheme are provided in Section 3 of the River Nene CFMP.

5.8.7 Table 3.22 of the CFMP provides a summary of the current flood risk issues for different areas within the River Nene catchment. Part of the SFRA study area falls under the Fens category. The summary states that significant flooding would only occur in a 0.5% (1 in 200) AEP or worse event. Considering the level of defence in Wisbech, it is assumed that this flooding would not occur within the study area. If a breach event were to occur then significant damage could be done to the surrounding area as depths and velocities of flood water would be high. Overall flood risk is stated as being low. The effect of breaching along the River Nene defences has been illustrated in Appendix E.

5.8.8 Table 4.18 of the CFMP provides a summary of the future flood risk issues for different areas within the River Nene catchment. The summary states that in the future the flood defences would be overtopped at a number of locations along the Nene in a 1% (1 in 100) AEP event. Considering the level of defence currently provided 0.5% (1 in 200) AEP event, this would not impact on the study area. Overall flood risk is stated as being moderate for the Policy Unit in the future.

5.8.9 Table 4.19 of the CFMP provides a summary of the current and future flood risk issues, restating the above information. The summary further states under the heading 'the difference between current and future flood risk':

MODERATE INCREASE - Small increase in the number of people and properties affected, however a significant increase in the risk of defences failing given the increase in sea level predicted in the future as well as the predicted increase in peak flows.

5.8.10 The mapping for the Tidal Nene Hazard Mapping Study (2011) shows the effects of overtopping in the study area (see Appendix E). The flood risk management scheme that has been implemented for Wisbech will sustain the current level of protection with an allowance for climate change to provide protection against future flood risk up to a 0.5% (1 in 200) AEP event.

Great Ouse Catchment Flood Management Plan

5.8.11 The Great Ouse Catchment Flood Management Plan (CFMP) was issued in July 2010 by the Environment Agency and divides the area that the Great Ouse flows through into 25 distinct areas which it calls Policy Units. Further general details of the Great Ouse CFMP can be found in section 2.8 of this report.

5.8.12 The Great Ouse CFMP covers the eastern extent of the study area, covering all of sub location A, half of sub location E, and a small portion of sub location F. A plan showing the extent of the CFMP is included in Appendix B. The Great Ouse is located approximately 12km to the east of Wisbech, and as such there are no direct impacts on the study area from the main river. There are no raised defences in the study area that are within the Great Ouse CFMP area.

5.8.13 The Wisbech study area falls into the Policy Unit covering the Fens (Policy Unit 24), which is covered by Policy Option 4. Policy Option 4 is to "take further action to sustain the current level of flood risk into the future." The CFMP states for Policy Unit 24:

"Policy Unit 24 comprises the flat, low-lying fenland area of the catchment. The unit is rural with a low population density. The policy unit covers the Middle Level and most of the South Level, from Fenstanton in the south, Soham in the west and March in the west. Urban areas consist of scattered towns and villages including the towns of Wisbech, Ely, March, Chatteris, Ramsey and Littleport. Heavily regulated watercourse systems drain the Fens for agricultural production and protect the population from flooding."

5.8.14 King's Lynn IDB supported the implementation of Policy Option 4 for PU24 during the consultation process.

5.8.15 The CFMP further states that:

The Fens are well drained by the activities of Internal Drainage Boards who maintain the drains to a good standard, through maintenance and pumping. Flooding on the Fens is usually restricted to low lying agricultural land or from the threat of potential failure of defences/pumps etc.

5.8.16 The above information from the CFMP highlights that the portion of the study area that is covered by the Great Ouse CFMP is managed directly by King's Lynn IDB through their network of watercourses and pumping stations.

5.9 EXISTING INFRASTRUCTURE

Transport and other Infrastructure

5.9.1 Within the Wisbech area engineered earth embankments relating to highways do have an influence on the flood flow routes within the study area. Whilst they do not act as a full defence, embankments relating to the highway network do have an impact on reducing the flood hazard rating in some areas. Key highways within Wisbech that have an influence on flood flows are as follows:

- Wisbech to March railway line;
- A1101 and the Roman Bank Road to the north west (sub-location D);
- B198 to the east (sub-locations A and F);
- B1169 / Dowgate Road to the west (sub-locations C and F); and
- Barton Road to the west (sub-location C and F).

5.9.2 Reference should be made to the Breach and Overtopping Hazard Maps in Appendix E for further information.

5.10 FUTURE INFRASTRUCTURE

5.10.1 Road embankments, rail embankments and other existing transport infrastructure can affect water flows during floods. It is therefore important that where use of such infrastructure is proposed for flood management purposes, this is discussed with the infrastructure owners. Where new transport infrastructure is proposed, the possibility of building-in flood management measures at the design stage should be considered. The function, performance and integrity of any flood risk protection provided by transport infrastructure should be assessed by developers at the planning stage as part of a site specific Flood Risk Assessment.

Western Relief Road

5.10.2 A western relief road for Wisbech has been proposed and a pre-feasibility study has been carried out to determine a possible route and what impact the road would have on the existing landscape. The road would run from the A1101 Sutton Road to the north-west of Wisbech between Leverington and Wisbech, and down to the A47 Cromwell Road roundabout. A bridge is also proposed across the River Nene close to the A47 roundabout.

5.10.3 The route of the road would cross land drained by both the North Level District IDB and the Hundred of Wisbech IDB. Some of ditches and drains to the east of the proposed road alignment currently drain to the west as part of the North Level District IDB drainage system. All parts of this drainage infrastructure to the east would need to have suitable measures put in place to ensure that they can still drain to the west with the road constructed. Approximately 250 hectares of land drained by the North Level District IDB would be affected. The route and design of the road needs to ensure that the urban area between the proposed road and the River Nene does not experience an increased risk of flooding once the road is in place.

5.10.4 If the tidal River Nene flood defences were to fail, either through overtopping in an extreme event, or through a breach, then the area between the River Nene and the proposed line of the western relief road would potentially experience more severe flooding due to constraints imposed on the flood waters by the proposed relief road (this would create a 'flood cell'). This constraint on flood water will need to be addressed to minimise and to mitigate the impact on any development within the area.

Green Infrastructure

5.10.5 Extensive areas of green open space within the various sub locations can be viewed as Green Infrastructure. Green Infrastructure within the context of this SFRA can be defined as a multifunctional resource that can be used for flood storage purposes as well as amenity benefits within urban areas. Extensive green areas also assist in mitigating against the effects of climate change, through reducing temperatures within localised micro climates. Green Infrastructure should be viewed as a positive solution to mitigating against flood risk in areas that are prone to extensive fluvial and tidal flooding. This is especially relevant to areas along the River Nene, that in the unlikely event of a breach in the Nene's defences, would be prone to rapid inundation of flood water.

5.10.6 Policy Env1 (Green Infrastructure) of the East of England Plan (2008), highlights that Local Development Documents should:

- define a multiple hierarchy of green infrastructure, in terms of location, function, size and levels of use, based on analysis of natural, historic, cultural and landscape assets and the identification of areas where additional green infrastructure is required;
- require the retention of substantial connected networks of green space in urban, urban fringe and adjacent countryside areas to serve the growing communities in key centres for development and change; and
- ensure that policies have regard to the economic and social as well as environmental benefits of green infrastructure assets and protect sites of European or international importance for wildlife.

5.10.7 Green Infrastructure can provide an effective means of mitigating against the risk of flooding within the study area and making space for water is encouraged. These areas of green open space should be linked to other areas of green open space to increase the biodiversity opportunities and provide green corridors within urban environments.

5.10.8 Flood management infrastructure, including SuDS, should be retained and maintained primarily for the purpose for which it was designed, whilst being sensitive to the multi-functional benefits these can provide.

5.10.9 As detailed in section 2.14 a Green Infrastructure Study was published for the King's Lynn and West Norfolk Borough in May 2010. There are no specific projects which directly affect the portion of the study area which falls within the Borough of King's Lynn and West Norfolk. However the Green Infrastructure Study does set out a number of policies which cover a wide range of issues, such as planning and development, maintenance and management, climate change, and biodiversity. Where new development is planned within the Borough these policies should be reviewed to ensure that the proposals are in line with these policies.

6 Flood Risk

6.1 OVERVIEW

6.1.1 This Level 2 SFRA provides a strategic overview of flood risk and its impact on the Wisbech study area. It should be noted that:

- This Level 2 SFRA reflects current national planning policies and guidance at the time of writing;
- Policies may change; and
- Flood levels/flood zone classifications may change.

6.1.2 Through detailed data collection and analysis, it is concluded that a sufficient amount of information has been gathered to complete the Level 2 SFRA. Refer to Section 4.1 for further detailed information and Appendix I for the data register.

6.1.3 The mechanism of flooding at Wisbech can be as a result of a series of scenarios and not one standalone event. The primary source of flooding in Wisbech is tidal, resulting from the River Nene, however other sources of flooding may pose a risk to both existing and proposed development.

6.1.4 Wisbech is a complex area and the mechanisms that are likely to contribute to the flooding and water level rises are as follows:

- Water in existing channels (from tidal effect, fluvial and pluvial contributions);
- Soil types (increase runoff from poor infiltrating soils, saturation of ground);
- Pumping volumes (volumes of storage effected during high water levels);
- Weather conditions (can cause overtopping of defences, contributed to the 1978 flood); and
- Sedimentation (reduce available storage capacity and affects flow routes).

6.1.5 Refer to section 3.2 for further information on flood sources.

6.2 FLOOD MAPS

6.2.1 The EA publishes the Flood Map (see Appendix G), which shows areas potentially deemed to be at risk of flooding for all watercourses with a catchment area greater than 3km² in the UK. There are two different kinds of area shown on the Flood Map. They can be described as follows:

6.2.2 Dark blue (Flood Zone 3) shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- From the sea by a flood that has a 0.5% (1 in 200) or greater chance of occurring in any year.
- Or from a river by a flood that has a 1% (1 in 100) or greater chance of occurring in any year.

6.2.3 Light blue (Flood Zone 2) shows the extent of the Extreme Flood Outline from rivers or the sea, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

6.2.4 The Flood Map also shows the areas that benefit from flood defences, in the event of a river flood with a 1% (1 in 100) chance of occurring in any year, or a flood from the sea with a 0.5% (1 in 200) chance of occurring in any year.

6.2.5 The Flood Map is updated periodically, typically every 3 months.

6.2.6 The probability or likelihood of flooding is described as the chance that a location will flood in any one year. This can either be expressed as a percentage or a ratio. It is important to note that if an area is classified as having a 1% (1 in 100) AEP of flooding, for example, it does not mean that if it floods once in 100 years then it will definitely not flood for the next 99 years. In the same token, if it has not flooded for 99 years it may not necessarily flood in the last year.

6.2.7 A description of the different Flood Zones as provided in the NPPF Technical Guidance is given below:

- **Flood Zone 1 (low probability):** This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%);
- **Flood Zone 2 (medium probability):** This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year;
- **Flood Zone 3a (high probability):** This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year; and
- **Flood Zone 3b (functional floodplain):** This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

6.2.8 The Environment Agency's Flood Map has been provided in Appendix G. The flood map outlines, provided for the study area, are a combination of a 'refined' J-Flow GPU output and TUFLOW 2D modelling. The TUFLOW modelling outputs are derived from the Environment Agency modelling of the River Nene (2009) as part of the Northern Area Tidal mapping; this modelling did not take flood defences into consideration.

6.2.9 The Environment Agency Flood Maps do not show specific functional floodplain outlines for the study area. As the functional floodplain is confined to the river channel through the presence of raised defences, it has been agreed with the Environment Agency that it is not necessary to provide outlines in this SFRA.

6.2.10 The Environment Agency are currently reviewing the information relating to Areas Benefitting from Defences (ABDs). This is considering fluvial, tidal and lowland drainage sources of flooding and, for the Wisbech area. It is not yet known when this information is expected to be completed by. The ABDs only show protection provided by Environment Agency defences.

6.3 HYDRODYNAMIC MODELLING

6.3.1 As previously stated, the Environment Agency's Tidal Nene Hazard Mapping Study (2011) has provided the Flood Hazard outlines (see Appendix E) used in the Level 2 SFRA for the following scenarios:

- 0.5% (1 in 200) breach scenario;
- 0.5% (1 in 200) plus climate change breach scenario;
- 0.1% (1 in 1000) breach scenario;
- 0.1 % (1 in 1000) plus climate change breach scenario.
- 0.5% (1 in 200) overtopping scenario;
- 0.5% (1 in 200) plus climate change overtopping scenario;
- 0.1% (1 in 1000) overtopping scenario; and
- 0.1% (1 in 1000) plus climate change overtopping scenario.

6.3.2 This modelling takes into consideration the defence upgrades through Wisbech. Flood Hazard maps show the velocity and depth of flood water and link this as a hazard to people based on DEFRA guidance FD2320/TR2 (see Appendix H). These hazards are classified into Low Hazard; Danger for some, Danger for most and Danger for all.

6.3.3 Flood Maps as provided by the Environment Agency show areas potentially deemed to be at risk from fluvial and tidal flooding without the presence of defences (Flood Zone 3) and in an extreme event (Flood Zone 2).

6.3.4 Flood Maps and Flood Hazard Maps in combination allow a detailed assessment to be made of the overall sustainability of development in the six sub locations in terms of fluvial/tidal flood risk.

6.3.5 Flood Maps and Flood Hazard Maps for the various sub-locations within the study area have been provided in Appendices E and G.

6.4 FLOOD MAP FOR SURFACE WATER

6.4.1 Maps showing the Flood Map for Surface Water have been provided to give an indication of the extents of surface water flooding, however they are not intended to identify whether an individual property will flood (see Appendix G). These maps have been produced based on data received from the Environment Agency.

6.4.2 These maps show the extent of surface water flooding for the 3.33% (1 in 30) and 0.5% (1 in 200) AEP. For each AEP the maps illustrate two classifications showing shallower and deeper surface water flooding:

- **Shallower** is defined as surface water flooding from 100mm to 300mm deep; and
- **Deeper** is defined as surface water flooding greater than 300mm deep.

6.4.3 The 300mm threshold is chosen as it represents a typical value for the onset of significant property damages from flooding (above doorstep level). In addition, driving or walking through flood water at this depth may become more difficult.

6.4.4 Surface water flooding can be defined as an event that results from rainfall generated by overland flow before the runoff enters any watercourse or sewer. The maps do not show flooding that occurs from overflowing watercourses, drainage systems or public sewers caused by catchment-wide rainfall events or river flow.

6.4.5 One of the key findings of the Pitt Review "*Learning lessons from the 2007 floods*" was that the Environment Agency, supported by local authorities and water companies, should urgently identify areas that are at highest risk from surface water flooding. The Flood Map for Surface Water has been produced in direct response to these recommendations.

6.4.6 It is important to note that these maps should not be used to guide the site allocation process within the context of this Level 2 SFRA. The intention of these maps is to act as a starting point to highlight areas where the potential for surface water flooding needs particular assessment and scrutiny. These maps should not be used in isolation in terms of assessing surface water flooding issues. Additional studies such as historical records should also be used as supporting evidence. Further guidance on their application to site specific planning applications is provided in the FRA Toolkit in Appendix J.

6.4.7 The maps provided in Appendices E and G were modelled using a Digital Terrain Model with rainfall data taken from the Flood Estimation Handbook CD-ROM. Depth-duration-frequency curves derived from the CD Rom are then used to derive the 3.33% (1 in 30) and 0.5% (1 in 200) annual exceedance probability rainfall depths.

6.4.8 Surface water management plans (SWMPs) are a useful tool for looking at existing problems within an area and helping to inform planning decisions for new development. Assessing and managing all forms of flooding to development is a key theme of the NPPF. The Surface Water Management Plan that is currently being undertaken for Cambridgeshire will be key in providing a further insight into surface water flooding issues within the study area. Refer to Section 2 of this report for further information.

6.4.9 The Hundred of Wisbech IDB has particular concerns about its Oldfield Lane / Weasenham Lane water level / flood risk management system which is sensitive to increased surface water / treated effluent discharges. For this reason, flows from this site must be restricted and not increase as a result of this development. No additional flow or increase rates of run-off to this system will be consented. The extent of this sub-catchment is shown in Appendix D – 2.1.

6.5 STRATEGIC ASSESSMENT OF SUB-LOCATIONS

6.5.1 A strategic assessment of the principle sources of flood risk affecting the study area has been made based on the data collected. The sections below provide an initial analysis of each of the sub-locations within the study area, based around the Flood Map and Flood Hazard mapping. A more detailed analysis has been provided in section 8 in relation to policy implications.

6.5.2 Tidal flooding occurred in 1978 and this led to surface water flooding within the Wisbech area. For further information on the extent of historical flooding. Refer to Historical Flood Map in Appendix C.

Sub-Location A - East

6.5.3 This sub-location is 435 ha and is located to the east of the centre of Wisbech. This sub-location is predominately greenfield. As shown on the Flood Map in Appendix G approximately 50% of the sub-location is impacted on by Flood Zones 2 and 3. The flood outlines originate from the various ditches and drains that fall within the area. Kings Lynn IDB are responsible for the management of water levels within these watercourses. In general terms, the parts of the sub location closest to the urban centre of Wisbech fall into Flood Zone 1 which is an area of low flood risk.

6.5.4 Based on the Flood Hazard mapping for the River Nene in Appendix E, the sub-location is not impacted on by the critical 0.5% (1 in 200) plus climate change overtopping extent. For the breaching event the 0.5% (1 in 200) plus climate change scenario impacts on a small part of this sub-location.

6.5.5 The sub location benefits from formal raised defences on the River Great Ouse. In addition, the Kings Lynn IDB pumping stations at Ingleborough and Islington maintain water levels within the various watercourses within this sub location. Both these pumping stations fall outside of the study area. The Kings Lynn IDB will require a 9 m maintenance easement of no development either side of their watercourse.

6.5.6 The historical flood extent for the 1978 River Nene flood does not impact on this sub-location.

Sub-Location B - South

6.5.7 This sub-location is 266 ha and is located to the south of the centre of Wisbech. This sub-location is predominately greenfield. The Flood Map in Appendix G shows that approximately 45% of the sub-location falls into Flood Zones 2 and 3. The flood outlines in this area would be a combination of fluvial and tidal; the tidal element emanates from the River Nene to the west. The defences along the River Nene in this area comprise of flood banks reinforced with steel sheet piling. In simplified terms the areas of the sub-location that fall into Flood Zone 1 are located in the eastern half away from the Nene.

6.5.8 Based on the Flood Hazard mapping provided in Appendix E the 0.5% (1 in 200) plus climate change overtopping extents do not impact on the sub-location. However, for the breaching event the 0.5% (1 in 200) plus climate change scenario impacts on the western half of the sub-location.

6.5.9 The Hundred of Wisbech IDB is the primary water level management authority in this sub-location. Water levels in this location are maintained by the pumping station at South Brink which falls outside of the study area. The Hundred of Wisbech IDB, like the Kings Lynn IDB, will require a 9m maintenance easement of no development either side of their watercourse.

6.5.10 The historical flood extent for the 1978 flood event is not shown on the historical flood map in Appendix C as reaching this sub-location. However, the watercourse would have transferred the flood water and thus this sub-location would have been indirectly affected.

Sub-Location C - West

6.5.11 This sub-location is 425 ha and is located to the south west of the centre of Wisbech. This sub-location is predominately greenfield. The Flood Map in Appendix G shows that approximately 75% of the sub-location falls into Flood Zones 2 and 3. The flood outlines in this area would be a combination of fluvial and tidal. The tidal element originates from the River Nene to the east and would be the most dominant. The defences along the River Nene that are of relevance for this sub-location comprise flood banks and flood walls reinforced with steel sheet piling and brick cladding. In simplified terms the areas of the sub-location that fall into Flood Zone 1 are located in the western part away from the Nene.

6.5.12 Based on the Flood Hazard mapping provided in Appendix E, the 0.5% (1 in 200) plus climate change overtopping extents impact on the north east part of the sub-location. For the breaching event, the 0.5% (1 in 200) plus climate change scenario impacts on the entire length of the sub-location. However, the outer most western and northern areas of the sub-location remain in Flood Zone 1.

6.5.13 The North Level District IDB is responsible for the management of water levels within watercourses outside of the River Nene. These water levels would be maintained by the pumping stations at Mouth Lane, Willow Holt and Tydd which fall outside of the study area. The North Level District IDB like the other IDBs will require a 9m maintenance easement of no development either side of their watercourses.

6.5.14 The historical flood extent for the 1978 flood event impacted on the eastern extremity of the sub-location closest to the centre of Wisbech.

Sub-Location D - North West

6.5.15 This sub-location is 378 ha and is located to the north west of the centre of Wisbech. This sub-location is predominately greenfield however the village of Leverington is located in the western quarter. The Flood Map in Appendix G shows that approximately 35% of the sub-location falls into Flood Zones 2 and 3. The flood outlines in this area would be a combination of fluvial and tidal elements. The tidal element originates from the River Nene to the east and would be the most dominant. The defences along the River Nene that are of relevance for this sub-location are comprised of flood embankments (see Appendix D). In general terms the areas of the sub-location that fall into Flood Zone 1 are located in the western half away from the Nene.

6.5.16 Based on the Flood Hazard mapping provided in Appendix E, the 0.5% (1 in 200) plus climate change overtopping extents do not impact on this sub-location, except for a very small area close to the southern boundary. For the breaching event, the 0.5% (1 in 200) plus climate change scenario impacts on the entire length of the sub-location closest to the River Nene. However, the outer most western parts of the sub-location remain in Flood Zone 1.

6.5.17 The North Level District IDB is responsible for the management of water levels within watercourses outside of the River Nene. These water levels would be maintained by the pumping station at Tydd, Willow Holt and Poplars which fall outside of the study area. The North Level District IDB will require a 9m maintenance easement of no development either side of their watercourses.

6.5.18 The historical flood extent for the 1978 River Nene flood does not impact on this sub-location.

Sub-Location E - North

6.5.19 This sub-location is 333 ha and is located to the north of the centre of Wisbech. This sub-location is predominately greenfield. The Flood Map in Appendix G shows that approximately 85% of the sub-location falls into Flood Zones 2 and 3. The flood outlines in this area would be a combination of fluvial and tidal. The tidal element originates from the River Nene to the west and would be the most dominant. The defences along the River Nene that are of relevance for this sub-location comprise flood embankments (see Appendix D). In general terms the small parts of the sub-location that fall into Flood Zone 1 are located in the eastern half away from the Nene. However, these are isolated 'dry islands', surrounded by Flood Zones 2 and 3.

6.5.20 Based on the Flood Hazard mapping provided in Appendix E, the 0.5% (1 in 200) plus climate change overtopping extents impacts on the western part of this sub-location adjacent to the River Nene. For the breaching event, the 0.5% (1 in 200) plus climate change scenario impacts on the entire sub-location; however this impact is greatest in the western half which is closest to the River Nene.

6.5.21 The Kings Lynn IDB is responsible for the management of water levels within watercourses outside of the River Nene. These water levels would be maintained by the pumping station at Ingleborough and Islington which fall outside of the study area. The Kings Lynn IDB will require a 9m maintenance easement of no development either side of their watercourses.

6.5.22 The historical flood extent for the 1978 River Nene flood does not impact on this sub-location.

Sub-Location F - Centre

6.5.23 This sub-location is 792 ha and covers the entire urban area that makes up Wisbech. The Flood Map in Appendix G shows that approximately 45% of the sub-location falls into Flood Zones 2 and 3. The flood outlines in this area would be a combination of fluvial and tidal. The tidal element originates from the River Nene which runs through Wisbech and this is the most dominant influence on flooding in this area. The defences along the River Nene that are of relevance for this sub-location are a combination of raised flood walls and flood banks (see Appendix D). The eastern part of the sub-location falls into Flood Zone 1.

6.5.24 Based on the Flood Hazard mapping provided in Appendix E, the 0.5% (1 in 200) plus climate change overtopping extents impacts on the western part of this sub-location adjacent to the River Nene. This flood outline is very similar to the 1978 historical flood outline that would have affected this sub-location (see Appendix C). For the breaching event, the 0.5% (1 in 200) plus climate change scenario covers parts of this sub-location and would aim to maintain water-levels within IDB watercourses. Areas to the east remain in Flood Zone 1.

6.5.25 All three IDBs impact on this sub-location and would maintain water levels within IDB watercourses via the various pumping stations. All three IDBs require a 9m maintenance easement for no development either side of their watercourses.

6.6 OTHER SOURCES

6.6.1 Potential sources of flooding from overland flow, groundwater, sewers and water mains would need to be assessed in detail by developers as part of a site specific Flood Risk Assessment. For all six sub-locations, none of these were deemed to be a significant issue when assessing flood risk at a strategic level. The implementation of measures such as cut-off drains and overland flow routes for example, can help mitigate against surface water flooding from on and off site areas.

6.6.2 For the purposes of this Level 2 study, incidents of sewer flooding, as provided by Anglian Water, have been shown in Appendix C. Surface water flooding issues within Wisbech will be assessed in greater detail as part of the Cambridgeshire SWMP (see section 2.11). The Anglian Water sewer flooding records highlight a cluster of sewer flooding events in the southern part of sub-location F.

6.6.3 The Environment Agency has confirmed that they have no record of ground water flooding incidents within the study area. Groundwater levels were also unavailable.

6.6.4 Incidents of pluvial (surface water) flooding will be assessed in greater detail as part of the Cambridgeshire Surface Water Management Plan. Based on the Environment Agency's Flood Map for Surface Water provided in Appendix G, the following conclusions can be made:

- **3.33% (1 in 30) AEP** - all sub-locations show small pockets of surface water flooding to a shallow depth. Sub-location F shows the highest proportion of flooded area; and
- **0.5% (1 in 200) AEP** - all sub-locations show that there is a greater level of surface water flooding for this AEP event. The depth of flooding in certain areas also increases. As with the 3.33% (1 in 30) AEP event, sub-location F shows the highest proportion with the greatest depth.

6.6.5 The Fenland District Council Level 1 SFRA (2011) states that surface water flooding occurred in Wisbech in 1978 as the discharge of surface water was impeded by high tides. The initial cause of the flooding was overtopping of the flood defences alongside the River Nene. The Outline Water Cycle Study (WCS) for East Cambridgeshire and Fenland (2010), highlights that one of the key flood risk issues within the study area is surface water flooding from the managed drainage system. The WCS states that the pumping stations within the study area are key in ensuring that surface water flooding does not inundate generally low lying urban areas and high grade agricultural land.

6.6.6 Hydraulic structures have the potential to fail or block causing flooding to upstream or downstream areas, the chance of which can be mitigated through appropriate maintenance procedures. This should be assessed in greater detail as part of a site specific Flood Risk Assessment. Appendix D includes plans showing where hydraulic structures are located within the study area.

6.7 FLOOD WARNING AND EMERGENCY PLANNING

6.7.1 Within the Wisbech study area as elsewhere in England, the responsibility for flood warnings rests with the Environment Agency. The Environment Agency provides flood warnings for designated areas. Information relating to the Environment Agency's flood warning areas within the study area has been provided in Appendix G. Floodline Warnings Direct is the service which the Environment Agency use to disseminate flood warnings across the country. Primarily the Environment Agency issue these warnings by loudhailer, telephone and emergency officers on the ground; these warnings only cover tidal and fluvial flooding in the area. The flood warnings impact on areas which fall within the floodplain of the River Nene.

6.8 FLOODLINE WARNINGS DIRECT

6.8.1 Flood Warning is an essential component of the strategy to reduce flood risk. The Environment Agency runs a system called Floodline Warnings Direct, which provides guidance on the risk to people and property from flooding across the country. The warning levels are shown below, including key information about each warning level.

6.8.2 The online flood risk forecast is updated at least once a day. It is recommended to stay aware of the weather and check the flood risk forecast on the Environment Agency website.

Flood Alert



Key Message: Flooding is possible. Be prepared.

Timing: Two hours to two days in advance of flooding.

Actions:

- Be prepared for flooding;
- Prepare a flood kit of essential items; and
- Monitor local water levels and the flood forecast on the Environment Agency website.

Channels:

- FWD;
- Floodline; and
- Internet.

Flood Warning



Key Message: Flooding is expected. Immediate action required.

Timing: Half an hour to one day in advance of flooding.

Actions:

- Move family, pets and valuables to a safe place;
- Turn off gas, electricity and water supplies if safe to do so; and
- Put flood protection equipment in place.

Channels:

- FWD;
- Floodline;
- Internet;
- Sirens;
- Loudhailers; and
- Media.

Severe Flood Warning



Key Message: Severe flooding. Danger to life.

Timing: When flooding poses a significant threat to life and different actions are required.

Actions:

- Stay in a safe place with a means of escape;
- Be ready should you need to evacuate your home;
- Co-operate with the emergency services; and
- Call 999 if you are in immediate danger.

Channels:

- FWD;
- Floodline;
- Internet;
- Sirens;
- Loudhailers; and
- Media.

Warning no longer in force

Key Message: No further flooding is expected for your area.

Timing: Issued when a flood warning is no longer in force.

Actions:

- Flood water may still be around and could be contaminated; and
- If you've been flooded, ring your buildings and contents insurance company as soon as possible.

Channels:

- FWD;
- Floodline; and
- Internet.

6.8.3 Flood Warning is an essential component of the strategy to reduce flood risk. The current flood warning systems provided by the Environment Agency are described in the Level 1 SFRA. However, it should be noted that the flood warning system only operates for fluvial or tidal flooding. Wisbech benefits from protection from these sources of flooding as a result of flood defences on the River Nene. Therefore, other than in extreme circumstances, any flooding likely to occur within the Fenland area would result from an exceedance in capacity of the managed IDB or surface water systems which would occur without any warning.

6.8.4 Sir Michael Pitt's review of the summer 2007 floods stresses the importance of developing a flood warning system for surface water flooding. One of the reports interim conclusions (IC3) was "the Environment Agency further develops tools and techniques for predicting and modelling river flooding, especially to take account of extreme multiple events; and takes forward work to develop similar tools and techniques to model surface water flooding."

6.9 EMERGENCY PLANNING

6.9.1 Fenland District Council's Emergency Planning Team develop Plans, Policies and Procedures within the study area. This is guided by a number of Acts of Parliament, including the Civil Contingencies Act (2004). This Act highlights the following responsibilities that Fenland District Council must ensure that they comply with, to ensure that they are as prepared as possible. These are set out below:

6.9.2 To assess the risk of a number of emergencies and use the results to inform their work:

- To create Emergency Plans, Policies and Procedures;
- To identify and address Business Continuity Management issues;
- To inform the public about emergency planning matters;
- To share any information with other local responders to improve co-ordination;
- To work alongside other agencies to improve efficiency; and
- To provide advice and assistance to business and voluntary organisations about Business Continuity Management.

6.9.3 Further details can be found on Fenland District Council's website in relation to flood risk and emergency planning. Fenland District Council's Emergency Plan (2010) has a section which covers flood risk issues; this highlights the location of the various rest centres and procedures that need to be undertaken in the event of flooding. Most of the rest centres, as shown in the Level 1 SFRA, fall within the central area of Wisbech. The overarching policy which influences this local emergency plan is the government's Civil Contingencies Act (2004). This Act provides a single framework for civil protection in the UK which is capable of meeting the challenges of the 21st century.

6.9.4 An additional overarching policy document that influences emergency management procedures within the study area is the Cambridgeshire Multi-Agency Flood Plan (2010). This plan aims to provide a coordinated response to the threat or incidence of flooding in Cambridgeshire. The objectives of this document are as follows:

- Document the coordinated response to a flood threat for the emergency services, local authorities and other partner agencies in Cambridgeshire;
- Define the responsibilities of the emergency services, local authorities and other partner agencies to flood warning alerts; and
- Outline the arrangements that have been put in place to help mitigate and minimise the effects of a flooding incident.

6.9.5 As part of the study area to the east of Wisbech falls within Norfolk, then the Kings Lynn and West Norfolk Borough Council's Borough Emergency Response plan (2010) should also be reviewed. These documents highlight procedures that would need to be undertaken in the event of extensive flooding, from both fluvial and tidal sources within the area.

6.9.6 Emergency planning is key to ensuring the safe evacuation of people from an area in the event of extensive flooding. The Fenland District Council emergency plan was not available at the time of writing this report, however for further information please contact Fenland District Council direct.

6.9.7 Both Council's websites should be read by residents who live in areas prone to flooding. The web links to these websites are provided below:

Fenland District Council:

<http://www.fenland.gov.uk/ccm/content/emergency-planning/preparing-for-a-emergency-.en>

Borough Council of Kings Lynn and West Norfolk:

<http://www.west-norfolk.gov.uk/pdf/Borough%20Emergency%20Response%20Plan%202010%20Public%20Version.pdf>

6.9.8 Reference should also be made to the Fenland District Council Level 1 SFRA, which provides additional information in relation to emergency planning issues within the study area.

7 Planning and Development

7.1 FLOOD RISK MANAGEMENT HIERARCHY

7.1.1 When assessing a site's development potential, the following flood risk management hierarchy should be used. This hierarchy emphasises the importance of assessing flood risk management in five steps:

- Step 1 - Assess (appropriate flood risk assessment);
- Step 2 - Avoid (apply the Sequential approach);
- Step 3 - Substitute (apply the Sequential Test at site level);
- Step 4 - Control (e.g. SuDS design); and
- Step 5 - Mitigate (e.g. flood resilient construction).

7.2 SEQUENTIAL AND EXCEPTION TEST

7.2.1 The primary reason for the completion of this Level 2 SFRA is to provide guidance on undertaking the Sequential and Exception Test within the study area. The flood maps produced for this Level 2 SFRA provide the basis for providing guidance on the Sequential and Exception Test within the various sub-locations. It is important to note that this SFRA should be used as guidance to undertake both these tests and does not replace the need for Fenland District Council to complete them as a separate process. Both the Sequential and Exception Test help contribute towards the process of Sustainable Development.

7.2.2 Table 1, of the Technical Guidance to the NPPF (below) provides definitions for the flood zones, referring to the probability of fluvial and tidal flooding, ignoring the presence of defences.

Technical Guidance to the NPPF, Table 1: Flood Zones & Appropriate Land Uses

Zone 1 Low Probability

Definition

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Appropriate uses

All uses of land are appropriate in this zone.

FRA requirements

For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 2 Medium Probability

Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses

Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2 (of the Technical Guidance to the NPPF), are appropriate in this zone.

The highly vulnerable uses are *only* appropriate in this zone if the Exception Test is passed.

FRA requirements

All development proposals in this zone should be accompanied by a FRA.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 3a High Probability

Definition

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses

The water-compatible and less vulnerable uses of land (table 2 of the Technical Guidance to the NPPF) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone

The more vulnerable and essential infrastructure uses should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

FRA requirements

All development proposals in this zone should be accompanied by a FRA.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b The Functional Floodplain

Definition

This zone comprises land where water *has* to flow or be stored in times of flood.

Local planning authorities should identify in their SFRA areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in Table 2 (of the Technical Guidance to the NPPF) that has to be there should be permitted in this zone. It should be designed and constructed to:

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

Essential infrastructure in this zone should pass the Exception Test.

FRA requirements

All development proposals in this zone should be accompanied by a FRA.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and
- relocate existing development to land with a lower probability of flooding.

7.2.3 The principle aim of the Sequential Test is to steer new development to areas at the lowest probability of flooding. If there are no reasonably available sites in Flood Zone 1, then the flood vulnerability of the proposed development can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Reference should be made to table 2 (Technical Guidance to the NPPF) Flood Risk Vulnerability classification in relation to the vulnerability of various land uses. Reference should also be made to table 3 Flood Risk Vulnerability and Flood Zone Compatibility classifications as set out in the NPPF Technical Guidance. Both these tables are provided below:

Technical Guidance to the NPPF, Table 2: Flood Risk Vulnerability Classification

Essential Infrastructure	<ul style="list-style-type: none"> • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	<ul style="list-style-type: none"> • Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More Vulnerable	<ul style="list-style-type: none"> • Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan.</i>

Less Vulnerable	<ul style="list-style-type: none"> • Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding. • Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment plants (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-compatible Development	<ul style="list-style-type: none"> • Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Technical Guidance to the NPPF, Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification (see Table 2)		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (See Table.1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	X	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	X	X	X

Notes from the Technical Guidance for the NPPF applicable to this table:

This table does not show:

- the application of the Sequential Test which guides development to Flood Zone 1 first, then Flood Zone 2, and then Flood Zone 3;
- Flood Risk Assessment requirements; or
- the policy aims for each Flood Zone.

Key:



Development type is permitted under the NPPF. A site based FRA is required in accordance with the SFRA.



Development type is permissible under the NPPF, only if the exception test is passed. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk. A site based FRA is required in accordance with the SFRA.



Development type is not permitted under the NPPF.

7.2.4 As highlighted in section 2.5, the NPPF and NPPF Technical Guidance expands on the Sequential Test by incorporating the Exception Test. If following the application of the Sequential Test, it is not possible or consistent with wider sustainability objectives, for the development to be located in zones of lower probability of flooding then the Exception Test can be applied.

7.2.5 The Exception Test provides a mechanism for managing flood risk whilst still allowing necessary development to occur. However, it should not be used to justify 'highly vulnerable' development in Flood Zone 3a, or 'less vulnerable', 'more vulnerable' and 'highly vulnerable' development in Flood Zone 3b.

7.3 SUSTAINABLE DRAINAGE SYSTEMS

7.3.1 Sustainable Drainage Systems (SuDS) are the preferred approach to managing rainfall runoff generated from impermeable surfacing and should be used at any appropriate proposed site. They can be used to reduce the rate and volume of surface water discharges from sites to the receiving environment (e.g. natural watercourses, public sewers), as well as reduce pollutants, maintain recharge to groundwater and provide a natural amenity and green space within a development. SuDS also provides an effective means to deal with the effects of climate change. Further information on the application of SuDS within the study area can be found within the 'FRA Toolkit' in Appendix J.

7.3.2 The SuDS hierarchy must be applied to all proposed sites and assessed within a site specific FRA, with justification given for the omission of a device. Refer to the Toolkit in Appendix J for the SuDS Hierarchy table.

7.3.3 Pre-application discussions must be undertaken with the relevant stakeholders for the site, in most cases this will be both the Environment Agency and if within 50m of an IDB watercourse then the relevant IDB. Wisbech is seen as an area which is water stressed therefore the type of SuDS techniques used will be high on the agenda of the stakeholders and they are therefore likely to have specific requirements for a proposed site. It is possible that the IDB will have different criteria to the Environment Agency and therefore these discussions are an important part of the FRA process.

7.3.4 There are various SuDS techniques that are available and should be investigated for a proposed site; however the techniques operate on two main principles:

- Infiltration; and
- Attenuation.

7.3.5 Infiltration SuDS rely on discharging to ground, where suitable ground conditions allow. Infiltration methods include the use of permeable pavements, infiltration trenches, soakaways and other techniques that are generally located below ground such as geocellular systems.

7.3.6 Where site ground conditions are deemed unsuitable for the widespread implementation of infiltration techniques, surface water runoff will need to be attenuated using on-site attenuation storage. On site 'above ground' storage measures include basins and ponds, with 'below ground' facilities generally following the more engineered forms of underground storage. In other cases a combination of both infiltration and attenuation methods could be applied. The East Cambridgeshire and Fenland Water Cycle Strategy identifies that attenuation is more likely to be utilised in the area than infiltration due to the poor infiltration potential across the study area.

7.3.7 Consideration needs to be given to the facility to be used, what is trying to be achieved and the nature of water level management in the area. The use of SuDS within the Fens can increase the risk of flooding in some watercourses by reducing any self-cleansing effect resulting in increased siltation which may also adversely affect biodiversity in the receiving watercourse. A holistic approach will require considerable master planning together with the resolution of funding and maintenance issues. Prior funding from an external source, say the proposed Community Infrastructure Levy, may be required if this is to work correctly.

7.3.8 Where possible, a SuDS technique should seek to contribute to each of the three goals identified below with the favoured system contributing significantly to each objective:

- Reduce flood risk (to the site and neighbouring areas);
- Reduce pollution; and
- Provide landscape and biodiversity benefit.

7.3.9 Wisbech is a water stressed area and therefore SuDS devices should form part of a hydrological train where the retained water could be used for water harvesting and irrigation purposes etc.

7.3.10 The Flood and Water Management Act (2010) highlights that national SuDS design standards will be released and that allocated SuDS Approval Bodies (SABs) will be responsible for approving and adopting SuDS schemes.

7.3.11 Documents such as the Pitt Review emphasise the importance of controlling and reducing surface water flows. This helps reduce the level of flood risk to the subject site and surrounding areas.

7.3.12 Source Protection Zone Maps, SuDS Infiltration Feasibility Plans (Appendix F) and sewer records have been reviewed to provide general recommendations on the implementation of SuDS on a site specific basis. The Level 1 SFRA (2011) produced for Fenland District Council provides a detailed explanation of the geological conditions within the study area. The general recommendations made in this SFRA in relation to the implementation of SuDS do not substitute the need for detailed analysis of ground conditions as part of a site specific Flood Risk Assessment.

7.3.13 Information on groundwater levels has not been provided on a site specific basis as it was not available.

Site Geology and SuDS Infiltration

7.3.14 Based on the Level 1 SFRA Estimated Infiltration Feasibility Plans shown in Appendix F, the following statement applies to all six sub locations;

The drift geology is made up of tidal mud flats. There is a low infiltration potential across the entire study area.

7.3.15 Detailed ground investigation studies and site specific studies should be used to augment the findings of this initial analysis. Further information on the application of SuDS can be found within the 'FRA Toolkit' in Appendix J.

Source Protection Zones

7.3.16 As stated in section 3.4.3, there are no Source Protection Zones within the study area.

Ground Contamination

7.3.17 Information relating to land contamination issues has been provided by Fenland District Council Environmental Protection Team for the study area. The information provided contains data on a site's former land use, indicating where there is the potential for ground contamination. Land contamination issues have the potential to impact on the ability to use infiltration SuDS techniques for example. In order to reduce the risk of spreading contamination to wider areas, ground conditions need to be taken into consideration when implementing SuDS.

7.3.18 Due to the sensitive nature of site contamination, the SFRA does not provide specific details on the location and nature of contaminated sites within a sub-location. However, sub-location F which covers the urban area of Wisbech has the highest potential for contamination as historically this area has experienced the most development. Information relating to previous land uses and the potential for ground contamination should be reviewed on a site specific basis; information held by Fenland District Council's Environmental Protection Team should be reviewed.

7.3.19 Detailed ground investigations would need to be undertaken as part of a site specific FRA, in order to establish further details on contamination issues and the application of SuDS infiltration techniques.

7.3.20 A Flood Risk Management Hierarchy can be applied to surface water management as it is important to consider both flood risk to the proposed development as well as the potential impacts on areas adjacent to and downstream of the development. The management hierarchy in relation to surface water is given below:

- **Assess** - risk associated with surface water through regional, strategic and site specific Flood Risk Assessments and Surface Water Management Plans where completed;
- **Avoid** - risks from surface water by controlling water at sources using SuDS and locating development away from risk areas;
- **Substitute** - apply the sequential approach to locate more vulnerable developments in lowest risk areas; and
- **Control** - use SuDS and implement Surface Water Management Plans to manage and reduce risk within the development and downstream.

7.3.21 Based on the information provided in this SFRA, guidance on the application of various SuDS techniques for each sub-location has been provided in the Flood Risk Toolkit (see Appendix J).

7.4 MAINTENANCE

7.4.1 A maintenance plan should be provided for any SuDS feature. The plan will contain details of how to ensure the SuDS feature will work reliably throughout the lifetime of the development. The maintenance plan may be provided as part of an Owner's Manual for SuDS, as specified in section 22 of CIRIA document C697: The SuDS Manual. Section 22.9.1 of C697 provides specific details on the documentation that should be provided alongside SuDS features.

7.4.2 In the case of small developments a maintenance statement is commonly provided explaining the site management requirements for the development, including maintenance requirements for any SuDS features.

7.4.3 Guidance documents have been produced by certain bodies to ensure the maintenance plan that is provided is adequate for the adopting body. SuDS features may be adopted by the local water authority (e.g. Anglian Water), the local Internal Drainage Board (IDB), or the local council (e.g. Fenland District Council).

7.4.4 A national guidance for SuDS maintenance and design is currently being produced by DEFRA, this document has not been published at the time of writing this document. This national guidance document may not be appropriate to the Fens due to specific problems such as lack of gradient. After this document has been published it is still recommended that any planned maintenance and design should be discussed with relevant authorities to ensure local requirements are taken account of.

7.4.5 Specific requirements may be asked for by the local council, internal drainage board, or other relevant authorities to ensure that any maintenance plan incorporates all required measures ensuring the SuDS feature(s) are reliable for the lifetime of the development.

7.4.6 Anglian Water has published a Sustainable Drainage Systems (SuDS) Adoption Manual. This manual covers the design, construction and adoption of SuDS schemes. A major part of the adoption process is making sure that suitable maintenance procedures are implemented to allow the SuDS feature to be reliable throughout their design life. The Anglian Water SuDS Manual is only applicable where Anglian Water are adopting the system, but can be used as a reference document for other systems.

7.4.7 The maintenance requirements for a SuDS feature are set out in section 4.3 of the Anglian Water SuDS Adoption Manual, with further detail in part 3 of the manual which starts at section 12. It proposes that a management plan should be set out for the SuDS feature which will contain maintenance information, such as the tasks that need to be carried out for the system to perform as designed, specifications of how maintenance should be carried out and what materials should be used, a schedule describing what work is to be done and when, and a plan which shows the maintenance areas, control points and outfalls for the system. Responsibilities should be highlighted for each element of the system as part of the management plan.

7.4.8 The management plan should provide evidence that for the 12 months following the construction, the system is maintained and that all parts of the SuDS are effective and robust. An example maintenance plan is contained in section 14 of the manual, which shows what work is to be done and the frequency of operations.

7.4.9 Implementation of the new SuDS standards and the introduction locally of a new SuDS Approving Body (SAB) will be the responsibility of the Lead Local Flood Authority, Cambridgeshire County Council.

7.5 FLOOD AND WATER MANAGEMENT ACT 2010

7.5.1 The Act requires SuDS to be designed, constructed, maintained and operated in accordance with National Standards. One of the key features of the Act is to encourage the uptake of sustainable drainage systems by removing the automatic right to connect to sewers and providing for unitary and county councils to adopt SuDS for new developments and redevelopments.

7.5.2 The sustainable drainage strategy produced as part of a site specific FRA will need to be submitted to the relevant SuDS Approval Body for consent in accordance with the requirements of the Act. Details on how the scheme shall be maintained and managed after completion must also be included. Implementation of the new standard and the introduction locally of the new SuDS Approving Body (SAB) will be the responsibility of the Lead Local Flood Authority, Cambridgeshire County Council.

7.6 APPROPRIATENESS OF LAND USES WITHIN THE STUDY AREA

7.6.1 This section seeks to provide a policy direction in relation to flood risk and allow Fenland District Council to make informed judgements in allocating land using the Sequential Test. Advice is also provided where necessary on the Exception Test for areas that are in medium and high flood risk and where there may be no other suitable alternative areas for development, after applying the Sequential Test. It is important to note that the flood outlines used within this SFRA have been provided to guide land use allocations for the study area in relation to the Council's Core Strategy. This Level 2 SFRA is a strategic level appraisal of flood risk and does not replace the need for a site specific FRA. For the production of a site specific FRA then the Toolkit in Appendix J must be applied.

7.6.2 The highest flood hazard rating has been provided for each sub-location based on the highest recorded within the 0.5% (1 in 200), 0.5% (1 in 200) plus climate change, 0.1% (1 in 1000) and 0.1% (1 in 1000) plus climate change events. It is imperative that these flood risk and hazard ratings should be taken into consideration when undertaking the Exception Test for the following land uses: More Vulnerable in Flood Zone 3a, Highly Vulnerable in Flood Zone 2, and Essential Infrastructure in Flood Zone 3a and 3b.

7.6.3 Where suitable, finished floor levels should be set at or above the 0.1% (1 in 100) plus climate change level (fluvial) and 0.5% (1 in 200) plus climate change level (tidal) with a 300mm freeboard allowance. It should be noted that raising floor levels or ground re-shaping may not be the most suitable option and agreement should be reached with the Environment Agency and relevant IDB to ensure that flow paths will not be adversely affected.

7.6.4 Table 7.1 gives a summary of each sub location in relation to Flood Risk and Flood Hazard experienced. This is followed within the report by a more detailed description of how each sub location is affected. The highest hazard found has been quoted for each AEP event.

7.6.5 Table 7.1 should be read in line with the maps in the Appendices of this SFRA and the table does not necessarily mean the entire-sub-location is subject to the same findings as that shown in the two hazard columns.

Table 7.1 – Summary of Sub Location Flood Risk and Hazard Information

Sub Location	Flood Zones	Hazard during Overtopping	Hazard during Breach
A	FZ1, FZ2 and FZ3	1. No Hazard	1. Danger for Most
		2. Low Hazard	2. Danger for Most
		3. No Hazard	3. Danger for Most
		4. Danger for Most	4. Danger for All
B	FZ1, FZ2 and FZ3	1. No Hazard	1. Danger for All
		2. No Hazard	2. Danger for All
		3. No Hazard	3. Danger for All
		4. No Hazard	4. Danger for All
C	FZ1, FZ2 and FZ3	1. No Hazard	1. Danger for All
		2. Danger for All	2. Danger for All
		3. No Hazard	3. Danger for All
		4. Danger for All	4. Danger for All
D	FZ1, FZ2 and FZ3	1. No Hazard	1. Danger for All
		2. Danger for Most	2. Danger for All
		3. No Hazard	3. Danger for All
		4. Danger for All	4. Danger for All
E	FZ1, FZ2 and FZ3	1. No Hazard	1. Danger for All
		2. Danger for Most	2. Danger for All
		3. Low Hazard	3. Danger for All
		4. Danger for Most	4. Danger for All
F	FZ1, FZ2 and FZ3	1. No Hazard	1. Danger for All
		2. Danger for All	2. Danger for All
		3. No Hazard	3. Danger for All
		4. Danger for All	4. Danger for All

Key

Type of Event	Hazard Rating
1. 0.5% (1 in 200) AEP – 2006	No Hazard
2. 0.5% (1 in 200) AEP – 2115	Low Hazard
3. 0.1% (1 in 1000) AEP – 2006	Danger for Some
4. 0.1% (1 in 1000) AEP – 2115	Danger for Most
	Danger for All

Sub Location A - East

7.6.6 The Flood Map and Flood Hazard mapping provided in Appendices G and E respectively show that this sub-location is at risk of flooding from the various ditches and drains that make up the Kings Lynn IDB watercourses in the area. There is no tidal influence to the fluvial flooding mechanism in this area. Fluvial flooding originates from watercourses to the north and east of this sub-location. The 0.5% (1 in 200) plus climate change and 1 in 0.1% (1 in 1000) plus climate change overtopping and breaching flood hazard outlines do not heavily impact on this sub-location. For the 0.5% (1 in 200) plus climate change breaching flood hazard extent, there are no instances of a 'Danger for All' occurring in this sub location. The 0.5% (1 in 200) plus climate change overtopping extent has a 'Danger for Most' rating and the 0.1% (1 in 1000) does have a 'Danger for All'.

7.6.7 Where appropriate, mitigation measures could include land raising and floodplain compensation (please refer to the Flood Risk Assessment Toolkit in Appendix J for further information). Residential, health service facilities and educational establishment land uses are classified as 'More Vulnerable'. Development which should always be steered to Flood Zone 1, however 'More Vulnerable' land uses are permissible in Flood Zone 2 subject to the passing of the Sequential Test and should only occur in Flood Zone 3 if both the Sequential and Exception Tests have been satisfied. 'Highly Vulnerable' land uses should only be provided in Zone 1, they are not permissible in Flood Zone 3 and are only permitted in Flood Zone 2 providing the Sequential and Exception Tests have been passed. The information provided in Appendix G shows this sub-location is not covered by the Environment Agency's flood warning system. The area does not benefit from any raised flood defences, however pumping stations maintained by the King's Lynn IDB help to ensure that water levels are well managed within the various watercourses.

7.6.8 Hydraulic modelling undertaken by the King's Lynn IDB in 2010 indicated that flood alleviation measures such as the pumping stations and construction of a storage pond to the east of the SFRA study area, help to ensure that water levels remained predominately within channel in this area up to a 1% (1 in 100) AEP event.

Sub Location B - South

7.6.9 The Flood Maps and Flood Hazard mapping provided in Appendices G and E respectively show that this sub-location is at risk of flooding, although this area is defended from the River Nene. Areas that are most heavily impacted on by the flood outlines fall into the western half of the sub-location. The 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change breaching flood hazard outlines impact on the western part of this sub-location. 'Danger for All' areas are found within the sub-location under these circumstances. The 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change overtopping hazard extents do not impact on this sub-location.

7.6.10 Residential, health service facilities and educational establishment land uses are classified as 'More Vulnerable'. Development which should always be steered to Flood Zone 1, however subject to the passing of the Sequential Test 'More Vulnerable' land uses are permissible in Flood Zone 2 and should only occur in Flood Zone 3 if both the Sequential and Exception Tests have been satisfied. 'Highly Vulnerable' land uses should only be provided in Flood Zone 1, they are not permissible in Flood Zone 3 and are only permitted in Flood Zone 2 providing the Sequential and Exception Tests have been passed. Where appropriate, mitigation measures could include land raising and floodplain compensation (please refer to the Flood Risk Assessment Toolkit in Appendix J for further information).

7.6.11 The information provided in Appendix G shows the western part of this sub-location adjacent to the River Nene is covered by the Environment Agency's flood warning system. Pumping stations and other assets operated and maintained by both the Hundred of Wisbech and Waldersey IDB are held to ensure that water levels are managed within this sub-location.

Sub Location C - West

7.6.12 As shown in the Flood Maps and Flood Hazard mapping provided in Appendices G and E respectively this sub-location is at risk of flooding from the River Nene and the various ditches and drains that make up the IDB watercourses in the area. The 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change overtopping flood hazard outlines impact on the north east part of this sub-location. These extents show occurrences of a 'Danger for All' occurring in parts of the sub-location; this is specifically noted along the IDB watercourses. For the 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change breaching extents, areas closest to the River Nene are inundated the most, showing areas of 'Danger for All' along IDB watercourses. Breaching extents cover the entire length of the sub-location, whilst overtopping extents relate to the raised defences along the western bank of the Nene in the centre of Wisbech.

7.6.13 Residential, health service facilities and educational establishment land uses are classified as 'More Vulnerable'. Development which should always be steered to Flood Zone 1, however subject to the passing of the Sequential Test 'More Vulnerable' land uses are permissible in Flood Zone 2 and should only occur in Flood Zone 3 if both the Sequential and Exception Tests have been satisfied. 'Highly Vulnerable' land uses should only be provided in Flood Zone 1, they are not permissible in Flood Zone 3 and are only permitted in Flood Zone 2 providing the Sequential and Exception Test has been passed. Where appropriate, mitigation measures could include land raising and floodplain compensation (please refer to the Flood Risk Assessment Toolkit in Appendix J for further information). The information provided in Appendix G shows this sub location is covered by the Environment Agency's flood warning system. Pumping stations maintained by North Level District IDB help to ensure that water levels are well managed within the various IDB watercourses.

Sub Location D - North West

7.6.14 As shown in the Flood Maps and Flood Hazard mapping provided in Appendices G and E respectively, this sub-location is at risk of flooding from the River Nene and the various ditches and drains that make up the IDB watercourses in the area. The Flood Map extents show that flooding occurs predominately within the eastern part of the sub- location emanating from the River Nene. The 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change overtopping flood hazard outlines impact on a very small area within the southern part of the sub-location along the North Level District IDB watercourse (550). The 0.1% (1 in 1000) plus climate change extent shows occurrences of a 'Danger for All' hazard occurring along the IDB watercourses. For the 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change breaching extents, areas closest to the River Nene are inundated the most. The highest hazards that can be found in the event of a breach occur in between the Nene defences and Sutton Road, which runs in a north to south direction approximately 400m to the west of the defences. The overtopping extents indicate that the raised defences along the Nene in this area, provide a higher level of protection than the 0.5% (1 in 200) event.

7.6.15 Breaching extents cover the entire length of the sub-location, and in some areas there is a 'Danger for All' hazard rating.

7.6.16 Residential, health service facilities and educational establishment land uses are classified as 'More Vulnerable'. Development which should always be steered to Flood Zone 1, however 'More Vulnerable' land uses are permissible in Flood Zone 2 subject to the passing of the Sequential Test and should only occur in Flood Zone 3 if the Sequential and Exception Test has been satisfied. 'Highly Vulnerable' land uses should only be provided in Flood Zone 1, they are not permissible in Flood Zone 3 and are only permitted in Flood Zone 2 providing the Sequential and Exception Test has been passed. Where appropriate, mitigation measures could include land raising and floodplain compensation (please refer to the Flood Risk Assessment Toolkit in Appendix J for further information). The information provided in Appendix G shows this sub location is covered by the Environment Agency's flood warning system. Pumping stations maintained by North Level District IDB help to ensure that water levels are well managed within the various IDB watercourses.

Sub Location E - North

7.6.17 The Flood Maps and Flood Hazard mapping provided in Appendices G and E respectively show that this sub-location is at risk of flooding from the River Nene and the various ditches and drains that make up the Kings Lynn IDB watercourses in the area. The Flood Map extents show that highest level of flooding occurs predominately within the western part of the sub-location emanating from the River Nene. The 0.5% (1 in 200) plus climate change overtopping extent impacts the most on the area in between the Nene's raised defences and Waterlees Road which runs in a north to south direction approximately 600m to the east of the Nene. Both the 0.5% (1 in 200) plus climate change and the 0.1% (1 in 1000) plus climate change extent shows instances of a 'Danger for All' within the sub-location. For both the 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change breaching extents, the most inundated areas are those closest to the River Nene.

7.6.18 Breaching extents are almost identical for both the 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change extents; however for the 0.1% (1 in 1000) plus climate change extent, the instances of a 'Danger for Most' and 'Danger for All' are greater.

7.6.19 Residential, health service facilities and educational establishment land uses are classified as 'More Vulnerable'. Development which should always be steered to Flood Zone 1, however 'More Vulnerable' land uses are permissible in Flood Zone 2 subject to the passing of the Sequential Test and should only occur in Flood Zone 3 if both the Sequential and Exception Tests have been satisfied. 'Highly Vulnerable' land uses should only be provided in Flood Zone 1, they are not permissible in Flood Zone 3 and are only permitted in Flood Zone 2 providing the Sequential and Exception Tests have been passed. Where appropriate, mitigation measures could include land raising and floodplain compensation (please refer to the Flood Risk Assessment Toolkit in Appendix J for further information). The information provided in Appendix G shows part of this sub location is covered by the Environment Agency's flood warning system. Pumping stations maintained by Kings Lynn IDB, would help to ensure that water levels are well managed within the various IDB watercourses.

7.6.20 Hydraulic modelling undertaken by the Kings Lynn IDB in 2010, indicated that flood alleviation measures such as the pumping stations, and construction of a storage pond to the east of the SFRA study area, helped to ensure that water levels remain predominately within channel in this area up to a 1% (1 in 100) AEP event.

Sub Location F - Centre

7.6.21 Flood Maps and Flood Hazard mapping provided in Appendices G and E respectively show that this sub-location is at risk of flooding from the River Nene and the various ditches and drains that make up the IDB watercourses in the area. The Flood Map extents show that flooding occurs predominately within the western part of the sub location originating from the River Nene. Areas to the East fall into Flood Zone 1. Both the 0.5% (1 in 200) plus climate change and the 0.1% (1 in 1000) plus climate change overtopping extents show instances of flooding in the central northern area of the sub-location. These flood extents extend on both sides of the Nene defences. 'Danger for All' hazards are seen in parts of the sub- location for both these scenarios. For both the 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change breaching extents, areas closest to the River Nene experience the greatest levels of inundation. However, due to ground elevations the very centre of Wisbech to the east of the Nene is unaffected by the flood extents for both these breach scenarios.

7.6.22 The 1978 flood outline shows significant similarities with the overtopping climate change modelled outlines, where the northern parts of this sub location are shown to experience the greatest levels of tidal flooding.

7.6.23 Breaching extents are almost identical for both the 0.5% (1 in 200) plus climate change and 0.1% (1 in 1000) plus climate change scenarios, however for the 0.1% (1 in 1000) plus climate change extent, the instances of a 'Danger for Most' and 'Danger for All' are greater.

7.6.24 Residential, health service facilities and educational establishment land uses are classified as 'More Vulnerable'. Development which should always be steered to Flood Zone 1; however 'More Vulnerable' land uses are permissible in Flood Zone 2 subject to the passing of the Sequential Test and should only occur in Flood Zone 3 if both the Sequential and Exception Tests have been satisfied. 'Highly Vulnerable' land uses should only be provided in Flood Zone 1, they are not permissible in Flood Zone 3 and are only permitted in Flood Zone 2 providing the Sequential and Exception Tests have been passed. Where appropriate, mitigation measures could include land raising and floodplain compensation (please refer to the Flood Risk Assessment Toolkit in Appendix J for further information). The information provided in Appendix G shows part of this sub-location is covered by the Environment Agency's flood warning system. Pumping stations and other assets operated and maintained by the IDBs are held to ensure that water levels are managed within this sub-location.

Overview

7.6.25 It is important to note that the Flood Hazard outlines for the overtopping scenario shows that the raised defences along the River Nene provide an adequate level of protection up to the 0.5% (1 in 200) plus climate change event. This applies to all sub-locations within the study area.

7.6.26 Where a breach in the Nene defences has occurred, then the hazard mapping indicates the highest level of risk to be in the areas closest to the breach. However, it is important to note breaching could occur at any point along the defences.

7.6.27 A site specific Flood Risk Assessment Toolkit has been provided in Appendix J for the study area, based on the findings of this Level 2 SFRA. Guidance on the appropriate treatment of climate change impacts, control of surface water runoff, implementation of appropriate SuDS techniques and consideration of residual risks have been offered to assist Fenland District Council and future developers.

8 Recommendations

8.1 RECOMMENDATIONS

8.1.1 Fenland District Council are required to carry out the Sequential Test for allocating land for future development within the study area, based upon supporting evidence provided in this Level 2 SFRA. The Sequential Test should be undertaken in relation to the test criteria set out in section 7.2. Guidance has also been provided on appropriate policies for sites which satisfy the first part of the Exception Test and requirements to consider the planning application stage to pass the second part of the Exception Test as set out in the NPPF and NPPF Technical Guidance. The following recommendations should be taken into consideration by Fenland District Council:

- Ensure that developers and their consultants make reference to this Level 2 SFRA study, and the most up to date District-wide SFRA prior to the formulation of development proposals and planning applications, within the study area. This is to ensure that the key requirements of the NPPF (supplemented by recommendations within the SFRA) are met;
- Ensure the developers and their representatives consult with all relevant stakeholders before submitting a FRA;
- Ensure that developers carry out site specific FRA's for their proposals in line with the NPPF and the relevant authorities namely the Environment Agency, Internal Drainage Board, Local District Council and Anglian Water. Specific reference is made to the FRA 'Toolkit' provided in Appendix J;
- Ensure that flood mitigation measures are implemented on a site specific basis where necessary;
- Fenland District Council should seek to implement strategic flood mitigation opportunities such as areas of Green Infrastructure (where possible). These areas would also provide biodiversity benefits which would help to enhance the natural environment and would provide community benefit;
- Take into consideration the findings made within the emerging Cambridgeshire Surface Water Management Plan in relation to surface water flood risk issues within the study area;
- Support the implementation of SuDS by way of robust planning conditions and or Section 106 agreements; and
- Emergency Planners should take into consideration the findings presented within this Level 2 SFRA. This will help assist in the preparation of evacuation routes and emergency planning procedures in the event of extensive fluvial flooding in and around Wisbech.

8.2 AREAS FOR FURTHER INVESTIGATION

8.2.1 On-going consultation should be undertaken with the Environment Agency and IDBs with regards to future delivery of Flood Alleviation Schemes in relation to the study area.

8.2.2 Fenland District Council are recommended to investigate the application of a 'roof tax' or similar mechanism to supplement flood defence and strategic flood alleviation schemes. These measures are part of a planning application process required to safeguard the future of existing settlements that are deemed to be at risk of flooding currently and in the future, taking climate change into account. Any such change will be in addition to any contribution required by the IDBs or other authorities.

9 Conclusion

9.1 SUMMARY

9.1.1 A Level 2 strategic assessment of flood risk has been carried out to assist Fenland District Council with site allocations within their Core Strategy. The study area is shown in Appendix A.

9.1.2 One of the key aspects of this Level 2 SFRA is that the entire study area is well defended from fluvial and tidal flood risk issues. This defence is provided by the Environment Agency and other land owners through a combination of raised flood defences along the River Nene, and pumping stations and other assets owned and maintained by the various Internal Drainage Boards. Providing these defences are well maintained and upgraded when necessary, sustainable development could occur in defended flood risk areas subject to the Sequential and Exception tests being passed including assessment of residual risk and consideration of implications of the Hazard Mapping.

9.1.3 Fluvial and tidal flood risk within the Wisbech study area is well managed through raised defences and IDB pumping stations. Providing these engineered measures are well maintained and upgraded when necessary, flooding from both fluvial and tidal sources is considered to be a residual risk. In the unlikely event of a breach in the Nene's raised defences, areas of rapid inundation closest to the raised defences would experience the highest Flood Hazard. The low lying nature of the area would facilitate the passage of water under these conditions. Historically the north part of the Wisbech urban area that is found within sub-location F experiences the highest levels of tidal flooding.

9.1.4 Wisbech falls within the Fens Policy Unit Areas of both the River Nene and Great Ouse Catchment Flood Management Plans which set out that further action will be taken to sustain the current scale of flood risk into the future responding to the potential increases in risk from urban development, land use change and climate change.

9.1.5 In the absence of climate change outlines for the Flood Map, the Flood Zone 2 extent should be used to infer the Flood Zone 3 plus climate change extent.

9.1.6 Particular reference should be made to the Flood Maps and Flood Hazard maps for each sub-location shown in Appendices G and E respectively. The Flood Hazard mapping indicates that the raised flood defences along the Nene do not experience any overtopping for the 0.5% (1 in 200) plus climate change AEP tidal flood event.

9.1.7 Land allocations within each of the sub-locations must be made with reference to the Sequential and Exception Tests as set out within the NPPF. A sequential approach should be adopted for areas that fall within Flood Zones 2 and 3. Flood mitigation measures will be key to ensuring sustainable development within defended flood risk areas.

9.1.8 A site specific FRA 'Toolkit' (Appendix J) has been provided to assist Fenland District Council, the Environment Agency and future developers in identifying the key flood risk issues within the study area. This Toolkit is designed to assist with the formulation of policies and solutions to the management of flood risk and surface water runoff that are of benefit strategically rather than locally.

9.1.9 This SFRA has been based on government guidance and information available at the time of report issue (June 2012). Flood risk classifications may be subject to change in line with future government guidance. Flood zoning may also change within each of the strategic sites following consideration of detailed topographical information, and investigation of flood risk issues within site specific FRAs accompanying planning applications.

9.1.10 Both the Great Ouse CFMP and the Nene CFMP are key policy documents that provide a key strategic insight into the sustainable management of flood risk within the Wisbech study area.

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