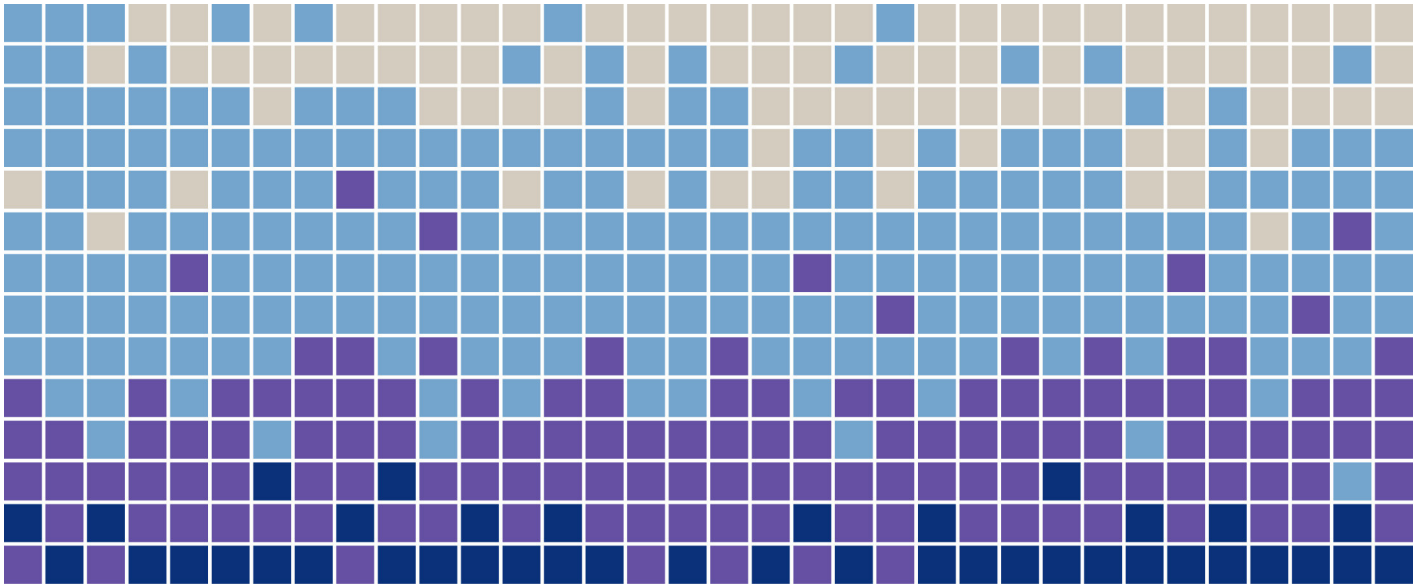

Newark and Sherwood District Council Strategic Flood Risk Assessment

Level 1 Report

Newark and Sherwood District Council

01 July 2009

QM

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Prepared by	N Harding	M Stinton	M Stinton	M Stinton	M Stinton	M Stinton
Signature						
Checked by		M Ewunetu	S Tucker	S Tucker	J Biggins	J Biggins
Signature						
Authorised by	N Harding		S Purcell	S Purcell	S Purcell	S Purcell
Signature						
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WSP Development and Transportation
Unit 9, The Chase
John Tate Road
Foxholes Business Park
Hertford
SG13 7NN

Tel: +44 (0)1992 526 000
Fax: +44 (0)1992 526 001
http://www.wspgroup.com

Reg. No: 2382309

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Executive Summary

A 'Level 1' Strategic Flood Risk Assessment (SFRA) has been undertaken for a designated study area defined by the Newark and Sherwood District Council (NSDC) boundary (see Appendix A). This will provide a comprehensive and robust assessment of the extent and nature of the risk of flooding and its implications for land use planning.

The principal aim of the study is to set out flood risk constraints to help inform the preparation of the Local Development Framework (LDF) for the District. The study area has been categorised into Flood Risk Zones in accordance with Planning Policy Statement 25: 'Development and Flood Risk' (PPS25).

This Level 1 SFRA report and appendices, provides a sound framework with an appropriate level of detail required at this stage for making consistent and sustainable future planning decisions. Extensive data has been made available for this study.

A key reason for the production of this report, is to allow NSDC to undertake the Sequential Test of the 72 sites listed in the SFRA (see Appendix A). Additional sites brought forward will also need the Sequential Test undertaken based on the findings of this SFRA. The findings of the SFRA have shown that 63% of these sites are located entirely in Flood Zone 1; the remainder fall within Flood Zones 2 and 3.

Due to an increase in the number of sites in the Strategic Housing Land Availability Assessment, the scope of the Level 1 SFRA has grown considerably since its commissioning.

The SFRA evaluates the current (2009) flood risk situation and the future flood risk situation over a 106 year timeframe (2115), incorporating the impacts of climate change in line with PPS25.

An FRA toolkit for each study area (with an urban or rural distinction, where appropriate) has been provided (see Appendix F), to assist NSDC to consider appropriate flood risk issues affecting future development proposals.

The Level 2 SFRA (to be prepared in due course), will provide a sound framework for making consistent and sustainable future planning decisions throughout the District. The key aim of the Level 2 SFRA should be to undertake further analysis that provides supporting evidence for the Exception Test. This analysis will focus on areas where there is potential development pressure in zones of medium to high flood risk.

One of the key findings of the Level 1 study is that further analysis needs to be undertaken of the standard and condition of existing flood defences. It is also recommended that further analysis and refinement of the hydraulic modelling data for the various watercourses in the District is completed. One of the key findings of the draft Trent Catchment Flood Management Plan is that many defences protecting urban areas within the catchment, will need improving or refurbishing due to the effects of climate change.

Future growth directions within the NSDC study area may alter from the direction currently evolving from the LDF process. **This SFRA should be reviewed annually and updated at least every five years, to reflect any amendments in future growth proposals.** This will ensure it remains a 'living' document.

As further modelling is conducted and flood defences are created or improved, areas at risk of flooding should be re-assessed based on changes to the Flood Zone Maps. The impact of this on potential development sites listed in the SFRA should be reappraised.

GLOSSARY

AEP	Annual Exceedance Probability e.g. 1% AEP is equivalent to 1% probability of occurring in any one year (or, on average, once in every 100 years).
BAP	Biodiversity Action Plan is a strategy prepared for a local area, aimed at conserving and enhancing biological diversity.
DCLG	Department for Communities and Local Government.
Catchment	An area drained by a specific river/ watercourse.
Catchment Flood Management Plan	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.
DEFRA	Department of Environment, Food and Rural Affairs
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.
Development Plan Document (DPD)	A spatial planning document within the Council's Local Development Framework which set out policies for development and the use of land. Together with the Regional Spatial Strategy they form the development plan for the area. They are subject to independent examination.
Drift Geology	The unconsolidated sediments at or near the Earth's surface (overlying the bedrock formations) of Quaternary age or more recent.
EA	Environment Agency.

EA Main River	These are all watercourses shown on the statutory main river maps held by the EA 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 EA has permissive powers to carry out works of maintenance and improvement on these rivers.
Flood Plain	Any area of land over which water flows or would flow or be stored in the absence of flood defences.
Flood Zone 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 return periods.
Fluvial	Relating to a watercourse (river or stream).
Formal Flood Defence	A structure built and maintained specifically for flood defence purposes.
Functional Floodplain	PPS25 Flood Zone, defined as areas at risk of flooding in the 5% AEP (20 year) design event.
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 stages and flows of water within a watercourse.
LIDAR	(Light Imaging Detection and Ranging). 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.

Local Plan	A document identifying detailed proposals for the use of land in a local area which interprets the broader policies and proposals of the Structure Plan.
Ofwat (Water Services Regulation Authority)	The economic regulator for the water and sewerage industry in England and Wales.
Ordinary Watercourses	This is every river, stream, ditch, drain, dyke, sluice, sewer and passage through which water flows and which does not form part of a main river.
Planning Policy Guidance (PPG)	A series of notes issued by the Government, setting out policy guidance on different aspects of planning. They will be replaced by Planning Policy Statements.
Planning Policy Statement (PPS)	A series of statements issues by the Government, setting out policy guidance on different aspects of planning. They have replaced Planning Policy Guidance Notes.
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.
PPS25	Planning Policy Statement 25: Development and Flood Risk Department of Communities & Local Government, 2006.
Previously Developed (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.
Reach	The extent of a watercourse.
Regional Spatial Strategy (RSS)	Planning strategies developed by the regions. These were previously called Regional Planning Guidance.
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.
Sustainability Appraisal	Sustainability Appraisal (SA) is an appraisal of plans, strategies and proposals to test them against the objectives set out in the Government's sustainable development strategy.

Solid Geology (Bedrock)	The consolidated soils and rock exposed at the surface of the Earth or overlain by unconsolidated material, weathered rock or soil.
Source Protection Zone (SPZs)	This is an area where recharge is captured by an abstraction borehole. SPZs are designated by the Environment Agency so as to protect potable water supplies against polluting activities.
SuDS	Sustainable Drainage Systems. 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.
Supplementary Planning Document (SPD)	Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.
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).
Washlands	These are areas of a floodplain where water is stored in times of flooding. This is the same purpose as the Functional Floodplain.
Windfall sites	These are sites that are not specifically allocated for development, but become available for development during the lifetime of a Development Plan.
Zone 1 Low Probability	PPS25 Flood Zone, defined as areas outside of Zone 2 Medium Probability. These areas have less than a 0.1% (1 in 1000) AEP of river or sea flooding in any year.
Zone 2 Medium Probability	PPS25 Flood Zone, defined as areas at risk of flooding in events that are greater than the 1% (100 year) AEP, and less than the 0.1% (1000 year) AEP event or between a 0.5% (200 year) and 0.1% (1000 year) AEP of sea flooding.
Zone 3a High Probability	PPS25 Flood Zone, defined as areas at risk of flooding in the 1% (100 year) AEP design event for river flooding and 0.5% (200 year) or greater AEP of sea flooding.
Zone 3b Functional Floodplain	PPS25 Flood Zone, defined as an area where water has to flow or be stored in times of flooding. This has a 5% (20 year) AEP potential of occurring.

1 Introduction

1.1 BACKGROUND

1.1.1 Newark and Sherwood District lies in the East Midlands region, and has been identified as a New Growth Point. The Secretary of State's Proposed Changes to the East Midlands Regional plan require 17,800 dwellings to be accommodated in the District between 2001 and 2026.

1.1.2 The District is approximately 65,000 hectares and extends over almost a third of Nottinghamshire (see Appendix A).

1.1.3 In order to plan the implementation of new development in a sustainable manner, NSDC will formulate a Local Development Framework (LDF) that contains Development Plan Documents (DPD) and Supplementary Planning Documents (SPD), taking into account the views of key stakeholders, and following careful consideration of sustainability issues and constraints to development. One such consideration is flood risk.

1.1.4 WSP Development and Transportation (WSP) have been commissioned by NSDC to undertake a Strategic Flood Risk Assessment (SFRA) for the District of Newark and Sherwood to inform the LDF process.

1.1.5 This Level 1 SFRA has been carried out with the co-operation and support of the Environment Agency (EA), Newark Area Internal Drainage Board (NAIDB), Upper Witham Internal Drainage Board (UWIDB), Severn Trent Water, Anglian Water, NSDC, and other local stakeholders.

1.2 OBJECTIVES

1.2.1 The objectives of the SFRA study are to:

- Provide a reference and policy document to inform the preparation of the LDF for the District.
- Ensure that NSDC meet their obligations under the current PPS25 and Local Plan Policy guidelines and standards.
- Inform the Sustainability Appraisal so that flood risk is taken into account when considering options and in the preparation of land use policies.
- Provide a sufficient level of detail to allow NSDC to undertake the Sequential Test.
- To advise and inform private and commercial developers of their obligations under PPS25 in relation to sustainable development and flood risk.

1.3 SCOPE

1.3.1 This 'Level 1' study forms the first part of a two stage approach, namely:

- 'Level 1' which comprises the collection and initial review of baseline information collected to carry out the SFRA and an overview of fluvial and tidal flood risk issues in relation to potential growth areas within the District. This is based principally, upon the EA's Flood Zone Maps. Detailed modelled flood outlines have also been used in combination with the EA's flood outlines;

- 'Level 2' should focus upon the identification and assessment of the principal sources of flood risk associated with the study area in relation to existing, proposed, and potential key development proposals following a more detailed review of data collected within the 'Level 1' study. The assessment will pay due regard, however, to the NSDC settlement hierarchy (see section 4.12) where potential future growth areas have been identified as well as brownfield sites.

1.3.2 The SFRA is essentially a planning tool. It is an assessment of flood risk intended to inform the spatial planning process and, therefore, the level of detail and accuracy should relate 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 PPS25 (Development and Flood Risk).

1.4 THE SEQUENTIAL TEST

1.4.1 The Sequential Test as set out within Planning Policy Statement 25 aims to steer vulnerable development towards areas of lower flood risk; it is central to PPS25 and should be applied at all levels of the planning process. The Sequential Test should demonstrate whether there are sites available in areas at a lower probability of flooding. A key reason for the completion of the Level 1 study is to provide supporting evidence for NSDC to undertake this test.

1.5 THE EXCEPTION TEST

1.5.1 PPS25 expands on the Sequential Test by incorporating an Exception Test, whereby if following the Sequential Test it is not possible or consistent with wider sustainability objects, for the development to be located in zones of lower probability of flooding, the Exception Test can be applied. For the Exception Test to be passed it must be demonstrated that;

1) the development provides wider sustainability benefits to the community that outweigh flood risk, informed by an SFRA where one has been prepared.

2) the development should be on developable, previously developed land or if it is not on previously developed land, that there are no reasonably alternative sites that are on previously developed land; and

3) the Flood Risk Assessment must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.

1.5.2 The Level 2 SFRA will need to provide supporting information for the Exception Test to be undertaken for any potential development sites that fall within areas of medium to high flood risk.

1.6 NATIONAL PLANNING POLICY

1.6.1 Since 1988 the Government has been issuing national guidance in the form of Planning Policy Guidance Notes (PPG's). Planning Policy Guidance Note 25: Development and Flood Risk (PPG 25), published in July 2001 by the Department of Transport, Local Government and the Regions (DTLR) specifically addressed Development and Flood Risk. Paragraph 27 states:

"Local Authorities should adopt a risk based approach to proposals for development in or affecting flood risk areas."

1.6.2 The Department for Communities and Local Government's (DCLG) Planning Policy Statement 25: Development and Flood Risk (PPS25), replaced PPG25 in December 2006. Paragraph 6 sets out that Local Planning Authorities (LPAs) should prepare and implement planning strategies that help to deliver sustainable development by:

Appraising Risk

- Identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;
- Preparing Strategic Flood Risk Assessments as freestanding assessments that contribute to the Sustainability Appraisal of their plans;

Managing Risk

- Framing policies to the location of development which avoids flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;
- Only permitting development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;

Reducing Risk

- Safeguarding land from development that is required for current and future flood management e.g conveyance and storage of flood water, and flood defences;
- Reducing flood risk to and from new development through location, layout, and design, incorporating sustainable drainage systems (SuDS);
- Using opportunities offered by new development to reduce the causes and impacts of flooding e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance, and SuDS; re-creating functional floodplain and setting back defences;

A Partnership Approach

- Working effectively with the EA, other operating authorities and other stakeholders to ensure that plans are effective and decisions on planning applications can be delivered expeditiously; and
- Ensuring spatial planning supports flood risk management policies and plans, River Basin Management Plans and emergency planning.

1.6.3 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.

1.6.4 As part of best practice and in line with EA guidance, NSDC have commissioned an SFRA in an effort to define areas suitable for development from a flood risk perspective and to provide a reference and policy document for private and commercial development.

1.6.5 For the purposes of this SFRA, the study has been based upon PPS25 and the supporting Practice Guidance (June 2008).

1.7 REGIONAL AND LOCAL PLANNING POLICY

1.7.1 East Midlands Regional Plan sets out in Policy 35 “A Regional Approach to Managing Flood Risk”. This policy outlines both the strategic and local context for managing flood risk. Policy 35 states;

“Local Authorities, developers, water companies, the Environment Agency and other relevant public bodies should work together to;”

- take water related issues into account at an early stage in the process of identifying land for development and in the phasing and implementation of development;
- assess the scope for reducing leakage of public water supply from current levels;

- promote improvements in water efficiency in new development and in regeneration to achieve a regional target of 25% (equivalent to an average saving of about 35 litres per person per day);
- reduce unsustainable abstraction from watercourses and aquifers to sustainable levels;
- protect and improve water quality and reduce the risk of pollution especially to vulnerable groundwater;
- protect the integrity of nature conservation sites designated as being of international importance, particularly through the phasing of development to match the availability of water resources;
- make provision for the development of new water resources where this represents the most sustainable solution to meeting identified water resource requirements, taking account of predictions of future climate change;
- use sustainable drainage techniques wherever practical to help mitigate diffuse pollution and support groundwater recharge. These will be required where development is upstream of a designated nature conservation site of international importance or to improve water quality, where the need is demonstrated through water cycle studies;
- support water conservation measures such as winter storage reservoirs on agricultural land; and
- ensure that sewage treatment capacity is sufficient to meet the needs of development. Necessary improvements should be in place so that development does not compromise the quality of discharged effluent. Priority areas for investigation include Mansfield, Worksop, Newark, Derby, Leicester, Market Harborough, Melton Mowbray, Lincoln, Grantham, Kettering and Wellingborough.

1.7.2 The present Newark and Sherwood Local Plan (adopted March 1999) contains detailed policy on flood risk. Policy PU1 Washlands require flood risk to be a material consideration for development proposals. Policy PU1 states;

Planning permission will not be granted for built development or the raising of ground levels in the washlands of the Rivers Trent, Devon, Fleet, Maun, Meden and Greet, except if alternative flood storage capacity has been provided elsewhere.

1.7.3 Section 14.12 of the Local Plan goes on to state:

Large areas of land in the District lie within washlands and are liable to flood. These areas, which have been identified by the EA, are shown on the Proposals Map. It is important to ensure that new development is not at risk from flooding which could endanger life, damage property or cause the wasteful expenditure of public resources on remedial works. Development in such locations may also increase the risk of flooding elsewhere by reducing storage capacity for the floodplain or by impeding the flow of flood water. Land raising in the floodplain may have a similar effect. Development will therefore be resisted in washlands, in accordance with guidance in Circular 30/92. "Development and Flood Risk" and Policy 11/1 of the Structure Plan Review. Exceptions may be made if alternative flood storage capacity has been provided elsewhere. Within the washland areas of the District, there are many existing buildings and uses ranging from dwellings and farm buildings to employment and retail sites. New built development associated with these sites and buildings will not normally be acceptable. However, it is recognised that small extensions or the rationalisation of existing sites to reduce the floor area covered by buildings may in certain circumstances be acceptable.

1.8 LOCAL PLANNING CONTEXT

1.8.1 The District Council is currently preparing a Local Development Framework to replace the existing Local Plan. Given the nature of the flood risk of the District and the level of growth envisaged in the East Midlands Regional Plan this SFRA will be a key piece of the District's LDF evidence base. The strategic element of the LDF the Core Strategy and Development Policy Development Plan Document is being progressed as a priority. Consultation on Options will be undertaken in May 2009 with a view to submission in January 2010 – adoption is scheduled for October 2010. Meanwhile work on the site specific element of the LDF will begin in summer 2009; submission will be in October 2010 with adoption scheduled for July 2011.

1.9 RIVER TRENT CATCHMENT FLOOD MANAGEMENT PLAN

1.9.1 The EA is currently preparing a Catchment Flood Management Plan (CFMP) for the River Trent catchment; a large proportion of the NSDC study area falls within this catchment. The CFMP is due to be issued in 2009. This is a high level strategic plan that will assess how flood risk might change and be sustainably managed over the next 50 to 100 years.

1.9.2 A number of opportunities and constraints were made apparent whilst undertaking the scoping stage. These have been used, along with aspirational targets, to develop a number of objectives for the CFMP in response to specific flood risk issues, features or problems. The CFMP aims to change the way we think about flood risk management. The overall objectives for the Trent CFMP as set out in the Pre-Publication Report (September 2008) are as follows:

- Sustain and improve the status of environmentally designated areas through appropriate frequency, extent and duration of flooding, including the utilisation of rivers and floodplains for the benefit of nature conservation.
- Reduce soil erosion resulting from surface water run-off.
- Support and encourage land management and land use that will reduce run-off rates from upland areas.
- Return watercourses to a more natural state, increasing biodiversity and opening up green corridors through urban areas.
- Sustain and increase the amount of Biodiversity Action Plan (BAP) habitat in the catchment.
- Support and encourage land management that will protect and improve water quality.
- Sustain and protect cultural and social heritage in the catchment.
- Reduce the number of people at risk from deep and fast flowing flood waters or fast onset of flooding.
- Minimise disruption to people, property and communities caused by flooding, taking into account future pressure resulting from climate change, sea level rise, population growth or land use change.
- Reduce the disruption caused by flooding to transport and infrastructure.
- Reduce the cost of flood damages where it is high and economically viable to do so.
- Reduce the cost of flood risk management and implement more sustainable methods of flood risk management.
- Minimise the increase in the cost of flood damages, taking into account future pressures which may increase flood risk.

1.9.3 The CFMP represents the first 'tier' in the strategic flood risk management process, providing a basic policy framework beneath which the EA can carry out a more detailed assessment of flood risk through strategies or specific schemes. The aim of the CFMP will be to reduce the overall flood risk within the catchment by setting the policies that best meet the specific CFMP objectives.

1.9.4 Part of the plan sets out the EA's commitment to implement flood risk reductions through working with other authorities, organisations and groups. The Pre-Publication Report (September 2008) states that the EA has developed policies that set out the direction flood risk management will take in the future that will help the EA to achieve their vision of a more sustainable, cost effective and natural approach to managing catchments in the future. These policies are as follows;

- Policy Option 1- No active intervention (including flood warning and maintenance). Continue to monitor and advise.
- 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 (accepting that flood risk will increase over time from this baseline).
- Policy Option 4- Take further action to sustain current scale of flood risk into the future (responding to the potential increases in flood 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).
- 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.

1.9.5 Within the CFMP, the entire catchment is divided up into ten different Policy Units (see Appendix A), based on geographical areas. Policy Units 2 (Sherwood) and 4 (Shelford to Gainsborough) relate to the NSDC area.

1.9.6 Policy Unit 2 identifies the level of flood risk to this area as being low but higher in urban areas. Flood risk is identified as mainly emanating from the River Torne and River Idle and its tributaries the Maun and the Meden. The Policy Unit objectives are as follows:

- Reduce the cost of Flood Risk Management and implement more sustainable methods, such as reduced run-off through land use change (planting more woodland in the upper areas of the catchment);
- Minimise the increase in the cost of flood damage in urban areas of Mansfield, Retford and Worksop, taking into account future climate change and urban growth.
- Sustain and improve the status of environmentally designated areas such as the River Idle Washlands, Sutton and Lound Gravel Pitts (Site of Special Scientific Interest) through appropriate frequency, extent and duration of flooding.
- Return watercourses to a more natural state, increasing biodiversity and opening up green river corridors through urban areas such as Mansfield, Worksop and Retford.
- Sustain and increase the amount of Biodiversity Action Plan (BAP) habitat in the policy unit.
- Support and encourage land management that will protect and improve water quality by reducing diffuse pollution from agricultural run-off.
- Create BAP habitats.

1.9.7 Policy Option 3 (see section 1.9.4) was chosen for Policy Unit 2. This option was chosen as the area has a low flood risk which is not expected to rise significantly. The CFMP further states that this policy is appropriate where the current level of flood risk management is considered appropriate. It is recognised that flood risk will change in the future, and management actions may change in time to gain efficiencies. It will also be possible to deliver environmental improvements through some of these changes. However, under this policy the level of flood risk management and activity and effort will remain the same and it is therefore likely that flood risk will increase slightly in the future.

1.9.8 Policy Unit 4 identifies the level of flood risk in the area to be medium, but with small pockets of high flood risk, such as Gainsborough and Newark. It states that flood defence schemes are already planned for these areas. The River Trent is identified as the main source of flood risk from the Nottinghamshire villages down to beyond Newark. Between Cromwell Weir and Gainsborough flood risk is mainly from the tidal River Trent. The policy unit objectives are as follows;

- Sustain and protect cultural and social heritage in the catchment, including the Scheduled Ancient Monuments within the River Trent floodplain through this policy unit.
- Minimise disruption to people, communities and commerce caused by flooding, taking into account future pressure resulting from climate change.
- Reduce the disruption caused by any of the four River Trent road crossing points which lie within the policy unit closing.
- Minimise the increase in the cost of flood damage, taking into account future pressures from climate change, which may increase flood risk.
- Sustain and improve the status of environmentally designated areas of Allington Meadows and Besthorpe Meadows through appropriate frequency, extent and duration of flooding.
- Sustain and increase the amount of Biodiversity Action Plan (BAP) habitat along the main Trent corridor and also within the many small tributary streams, with particular focus on maximising benefits from disused aggregate workings.

1.9.9 Policy Option 4 (see section 1.9.4) was chosen for Policy Unit 4. This option was chosen as there are a number of settlements along the Trent valley in this Policy Unit (Nottinghamshire Villages, Newark and Gainsborough) which are at risk from flooding. Broad scale modelling undertaken, indicates that flooding is likely to become more frequent with greater damages in the future. The CFMP also states that there is a considerable amount of infrastructure at risk of flooding, including road and rail links of national importance. According to the CFMP, the frequency of significant disruption from flooding is currently low. Under current flood risk management levels, this is expected to increase with climate change.

1.9.10 The final approved River Trent CFMP will provide a key strategic insight into the sustainable management of flood risk in the Newark and Sherwood District.

1.9.11 A small section of the District to the east of Newark, falls under the River Witham Catchment Flood Management Plan. Whilst the Trent CFMP will have the greatest impact on the District, the final version of the Witham CFMP should be reviewed for its relevance to the information provided in the SFRA.

2 Study Area

2.1 DESCRIPTION OF STUDY AREA

2.1.1 The District of Newark and Sherwood is a large and geographically diverse District covering much of central Nottinghamshire. The eastern and southern portions of the District are dominated by the River Trent and the various watercourses that flow into it. Two Internal Drainage Boards are also in operation in the District (Newark Area and Upper Witham (see Appendix B) carrying out flood defence work under the powers of the Land Drainage Act 1991. The largest settlement in the District, Newark, lies within this area on the River Trent, as do a number of 'Trent side villages'. The large central area of the District is described as the mid-Nottinghamshire farmlands. This area is characterised by undulating landscape and smaller villages and hamlets. A particular feature to the south of this area, around the Minster town of Southwell (approx. 50m AOD), are small meandering valleys known as Dumbles. The western area of the District lies within Sherwood Forest and contains a number of watercourses including the River Maun which flows through Edwinstowe, Ollerton and Boughton. Refer to Appendix A for details of the extent of the NSDC boundary.

2.2 TOPOGRAPHY OF THE STUDY AREA

2.2.1 The general topography of the NSDC area is highly variable but, for the purposes of this study, can be split into distinct areas as described below.

- The western area of the District is characterised by wooded areas including parts of historic Sherwood Forest. Ground levels are generally at their highest reaching a peak level of approximately 150mAOD to the east of Rainworth and Blidworth. While there are local variations of topography in the western area of the District, ground levels generally tend to fall in two directions; north east towards the catchments of the Rainworth Water and River Maun and south east towards the Trent Valley.
- The central area of the District is generally at a lower elevation than the western area. The River Trent flows towards the southern portion of the central area of the District. Variations in topography are defined by the natural valleys formed by the network of watercourses through the area. A particular feature to the south of this area, around the Minster town of Southwell (50mAOD), are small meandering valleys known as Dumbles.
- The eastern area of the District is dominated by the Trent valley which follows the River Trent along a north east to south west alignment. Ground levels are at their lowest in this area of the District particularly in the north east around the villages of South Clifton and Wigsley with levels of around 10mAOD. The topography to the east of the Trent tends to be at its flattest with peak levels in Newark at 40mAOD.

2.3 DESCRIPTION OF DRAINAGE CATCHMENTS

2.3.1 There are two main drainage catchments within the District, these are the Trent and the Witham. The principal drainage catchment is the River Trent which is fluvial to Cromwell Lock and then tidally influenced to its confluence with the River Humber in the north of the country. Refer to Appendix B for watercourse plan.

WITHAM

2.3.2 A relatively small area of the District in the east contributes to the River Witham which forms part of the District boundary to the east of Newark and Balderton.

2.3.3 Minor tributaries, including the Shire Dyke, to the east of Newark and Balderton flow to the River Witham. Parts of the Shire Dyke are designated as being EA Main River.

2.3.4 The Internal Drainage Board of Upper Witham administers this area of the land drainage catchment. Refer to Appendix B.

2.3.5 The River Witham is an EA Main River.

TRENT

2.3.6 The majority of the District (approximately 80%) forms part of the River Trent catchment. While the catchment is predominantly rural, it includes the urban areas of Newark and Trent side villages. The River Trent is theoretically influenced by the tide to a point inland up to Cromwell Lock, however the EA have advised that in practice it is only influenced to the Gainsborough Bridge crossing.

2.3.7 The main rivers and watercourse within the Trent catchment include the River Devon (and its tributary the Middle Beck), Carlton and Caunton Beck, the River Greet, Car Dyke, the Fleet, Dover Beck and Cocker Beck.

2.3.8 Carlton and Caunton Beck's tributaries arise through Eakring and drain predominately in an easterly direction through Caunton and converge with the Trent just upstream of the Cromwell Lock. Cromwell Lock is the generally recognised boundary between the tidal and fluvial reaches of the Trent.

2.3.9 The River Greet arises to the south of Farnsfield and flows through the north of Southwell to Rolleston before converging with the River Trent.

2.3.10 The Cocker Beck arises beyond the southern boundary of the District and flows through Lowdham before converging with the Trent near Gunthorpe.

2.3.11 The River Devon flows northwards through the District boundary to the south and joins with the Trent to the south west of Newark. The Middle Beck, a tributary of the Devon flows to the south of Newark.

2.3.12 The River Trent is an EA Main River.

MAUN

2.3.13 The River Maun and its tributaries (see Appendix B) forms part of the River Trent catchment but for the purposes of this study can be described as a separate drainage catchment within the District.

2.3.14 The Maun drainage catchment is served by approximately a fifth of the District area in the north west and is predominantly a rural drainage catchment. The Maun arises beyond the District boundary to the west and flows in a north westwards direction through Edwinstowe and Ollerton before its confluence with the River Meden at the District boundary.

2.3.15 The main tributary of the Maun is the Rainworth Water. Rainworth Water arises beyond the District boundary to the west and flows through Rainworth and Bilsthorpe before its confluence with the Maun to the south west of Ollerton.

2.3.16 A smaller tributary, the Vicar Water also arises beyond the District boundary to the west and flows to the south of Clipstone before its confluence with the Maun to the north east of Clipstone.

2.3.17 The River Maun is an EA Main River.

2.4 ADMINISTRATIVE BOUNDARIES

2.4.1 Land Drainage/Flood Risk Management

EA (East Area, Midlands Region) covers the entire area of the NSDC from their Nottingham office. The Newark Area and Upper Witham Internal Drainage Boards maintain a large number of watercourses in the District. The Newark Area Internal Drainage board is the predominant IDB within the Newark and Sherwood District (see Appendix B).

2.4.2 Sewerage

The NSDC area is predominately within the Severn Trent Water Ltd administrative boundary. The eastern extremity of the District, falls within jurisdiction of Anglian Water (see Appendix B).

3 General Approach & Methodology

3.1 DATA SOURCES

3.1.1 Section 4 of this report fully describes the data that was considered in the assessment that has been received to date. In summary, the key sources of data include:

- Environment Agency publications and archive reports e.g. historic flooding records;
- Reports and studies by consultants;
- Hydraulic modelling data (provided by the EA);
- Topographical survey data via OS mapping;
- Flood extent data;
- Flood defence and key asset information;
- Archive and Internet research;
- Local knowledge;
- Local Plan policy documents and urban growth studies.

3.2 APPROACH AND METHODOLOGY

3.2.1 This SFRA has been conducted in line with the EA's Guidance for Strategic Flood Risk Assessments, the DCLG's *Practice Guide Companion to PPS25 'Living Draft'* (June 2008) and NSDC Brief to Consultants (September 2006) which has been developed in partnership with the EA.

3.2.2 This section outlines the purpose and deliverables associated with the Level 1 SFRA and these have been outlined below:

- Evaluation of the flood risk to potential development areas and the ranking of the various sites in relation to the corresponding flood zones;
- Modelled flooding extents within 'high probability' Flood Zone 3 to supplement the EA's Flood Zone Maps;
- Assessment of the implications of climate change for flood risk at the various potential development sites;
- Locations of flood risk management measures, including both infrastructure and coverage of flood warning systems;
- Investigation of areas that may be classified as Zones of Rapid Inundation as a result of potential infrastructure failure;
- Addressing the potential increase in surface water runoff from developable sites;
- Assessment of historical flooding events within the District;
- Guidance on the preparation of FRA's for allocated development sites;
- Guidance on SuDS feasibility.

3.2.3 The SFRA seeks to provide a reference and policy document for NSDC to help to steer future development towards areas at low risk of flooding over the lifetime of the proposed developments. The SFRA pays regard to the future redevelopment of both greenfield and brownfield sites throughout the District. The SFRA also seeks to set out general guidance on requirements for specific flood risk assessments for key areas of the District comprising significant proposed development sites.

3.2.4 EA Flood Zone Maps illustrate the extent of the flooding and land at risk during the critical flood flows for the rivers and watercourses. These do not take into consideration the presence of defences. Areas covered by detailed hydraulic modelling have been used with the EA flood outlines to provide up to date flood risk maps of the entire District and key development areas. Refer to Appendix D. These maps provide the basis for the Level 1 assessment.

3.3 CLIMATE CHANGE

3.3.1 Annex B of PPS25 takes into account the impacts that climate change may have on flooding issues and sustainable development. PPS25 states that the nature of climate change at a regional level will vary. Projections for the UK predict a greater frequency of short duration, high intensity rainfall and more frequent periods of long-duration rainfall. Sea levels will continue to rise. Winters are predicted to become wetter in the UK by as much as 20% by the 2050s. Summer and autumn are predicted to become much drier. These effects will need to be incorporated into site specific Flood Risk Assessments. When assessing climate change, PPS25 encourages an integrated approach across various sectors such as land use, water resources and biodiversity.

3.3.2 NSDC have stated in their Core Strategy that planning policies must both protect against the effects of climate change and ensure that new development does not contribute towards it.

3.3.3 To help organisations (including local authorities) to assess their vulnerability to climate change, the Government established the UK Climate Impacts Programme (UKCIP). One of UKCIP's responsibilities is to produce predictions of future climate change in the UK. Climate change predictions may be revised as a result of UKCIP and this may result in the figures in Annex B of PPS25 being reviewed. Until any such revision, the figures from Annex B that are included in this Level 1 SFRA will remain applicable.

3.3.4 As mentioned in Section 2.3.6 the River Trent is both fluvial and tidal within the Newark and Sherwood District; however, the tidal influence within the study area is considered to be minimal.

3.3.5 Table B.2 of PPS25 gives a direction on how impacts of climate change should be calculated and applied. The contents of Table B.2 from PPS25 are reproduced below:

Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights *(From Table B.2 of PPS25);*

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

1. *Refer to Defra FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts. October 2006 for details of the derivation of this table.*

2. *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 B.2 are treated similarly.*

3.3.6 The 1 in 100 year climate change outlines produced by detailed hydraulic modelling have been provided for the River Trent (Fluvial- Including Defences), River Maun, River Meden and River Greet (see Appendix D). Where no modelling data is available to assess the impact of the climate change factors, it is recommended that design flows used in hydraulic modelling (for the 1 in 100 and 1 in 20 year plus climate change events) have an additional 20% added. It is also recommended that 30% is added to rainfall intensity.

3.3.7 The existing River Maun, Meden, Greet and Trent (Fluvial) climate change modelling results included a predicted increase of +20% to the river flows.

3.3.8 The effects of climate change should be taken into account during the Level 2 study.

3.4 POTENTIAL SOURCES OF FLOODING

3.4.1 The principal sources of flooding within the study area that have been focussed upon include:

- Fluvial/tidal (river) flooding resulting from 'out of bank' flows from rivers and watercourses;
- Groundwater flooding, including groundwater-fed watercourses;
- Sewer flooding;
- Localised surface water flooding, including from highway drainage; and
- Surface runoff/overland flow.

3.4.2 Fluvial flooding is the dominant source of flood risk within the District and will clearly have the greatest influence upon sustainable land-use planning.

3.4.3 Overtopping and breaching of flood defence structures (including flood storage and alleviation facilities), should be included as part of the Level 2 study. The location of Reservoirs within the District has been provided in Appendix B. There are no canals in the District.

4 Data Collection and Review (Level 1)

4.1 FLOOD ZONE MAPS

4.1.1 The EA publishes Flood Zone Maps (FZM), which show areas potentially deemed to be at risk of fluvial (river) flooding. The FZM have been produced using appropriate good quality mapping and modelling data, where available, supplemented with data derived from national generalised modelling and appropriate good quality local data which conform to the EA's acceptable criteria. The nationally generalised modelling utilises a Digital Terrain Model (DTM) which excludes the presence of man-made features such as flood defences and road and rail embankments. Fluvial flood zone outlines were produced using a 2D raster floodplain model (Jflow) and show the probability of flooding without the presence of defences.

4.1.2 Whilst the modelling methodology used to produce FZMs excludes the presence of flood defences, in order to ensure that the extent of the functional floodplain is delineated, the FZM also show the area of benefit provided by modern flood defences (less than 5 years old) where they are present. They show areas deemed to be at risk of flooding for all watercourses with a catchment area greater than 3 km^2 in the UK.

4.1.3 Flood Zone Maps are updated periodically – typically every 3 months.

4.1.4 A description of the different Flood Zones is provided below:

- **Flood Zone 1** is classified as land where the risk of flooding is greater than 1 in 1000 years. It is classed as an area of ***'low probability'*** risk of fluvial flooding.
- **Flood Zone 2** is classified as land having between 1 in 100 and 1 in 1000 year annual probability of fluvial flooding. It is classed as an area of ***'medium probability'*** risk of fluvial flooding.
- **Flood Zone 3a** is classified as land having a potential to flood for storm events greater than 1 in 20 year return period and up to 1 in 100 year annual probability. It is classed as an area of ***'high probability'*** risk of fluvial flooding.
- **Flood Zone 3b** is classified as land having the potential to flood for storm events up to 1 in 20 year return period. It is classed as ***'functional floodplain'***.

4.1.5 FZM data has been provided by the EA (East Area- Midlands Region), in electronic format, for all of the main rivers within the study area (see Appendix D).

4.1.6 Across the study area, FZM data would generally appear to shadow the routes of the rivers and watercourses. No significant off-setting of the mapping layers was noted. There would appear to be no obvious deficiencies in the graphical representation of flood risk areas and FZM currently available for the study catchment would appear to be fit for purpose.

4.1.7 Where possible, the EA's FZM outlines have been replaced with more detailed hydraulic modelling. Hydraulic models that have been combined with the EA's outlines are along the following watercourses; the River Trent-Fluvial (Black and Veatch 2004), River Trent-Tidal (Black and Veatch 2005) the River Maun (JBA Consulting 2007), the River Meden (JBA Consulting 2008) and the River Greet (Halcrow 2008). This has been illustrated on the flood maps in Appendix D.

4.2 STAKEHOLDER INFORMATION

Newark and Sherwood District Council

4.2.1 Information relating to the SFRA was sought from officers at NSDC; disciplines ranging from Planning through to Emergency Management were consulted.

Environment Agency

4.2.2 Meetings have been held with the EA in order to establish contact and to set out a schedule of data requirements. Extensive liaison with the EA has ensued in order to obtain, or confirm the availability of, relevant data for the study. The EA have been provided with frequent updates, so as to keep them involved with the progress of completing the Level 1 SFRA.

Newark Area Internal Drainage Board and Upper Witham Internal Drainage Board

4.2.3 Information was obtained from the Newark Area Internal Drainage Board and Upper Witham Internal Drainage Board on the location of the various drains and watercourses within the District (see Appendix B). Information on historical records was also provided.

4.2.4 The role of the drainage boards is to maintain a network of watercourses within the District to provide drainage. This responsibility is brought about through Acts of Parliament (Land Drainage Acts), to provide flood protection and water level management services. Both drainage boards have the power to undertake works on any watercourse within its district, other than 'Main Rivers' which are maintained by the EA. The Land Drainage Acts of 1991 and 1994 require IDBs to provide for;

- general supervision over all aspects of land drainage within the 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 river and under the EA's control;
- duties to conservation;
- raising income to support land drainage works.

Other Stakeholders

4.2.5 Contact was made with the Clerks of the Parish and Town Councils for numerous parishes in order to obtain further historic and anecdotal information relating to the significant flood events. Information received on historic flooding from Parish and Town Councils has been collated and presented within Tables 4A and 4B. Information was also provided by Anglian Water and Severn Trent Water relating to sewage treatment works and historical flooding within the District.

Records Search

4.2.6 A variety of other data sources were investigated as part of the Level 1 study. These included:

- Parish and Town Councils

- Water companies
- Internal Drainage Boards
- Hydrochronology Database
- Website Search
- Newark and Sherwood Archive data

4.3 HISTORIC FLOODING

Fluvial / Groundwater

4.3.1 Historic flooding information has principally been obtained from desk studies and archive research. Historic fluvial flooding locations have been shown graphically in Appendix B. Historical flood outlines for the River Trent have been obtained from NSDC and provided in Appendix B. Due to the format of the historical flood outlines, it is not possible to differentiate between the extents of the various events at the same location, in these plans.

4.3.2 The EA have confirmed that they have no records of any incidents of groundwater flooding within the Newark and Sherwood District. NSDC were able to provide some records of groundwater flooding.

4.3.3 Details of historic fluvial flooding records gathered during the Level 1 study have been tabulated below. Due to the complexity of coordinating and recording historical flooding data, the list below is not completely comprehensive, and information may be added in the future;

Table 4A: FLOODING HISTORY

DATE	LOCATION	ADDRESS	SOURCES OF FLOODING/DETAILS	DATA SOURCE
2000	Averham	Church Lane	River Trent	NSDC
9 August 2004	Balderton	Jericho Road Estate off Staple Lane. 8 properties flooded, Balderton Sewage Treatment Works	Lowfield Drain (watercourse – tributary of the Middle Beck) and Surface Water pump failure. 1 in 161 rainfall return period event	Balderton Parish Council, Newark Area IDB
2007	Balderton	Jerico Road	Local dyke	NSDC
2000	Besthorpe	Low Road	Washlands area	NSDC
2007	Bilsthorpe	Belle Eau Park	Local dykes and drains	NSDC
2000	Bleasby	Fiskerton Road, Gypsy Lane & Main Street	River Trent	NSDC
2007	Bleasby	Station Road	Gound water and local dyke	NSDC
2007	Bulcote	Old Main Road	Local dyke	NSDC

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/DETAILS	DATA SOURCES
2000	Carlton on Trent	Church Lane and Main Street	River Trent	NSDC
2007	Carlton on Trent	Main Street	The Beck	NSDC
2007	Caunton	Mill Lane and Chapel Lane	Local beck	NSDC
November 2000	Caythorpe	Main Street, Caythorpe Road	River Trent	NSDC and EA
1875	Collingham	Low Street	River Trent	Hydrochronology website
December 1910	Collingham	Low Street, along side church	River Trent Flood waters came to within 18 inches of 1875 level due to continuous rainfall and snow fall	Hydrochronology website
March 1947	Collingham, Sutton-on-Trent, Girton, South Clifton, Farndon, Newark, Gunthorpe, Fiskerton and North Muskham	Unknown	River Trent – Prolonged rainfall, snow melt and high spring tides	River Trent CFMP and EA
2000	Collingham	Trent Lane, Carlton Ferry Lane	River Trent	NSDC
2007	Edingley	Station Road and Main Street	Edingley Beck	NSDC
2007	Edwinstowe	Henton Road	Unknown	NSDC
2007	Egmanton	Laxton Road, Main Street, Tuxford Road, Weston Road and Kirton Road	Various dykes and groundwater	NSDC

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/DETAILS	DATA SOURCES
Unknown	Elston	Narrow culvert following the length of Old Chapel Lane, which has caused flooding in the road at Low Street outside Appleacre	Unknown	Elston Parish Council
2007	Epperstone	Main Street	Nearby beck	NSDC
November 2000	Farndon	Throughout the village	River Trent	EA
2000	Fiskerton-Cum-Morton	Bleasby Road and Rolleston Road	River Trent	NSDC
2007	Fiskerton-Cum-Morton	Occupation Lane	Nearby dyke	NSDC
2000	Gibsmere	Boat Lane, Main Street and Fiskerton Road	River Trent	NSDC
2000	Girton and Meering	West Lane, High Street, Procters Drive, Tinkers Lane, Green Lane and Trent Lane	River Trent	NSDC
November 2000	Gunthorpe	Throughout the village	River Trent- maximum recorded flood level 18m (AOD)	EA
December 2002	Gunthorpe	Throughout the village	River Trent- maximum recorded flood level 17.08m (AOD)	EA
May 1983	Halam	6 properties in the Mansfield Road area	Halam Beck	Newark Area IDB
2007	Halam	The Turnpike	Halam Beck	NSDC
2000	Holme	Main Street, Langford Lane and Winthorpe Lane	Local marsh	NSDC

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/DETAILS	DATA SOURCES
2000	Hoveringham	Gonalston Lane, Lansic Lane, Boat Lane and Main Street	River Trent	NSDC
November 2000	Kelham	Throughout the village	River Trent	EA
2007	Kirklington	Main Street	The Greet and local dykes	NSDC
2007	Little Carlton	Ollerton Road and Bathley Lane	Unknown-(local dyke)	NSDC
January and March 1999	Lowdham	Multiple locations: Nottingham Road, Long Moor Avenue, Victoria Avenue, Main Street, Southwell Road, The Corner, Merevale Close and Station Road	Cocker Beck	Lowdham Parish Council
November 2000	Lowdham	Throughout the village	Undefined	EA
July 2007	Lowdham	Throughout the village- Merevale Close, Main Street, The Corner, Ton Lane, The Priors, Lime Tree Gardens, The Orchards, Southwell Road, Station Road, Victoria Avenue, Longmoor Avenue, Magna Close, Manor House Close, Willow Holt, Gunthorpe Road, Old Tannery Drive, Blenheim Avenue, Newton Close and Worcester Close	Dover Beck, Cocker Beck and Car Dyke	EA and NSDC

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/DETAILS	DATA SOURCES
October 1875	Lower Trent/Trent side villages	N/A	Widespread tidal flooding. Second worst event on record	River Trent CFMP
1977	New Ollerton and Edwinstowe	Unknown	River Maun	EA
1795	Newark	N/A	River Trent - 1:500 year event (Estimate derived from analysis of historic data). Considered worst flooding on record	River Trent CFMP
1910	Newark	Kelham Road	Continuous rain following a fall of snow. Flood waters two foot deep along Kelham Road	Hydrochronology website
1979	Newark	Riverside Road	Overflow of River Devon	EA
2000	Newark	Riverside Park Area and Tolney Lane	Unknown	NSDC
2000	North Muskham	Macklays Lane and Crab Lane	Unknown	NSDC
2007	Norwell	Bathley Lane, Woodhouse Road and Moorlands Close	Nearby Beck	NSDC
2007	Ompton	Shortwood Lane	Gallow Hole Dyke	NSDC
2007	Oxton	Water Lane, Sandy Lane and New Road	Oxton Dumble	NSDC
Unknown	Rainworth	Bus stop of public car park in centre of Rainworth next to fish and chip shop	Overflow from stream next to site.	Rainworth Parish Council

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/ DETAILS	DATA SOURCES
Unknown	Rolleston	Agricultural land and at least two properties. Station Road and Staythorpe Road	River Trent River Greet	Rolleston Parish Council
2007	Rolleston	Station Road	Local dykes	NSDC
1950 – 1960 (Approx.)	Southwell	Potwell Dyke area near Church Street, Southwell	Overflow of Potwell Dyke	Southwell Town Council
2007	Southwell	Kirklington Road	Potwell Dyke and the Greet	NSDC
November 2000	South Muskham	Unknown	River Trent	NSDC and EA
2007	Staythorpe	Staythorpe Road	Groundwater flooding and local dykes	NSDC
2007	Sutton on Trent	High Street, Grassthorpe Road, Station Road, Old Great North Road and Mill Close	Flooding from nearby dyke	NSDC
May 1983	Thurgarton	Beck Street at entrance to Priory Beck	Thurgarton Beck- Flood level 18.98m (AOD)	Newark Area IDB
2007	Thurgarton	Beck Street and Station Road	Thurgarton Beck	NSDC
Unknown	Wellow	Eakring Road	Culvert for George Dyke under Eakring Road and Potter Lane	Wellow Parish Council
2007	Weston	Grassthorpe Lane and Great North Road	Nearby brook	NSDC
Unknown	Winthorpe	Field between railway line and River Trent next to Winthorpe Holme Lane	River Trent	Winthorpe-with-Langford Parish Council

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/ DETAILS	DATA SOURCES
Unknown	Winthorpe	Grid at culvert entrance on the River Fleet by Nelson pub	River Fleet	Winthorpe-with-Langford Parish Council
Unknown	Winthorpe	Drainage ditch opposite the pumping station, Holme Lane	River Trent	Winthorpe-with-Langford Parish Council

4.3.4 Information relating to return periods of historic events is inherently subjective, largely anecdotal, and scarcely available. Negligible recorded flood level information has been established to date. Information relating to the 2000 and 2007 flood events in the District was provided by the EA and Newark and Sherwood District Council. Aerial film footage was provided by the EA illustrating the communities (Gunthorpe, Lowdham, Caythorpe, Kelham, Farndon and South Muskham), affected by flooding from the Trent in November 2000. Appendix B shows the historical outlines for 2000 and 2007.

4.3.5 The Newark Area Internal Drainage Board has provided limited information on historic flooding for the May 1983 event at Thurgarton and Halam.

Sewers

4.3.6 Historic flooding information for the majority of the study area has been obtained from the 'Director General 5' (OFWAT). The 'At Risk' Register has been provided by Severn Trent Water, together with archive research. Newark and Sherwood District Council have provided information for the 2007 events; this also includes pluvial (surface water) flooding which emanates directly from rainfall. In many cases incidents have been recorded as a combination of surface water, sewer and fluvial flooding. Differentiating the various sources of flooding for the same event at the same location is a difficult task, due to the lack of detailed data. Various Parish and Town councils, within the District have also provided information.

4.3.7 Details of historic sewer and pluvial flooding locations have been shown graphically in Appendix B. As stated in PPS25, sewer flooding can occur when a system is overwhelmed by heavy rainfall, becomes blocked or is of inadequate capacity.

4.3.8 The 'Director General 5' (OFWAT) register sets out property addresses that:

- have been affected by flooding due to hydraulic deficiency on two or more occasions within the last ten years; or
- are protected from internal property flooding by non return valves.

4.3.9 Details of historic sewer and pluvial flooding records gathered during the study have been tabulated on the next page. Historic sewer flooding information provided to us by Severn Trent Water did not provide details on the specific locations of the sewer flooding, due to the implications that this may have for the current property owners; this information has been provided in Appendix B. Due to the complexity of recording and coordinating historical flooding data, Table 4B is not completely comprehensive, and information may be added in the future.

Table 4B: SUMMARY OF RECENT SEWER FLOODING HISTORY

DATE	LOCATION	ADDRESS	SOURCES OF FLOODING/DETAILS	DATA SOURCE
Unknown	Balderton	Haddon Drive/ Marquis Avenue	Severn Trent sewers	Balderton Parish Council
2007	Balderton	Jericho Road and Smith Street	Sewers and surface water runoff	NSDC
N/A	Barnby in the Willows	No history of sewer flooding	N/A	Barnaby in the Willows Parish Council
2007	Bilsthorpe	Oaktree Drive and Kirklington Road	Sewers and surface water runoff	NSDC
2007	Bleasby	Station Road	Sewers and surface water runoff	NSDC
2007	Blidworth	Meadow Road	Surface water runoff	NSDC
Unknown	Boughton	A6075 Tuxford Road (outside shops west of the junction with the B6387)	Sewers and surface water runoff	Ollerton and Boughton Town Council
Unknown	Boughton	Holles Close	Sewers and surface water runoff	Ollerton and Boughton Town Council
Unknown	Boughton	Brake Lane Junction with Hallam Road to the entrance of Boughton Pumping Station	Sewers and surface water runoff	Ollerton and Boughton Town Council
Unknown	Boughton	Newark Road Junction with Poplar Street south to the railway bridge	Sewers and surface water runoff	Ollerton and Boughton Town Council
Unknown	Boughton	B6387 Retford Road Junction with Brake Lane	Sewers and surface water runoff	Ollerton and Boughton Town Council

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/DETAILS	DATA SOURCES
2007	Bulcote	Old Main Road	Highway drainage	NSDC
2007	Carlton on Trent	Old Main Road	Highway drainage from A1	NSDC
N/A	Clipstone	No history of sewer flooding	N/A	Clipstone Parish Council
2007	Cromwell	Great North Road	Sewer network	NSDC
2007	East Stoke	Moor Lane	Highway drainage from Church Lane and A46	NSDC
2007	Edingley	Main Street, Greaves Lane, Mansfield Road and Station Road	Sewers and surface water runoff	NSDC
2007	Egmanton	Laxton Road	Highway drainage and surface water runoff	NSDC
Unknown	Elston	Old Chapel Lane and its junction with low Street. Toad Lane	Sewerage and drainage system	Elston Parish Council
Unknown	Farnsfield	The Green, opposite the Red Lion pub	Foul sewer when surface water enters drain in storm conditions.	Farnsfield Parish Council
Unknown	Morton	Corner of Middle Lane and Main Street between Full Moon pub and Main Street	Possible blocked drain.	Fiskerton-cum-Morton Parish Council
November 2000	Gunthorpe and Girton,	19 properties flooded at Girton,along the A617	Continuous rainfall. Estimated 1 in 20 to 1 in 50 year return period event depending on location	River Trent CFMP
2007	Halam	The Turnpike	Surface water runoff	NSDC

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/DETAILS	DATA SOURCES
2000	Hoveringham	Gonalston Lane, Lansic Lane, Boat Lane and Main Street	Sewers and surface water runoff	NSDC
2007	Kirklington	Main Street and Eakring Road	Sewers and surface water runoff	NSDC
2007	Little Carlton	Ollerton road and Bathley Lane	Sewer flooding	NSDC
2007	Lowdham	Throughout the village- Merevale Close, Main Street, The Corner, Ton Lane, The Priors, Lime Tree Gardens, The Orchards, Southwell Road, Station Road, Victoria Avenue, Longmoor Avenue, Magna Close, Manor House Close, Willow Holt, Gunthorpe Road, Old Tannery Drive, Blenheim Avenue, Newton Close and Worcester Close	Sewer flooding	NSDC
August 2004	Newark	Parts of Newark – Showground	Surface Water flooding	BBC website
2007	Norwell	Bathley Lane, Woodhouse Road and Moorlands Close	Sewer and surface water runoff	NSDC

DATE	LOCATION	ADDRESS	SOURCES of FLOODING/DETAILS	DATA SOURCES
Unknown	Ollerton	A6075 Ollerton Road leading to the junction with the A614	Sewers and surface water runoff	Ollerton and Boughton Town Council
2007	Ompton	Flash Lane and Newark Road	Surface water and highway drainage	NSDC
2007	Oxton	Main Street	Highway drainage	NSDC
Unknown	Rainworth	Junction of Warsop Lane/ Southwell Road East.	Surface water sewer and overland runoff from the top of Warsop Lane Junction of Westbrook Drive and Southwell Road East- flooding occurs to the highway from surface water sewers	Rainworth Parish Council
N/A	Rolleston	No history of historic sewer flooding	N/A	Rolleston Parish Council
N/A	South Muskham and Little Carlton	No history of historic sewer flooding	N/A	South Muskham and Little Carlton Parish Council
2007	Southwell	Halam Road, Kirklington Road, Glenfields, Lower Kirklington Road, Marrison Way, Church Street, Palace View, Potwell Close, Easthorpe, Harveys Field and Upton Road	Sewer and surface water runoff flooding	NSDC
N/A	Winthorpe	No history of historic sewer flooding	N/A	Winthorpe with Langford Parish Council

4.3.10 The 'Director General 5' (OFWAT) register is maintained by the sewerage undertaker's network management team. This information is gathered from verified complaints made by the public, observations made by operational staff during flood events and, to a lesser degree, from hydraulic modelling studies.

4.3.11 It should be noted that properties may not appear on the 'Director General 5' (OFWAT) register, or be removed from the register, if:

- the frequency of recurrence of flood events is less than twice in 10 years;
- flood alleviation schemes have been implemented since the flooding was reported;
- insufficient significant rainfall events have occurred within the 10 year timeframe.

4.4 TOPOGRAPHICAL DATA

LiDAR Data

4.4.1 Light Detection and Ranging (**LiDAR**) is an airborne mapping technique which uses a laser to measure the distance between the aircraft and the ground. For the production of this report LiDAR data was only available for certain parts of the study area from the EA's Data Management Team based in Twerton. Sufficient data was obtained for Newark and Balderton, Southwell and Trent side villages and surrounding areas. This information is available to complement any Level 2 hydraulic modelling and flood mapping that may be conducted.

4.4.2 The vertical tolerance of LiDAR data typically ranges between +/- 0.25m however the accuracy of the LiDAR data for some of the NSDC area has not been confirmed and any detailed site investigations for flood risk assessments should include sufficient investigations to establish the suitability of the LiDAR data.

SAR Data

4.4.3 The accuracy of SAR (surface model) data typically ranges between +/- 0.5m. This level of accuracy is often unsuitable for detailed hydraulic modelling but is highly suitable for the assessment of overland flood routing whereby the gradient of the terrain is the key requirement. SAR data has not been used at this stage of the SFRA.

Topographical Data

4.4.4 Contour mapping information provided on 1:50,000 scale Ordnance Survey (OS) maps for the entire District was available in digital format. This has been used to describe the topography of the study area within Section 2.2. OS Mapping to a 1:10,000 scale has been provided for site specific areas in digital format. This information has been used in Appendix E.

4.4.5 No detailed topographical survey data was made available for this stage of the SFRA process.

4.5 WATER BODIES

4.5.1 Refer to the Watercourses Plan provided within Appendix B for details of Main Rivers, Ordinary Watercourses and IDB watercourses. There are various lakes and other bodies of water throughout the District.

4.5.2 Based on information provided by the EA, there are seven reservoirs within the District that would fall under the classification of the Reservoirs Act (1975) (see Appendix B).

4.6 HYDRAULIC STRUCTURES

National Flood and Coastal Defence Database (NFCDD)

4.6.1 Details of hydraulic structures such as sluices, weirs and Penstock Valves etc, have been provided by the EA in GIS format for the study area (See Appendix C). Such features are designed to manage or stop the flow of water.

4.6.2 Structure details from the EA's NFCDD records for the River Trent show a range of defences and structure arrangements along the Trent Valley. Details are also provided for the River Greet, River Maun, River Meden, River Devon and River Witham. The EA have advised that the level of information provided for the Trent is relatively good. It has been demonstrated (with the modelled flood extents), that the defences in some places along the Trent are overtopped, providing a lower level of protection than stated in the NFCDD database (Appendix C). The design criteria for a flood defence is based on a statistical return period (i.e. 1 in 100 year event). This can change over time due to updated hydrological information for example that would alter statistical predications. Under such circumstances, the design standard in some cases can reduce. This should be assessed in greater detail as part of a Level 2 SFRA.

4.6.3 Where required, detailed surveys of key hydraulic structures will be undertaken to supplement any future hydraulic modelling and hydraulic assessments. This should be conducted as part of the Level 2 study.

4.7 FLOOD RISK MANAGEMENT ASSETS

Flood Alleviation Schemes

4.7.1 A range of flood defence arrangements and hydraulic structures are shown on the EA's National Flood and Coastal Defence Database (NFCDD) (see Appendix C).

4.7.2 One particular Flood Risk Management Asset identified is the Brewers Wharf Flood Defence scheme in Newark along the River Trent. The initial Brewers Wharf scheme was completed 4/5 years ago; this increased the Standard of Protection (SOP) from a 1 in 5 to a 1 in 10 year level. The new proposals are to provide a SOP for the 1 in 100 year flood event however, the EA have confirmed that the funding for this scheme is unavailable at this stage.

4.7.3 NSDC and the EA are currently discussing the possibilities of funding flood defences within the District through a variety of sources.

4.8 HYDRAULIC MODELS

4.8.1 The EA has confirmed that hydraulic modelling studies have been undertaken for the following watercourses:

River Trent

Fluvial Trent Study (April 2004)

4.8.2 The EA has conducted a study of the River Trent (Scheme Reference G1009) that incorporated the production of computational models to investigate the extent of flood risk. Due to the significant length of this watercourse, the river was split into four reaches that have been modelled separately using ISIS software by Black & Veatch consultancy. The hydraulic model for reach four has been obtained by WSP from the EA which covers the reach of the Trent between Shardlow Gauging Station and Cromwell Weir. Some of the principal aims of the study were as follows:

- A catchment wide hydrological and river modelling study;
- A review of the condition, performance and level of protection provided by the existing flood defences;

- Identification of existing and possible future flooding problem areas;
- Production of floodplain maps, for a range of return periods (i.e: 1 in 100 and 1 in 25 year events);
- Assessment of a wide range of flood management options at a strategic level.

Tidal Trent Study (April 2005)

4.8.3 The Tidal Trent study was also undertaken by Black & Veatch. This modelled extent is from Wilthorpe Bridge to Trent Falls at the confluence of the River Ouse. This model does not include the extent of the functional floodplain or climate change events. This model was produced using ISIS software.

Flood Modelling at the Confluence of the Rivers Trent and Devon - A46 Newark to Widmerpool Improvement (November 2005)

4.8.4 A section of the River Trent to the west of Newark plus the River Devon and tributaries has been modelled by consultants KBR (Jacobs) on behalf of the Highways Agency in order to investigate the impacts of the proposed A46 'dualling' embankment (Report reference XT0185/3A10/204/9060). This model was produced using InfoWorks RS software.

The investigations focused on the required mitigation measures to compensate for the impact on existing floodplain of the proposals for the construction of a replacement A46, dual carriageway, to the east of Farndon which is to the south west of Newark. The construction of this highway is due to commence in 2009.

This model provides a useful basis for assessing the proposed Newark South Growth Point site but has limited, if any, application for other identified sites in the District.

Lowfields Drain Flooding Assessment - Jericho Road Estate, Balderton (April 2005)

4.8.5 This report contains the results of a detailed hydrological investigation conducted by JBA Consulting into flooding that occurred in August 2004. The report contains results of hydraulic modelling of the Lowfields Drain and tributaries, plus various proposed mitigation options. Only the 1 in 100 year event has been simulated by this current model. It is recommended that this model is updated based on the requirements of PPS25. The hydraulic modelling was undertaken using ISIS software.

Cocker Beck, Lowdham – Feasibility Study (January 2000)

4.8.6 Following a flooding event in Lowdham from the Cocker Beck in January 1999 an investigation was undertaken for the NAIDB by JBA Ltd. Their report contains a summary of their investigations and also provided recommended improvement options. This model needs to be updated based on the requirements of PPS25. This watercourse was modelled using HEC-RAS Software.

River Maun- Flood Risk Mapping Study (March 2007)

4.8.7 The River Maun model produced by JBA Consulting in 2007 has been obtained from the EA. This is comprehensive and includes a detailed report that provides useful data for assessment of any potential development within the area covered by the study. The modelling methodology and outlines are based on the requirements of PPS25; these outlines are considered to be fit for purpose for this study. This model was produced using ISIS software.

River Meden- Flood Risk Mapping Study (May 2008)

4.8.8 The River Meden has been modelled in 2008 by JBA Consulting. This modelling was undertaken based on the requirements of PPS25 and the outlines are

considered to be fit for purpose for this study. This model was produced using ISIS software.

River Greet- Strategic Flood Risk Mapping (June 2008)

4.8.9 The River Greet and its tributaries were modelled in 2008 by Halcrow using TUFLOW software. The outlines produced are considered to be fit for purpose for this study. However, it is recommended that this model is linked with the River Trent and a combined model created in order to assess the flow interaction between the two watercourses.

4.8.10 The TUFLOW model currently developed by WSP for the Rivers Devon, part of the Trent, Middle Beck, Car Dyke and Doge Dyke have not yet been approved by the EA. Under these conditions, it is recommended that the results from the Jacobs InfoWorks model for the A46 be used as they are the most recent. The results of the A46 model should be updated at a later stage once the TUFLOW model has been approved by the EA.

4.8.11 The majority of the models listed above have been developed for the EA for Section 105 (S105) Flood Risk Mapping and National Engineering and Environmental Consultancy Agreement (NEECA) Framework contracts. It is recommended as part of a Level 2 SFRA, that a site assessment is undertaken to assess the current state of the river and hydraulic structures across the river channels. If any discrepancies are noticed, then the existing models will need to be updated accordingly.

4.9 SEWERAGE INFRASTRUCTURE

Sewer Records

4.9.1 Sewer records and network plans for the region have not been acquired at this stage. These should be collected as part of the Level 2 study in order to view the extent and layout of the public sewerage network, and to assess the likely impact of future growth upon the sewerage system.

4.9.2 Severn Trent Water have indicated that they maintain seventeen sewage treatment works in the District. Anglian Water have stated that they maintain two.

4.9.3 See (Appendix B) for extent of sewer authority jurisdiction.

4.9.4 A comprehensive set of sewer records for the District can be viewed at NSDC's Environmental Services department.

4.10 GEOLOGY, HYDROGEOLOGY & ENVIRONMENT

Geological Maps

4.10.1 British Geological Survey (BGS) maps were obtained for review during the Level 1 study as part of the initial SuDS infiltration feasibility assessment (see Appendix C).

4.10.2 The BGS 1:50,000 Solid and Drift editions 113, (Ollerton); 114, (Lincoln) and 126, (Nottingham), and the NRA 1:100,000 Groundwater Vulnerability edition 18, (Nottinghamshire) have been consulted to give the geological summary of the site area.

4.10.3 Drift deposits can be found from north to south west following the historical path of the River Trent; they are also present in the eastern section of the District. The drift deposits comprise alluvium which is thought to have little to no soak-away potential and River Gravels which are thought to have high soak-away potential. However, the River Gravels are underlain by the solid geology of the Mercia Mudstone Group and the Lower Lias which are considered to have little to no soakaway potential. The River Gravels have been classified as uncertain, as neither the thickness (due to underlying solid geology) or groundwater levels are known. Intrusive investigations are required on

a local scale to confirm the suitability of the granular deposits to accept infiltration. These investigations will need to assess the variability of the groundwater table with prevailing weather conditions and water levels in the main river networks.

4.10.4 The District is predominantly underlain, in it's central area by the Mercia Mudstone Group (MMG); this is part of the Triassic Series formerly known as the Keuper Marl. It comprises interlaminated siltstones and sandstones with the dominant component being mudstones. The MMG is shown as a Non-Aquifer and is thought to have little to no soakaway potential. However local shallow sandstone bands, or local pockets of fine grained sand/silt may allow the limited and localised use of soakaways; this would need to be investigated by local intrusive testing.

4.10.5 The northwest and western area of the District is underlain by the outcropping Kidderminster Formation which comprises sandstones and conglomerates which is classified as a Major Aquifer, and is thought to have a high soakaway potential. Running in a north to southerly trend across the central north western portion of the District is a line of outcropping Tarporley Siltstones, which comprises interbedded siltstones; sandstones and mudstones, which is classified as a Minor Aquifer.

4.10.6 The soakaway potential of the Tarporley Siltstones is uncertain due to the unknown quantities and depths of the siltstones, sandstones and mudstones. The extreme eastern portions of the District are underlain by the Lower Lias which consists of mudstones and shelly limestones. This strata is classified as a Non-Aquifer and is thought to have little to no soakaway potential.

4.10.7 Please refer to the tables in Section 8 for a summary of the geology underlying the NSDC District and the potential for the application of infiltration SuDS.

Source Protection Zone Maps

4.10.8 Source Protection Zones (SPZ's) relate to groundwater supplies used for drinking, and the risk of contamination through pollution. The EA classify them into three main zones; Zone 1 (Inner Protection Zone), Zone 2 (Outer Protection Zone), Zone 3 (Total Catchment) and Zone of Special Interest. Source Protection Zone boundaries have been provided in (Appendix C). According to Policy PU4- (Aquifer Protection) of the Newark and Sherwood Local Plan;

"Planning permission will not be granted for development proposals which could lead to the infiltration of harmful pollutants into groundwater or that will adversely affect groundwater movement. This restriction is particularly important to aquifers from which public water supplies are drawn, as defined on the Proposals Map."

4.10.9 The location of Source Protection Zones in the District should be taken into consideration when assessing the application of SuDS techniques based on infiltration. The Source Protection Zone plan should be read in conjunction with the SuDS Infiltration Feasibility Plan in Appendix C.

Contaminated Land Issues

4.10.10 Due to the ongoing release of new studies and data, together with the potentially sensitive nature of this type of information, it was deemed appropriate to assess SuDS feasibility independently of this data source. Land contamination in relation to SuDS infiltration feasibility should be assessed in greater detail as part of a Level 2 study. In general it is recommended that any development site being brought forward through the planning process, assess the feasibility of SuDS on a site by site basis taking into account underlying ground conditions.

4.11 FLOOD WARNING & EMERGENCY PLANNING

4.11.1 Within the Newark and Sherwood District, as elsewhere in England, the responsibility for flood warning rests primarily with the EA. The EA provides flood warnings for designated Flood Warning Flood Risk Areas (see Appendix C). Details of EA flood warning coverage zones are described later in this document. This information can also be viewed on the EA's and NSDC website.

4.11.2 The aim of the Newark and Sherwood District Council Emergency Plan is to outline the arrangements in place for co-ordinating and managing the response of Newark and Sherwood District Council to an emergency. This Plan describes the key roles that staff within the Council will perform during emergencies including flooding. The NSDC Emergency Plan links into the Nottinghamshire Local Resilience Forum county wide Multi-Agency Response Plan.

4.11.3 The Emergency Plan sets out the various roles and responsibilities of the emergency services. The objectives of the plan are as follows;

- Maintain a suitable level of preparedness to deal with an emergency;
- Conform to emergency planning at a strategic level;
- Designate staff training needs;
- Provide appropriate public access to the Council's emergency plans;
- Maintain up-to-date staff contact and callout ability;
- Designate available resources and expertise;
- Provide guidance and procedures to Council staff and public dealing with emergencies.

4.11.4 NSDC comply with the Civil Contingency Act, by the use of a generic public and more detailed staff emergency plan. Further considerations in relation to Emergency Planning should be taken into consideration at a more detailed level as part of the Stage 2 SFRA.

4.11.5 The NSDC Flood Emergency Plan (March 2007) has been reviewed along with Flood Evacuation Guidance provided by NSDC.

4.11.6 The Flood Evacuation Guidance information sheet sets out the various procedures that should be undertaken for preparing for a flood. Information relating to evacuations and flood warnings is also provided. As previously stated, the responsibility of issuing flood warnings lies primarily with the EA.

4.11.7 The Council has recently been awarded 'Beacon Status' for Emergency Planning. Much of the emergency planning preparation has focused on flooding due to the high risk of flooding in parts of the District.

4.11.8 Since 2007, NSDC have been involved in initiatives to encourage community and individual resilience in high risk areas. To date, 20 resilience stores have been created throughout the District. These stores are managed by trained community response teams/flood wardens and provide basic response equipment and supplies.

4.11.9 The NSDC website has a comprehensive section relating to Emergency planning and flooding. Detailed information is provided on topics relating to flood warnings, flood prevention, flood repairs and insurance. It is recommended that this is reviewed by all residents living in flood risk areas.

4.12 DEVELOPMENT SITES

Local Plan/Proposals Map

4.12.1 NSDC have been developing a Settlement Hierarchy for the District as part of their LDF Core Strategy. Within the Preferred Options document (October 2006), the following hierarchy was proposed:

Settlement Hierarchy

Sub Regional Centre
Newark and Balderton

Rural Centres	
Ollerton & Boughton	Rainworth
Southwell	Edwinstowe
Blidworth	Clipstone
Bilsthorpe	Lowdham
Collingham	Farnsfield
Farndon	Sutton-on-Trent

Villages		
Averham	Barnby	Bathley
Besthorpe	Bleasby	Bulcote (Part)
Carlton-On-Trent	Caunton	Kings Clipstone
Coddingston	Cromwell	Eakring
East Stoke	Edingley	Egmanton
Elston	Fiskerton-cum-Morton	Girton
Gunthorpe	Halam	Harby
Hockerton	Kelham	Kirklington
Kirton	Kneesall	Little Carlton
North Clifton	North Muskham	Norwell
Rolleston	South Clifton	South Muskham
South Scarle	Syerston	Thorney
Thurgarton	Upton	Walesby
Wellow	Weston	Winthorpe

Settlements			
Alverton	Brough	Budby	Cotham
Gibsmere	Goverton	Grassthorpe	Halloughton
Hawton	Holme	Kersall	Kilvington
Langford	Laxton	Maythorne	Maplebeck
Moorhouse	Normanton	Norwell Woodhouse	Ompton
Ossington	Perlethorpe	Rufford	Spalford
Staunton	Staythorpe	Thorpe	Wigsley
Green Belt Settlements			
Bulcote (Part)	Caythorpe	Epperstone	Gonalston
Hoveringham	Lowdham (Part)	Oxton	

Potential Areas of Development

4.12.2 As work on the Core Strategy has evolved, NSDC have refined the hierarchy to reflect advice from peer review and the views of Parish Councils and the public. In the Key Decisions of their Core Strategy Document, the Council is proposing that the higher order settlements could be categorised in the following way;

Settlement Type	Newark Area	Southwell Area	Sherwood and Mansfield Fringe	Nottingham Fringe
1) Sub Regional Centre	Newark and Balderton*			
2) Service Centres		Southwell	Ollerton & Boughton, Rainworth and Clipstone	
3) Principal Villages	Collingham, Sutton on Trent	Farnsfield	Blidworth, Bilsthorpe and Edwinstowe	Lowdham

*Newark and Balderton is a term which refers to the town of Newark and the villages of Balderton and Fernwood.

The District has a range of settlements below the level of Principal Village and as part of the development of the Core Strategy, NSDC intends to investigate their roles. Some settlements have schools and shops which NSDC need to support through limited development. Many villages are in the Trent valley and therefore assessing the level of flood risk will be a key part of reviewing their overall sustainability.

4.12.3 In line with the Secretary of State's Proposed Changes to the East Midlands Regional Plan, NSDC may be required to accommodate 712 dwellings per year on average within the plan period to 2026. That is 17,800 dwellings in total over a 25 year period (2001-2026). In order to satisfy the building of 17,800 houses between 2001 and 2026 land will need to be identified for accommodating approximately a further 12,000 houses over the next 18 years taking into account houses already built since 2001.

4.12.4 Potential Areas of Development identified for investigation as part of this process are summarised below; these are graphically depicted in Appendix A. These are not in any order of priority, preference nor flood risk:

1. Land South of Westhorpe, Southwell
2. Land South of Rainworth Bypass, Rainworth
3. Land at Wellow Road, Ollerton
4. Land North of Petersmiths Drive, Ollerton
5. Land South of Brake Lane, Boughton
6. Land North of River Trent, Newark
7. Land at the River Maun, Edwinstowe
8. Land at Clipstone Colliery
9. Land South of New Lane, Blidworth

10. Land West of Kirklington, Bilsthorpe
11. Land South of Newark
12. Land South of Beacon Hill Road, Newark
13. Land North of Maltkin Lane, Newark
14. Land West of Northgate, Newark
15. Land at Cow Lane, Newark
16. Land at Millgate Wharf, Newark
17. Land at Kelham Road Depot, Newark
18. Newark Lorry Park and Cattle Market
19. Balderton Hospital, Newark
20. NSK Bearings, Newark
21. Lowfield Lane, Balderton
22. Bowbridge Road, Newark
23. Wellow Road, Ollerton
24. Eakring Road, Bilsthorpe
25. Kirklington Road, Bilsthorpe
26. Mansfield Road, Bilworth
27. Cavendish Way, Clipstone
28. Ollerton Road, Edwinstowe
29. Beacon Hill Road, Newark
30. Main Road, Boughton
31. Land at Great North Road, South of Balderton, Fernwood
32. Cross Lane, Collingham
33. Manor Road, Collingham
34. Station Road, Collingham
35. Hemplands Lane, Sutton on Trent
36. Mount Place, Lowdham
37. Eakring Road, Bilsthorpe
38. Land off Farnside Road, Bilsthorpe
39. Land at Eakring Road/Swish Lane, Bilsthorpe
40. Land Adjacent to Dale Lane & Haywoods Oaks Lane, Bilsthorpe
41. Land to North of Kirks Croft, Fishpool Road, Blidworth

42. Land off Baulker Lane, Clipstone
43. Land Adjacent to Rufford Comp. School, Mansfield Road, Edwinstowe
44. Land at Villa Real Farm, Mansfield Road, Edwinstowe
45. Brownhills Motor Hoes, A1/A46 Junction, Newark
46. Land off Claypole Lane, Fernwood
47. Land off Lincoln Road, Newark
48. Land Between A46 and A1, Bridge House, Newark
49. Land at Quibells Lane, Newark
50. Land off Station Road, Ollerton
51. Land East of Harrow Lane, Boughton
52. Land at Kirk Drive, Stepnall Heights, Hallam Road, Boughton
53. Church Lane, Boughton
54. Land off Southwell Road East/Farnsfield Road, Rainworth
55. The Archer PH and Land Adjoining, Warsop Lane, Rainworth
56. Halam Road, Southwell
57. Land off Fiskerton Road, Southwell
58. Land off Crew Lane, Southwell
59. Rear of High Gables, Lower Kirklington Road, Southwell
60. Land at Crew Lane, Southwell
61. Field to the South of South End, Collingham
62. Ash Farm, Cockett Lane, Farnsfield
63. Land off Cockett Lane, Farnsfield
64. Land off Milldale, Ridgeway Estate, Farnsfield
65. Barrel Hill Road, Sutton on Trent
66. Grange Field Great North Road, Sutton on Trent
67. Barrel Hill Road and Great North Road, Sutton on Trent
68. Land between Bulham Lane & High Street, Sutton on Trent
69. Palmer Road, Sutton on Trent
70. Land at Rear of 24 Main Street, Sutton on Trent
71. Millfield, Main Street, Sutton on Trent
72. Land off Southwell Road, Lowdham

4.13 REVIEW OF DATA

Limitations of the Level 1 Study

4.13.1 This Level 1 report provides a review of baseline information collected to carry out the SFRA. A general assessment has been made of the principal sources of flood risk associated with the study area in relation to existing settlements and proposed key development sites. A site specific analysis of the level of protection provided by the flood defence infrastructure in the District has not been undertaken. This should be investigated in greater detail as part of a Level 2 investigation. The potential effects of climate change have been assessed.

4.13.2 Further detailed information is required on the extent of flood defences within the district. Detailed information relating to Flood Alleviation Schemes as discussed in (sect 4.7), was lacking at this stage.

4.13.3 WSP are of the view that the required level of information is available, for sufficient areas of the study catchment to proceed to the Level 2 assessment. Enough data has been provided within the Level 1 SFRA for NSDC to undertake the Sequential Test.

4.13.4 The hydraulic modelling outlines along the River Trent (Fluvial and Tidal), River Maun, River Greet and River Meden have been combined with the EA's flood outlines. This has enabled the key development areas to be assessed in relation to the various flood zones. Flood outlines indicating the climate change extent and functional flood plain, have also been provided where possible.

4.13.5 The existing hydraulic modelling undertaken, especially along the River Trent, needs refinement sometime in the future in order to broaden our understanding of flooding in the District. The Trent modelling should be updated in line with PPS25. This has been set out within the list of recommendations in Section 11.

5 Sources of Flooding

5.1 OVERVIEW

5.1.1 The SFRA gives, as its name implies, a strategic overview of flood risk in the District of Newark and Sherwood. It should be noted that:

- this SFRA reflects current national planning policies and guidance at the time of writing;
- policies may change; and
- flood levels / flood zone classifications may change.

5.2 DATA SOURCES

5.2.1 Section 4 identified several areas requiring further investigation and additional data to be collected in order to complete the Strategic assessment.

Hydraulic modelling

5.2.2 Hydraulic models (as described earlier in section 4) have been provided by the EA and JBA Consulting.

5.2.3 Assessments of the flood risks associated with the main river and ordinary watercourse networks within the study area, have been based principally on a combination of available modelled flood extents (based on various return periods) and the EA's FZM. These flood extents have also been supplemented in light of historic data and professional experience, where appropriate. The hydraulic modelling outlines have been combined with the EA's flood zone outlines and are shown in Appendix D. A more detailed assessment of the model analyses results should be conducted during the Level 2 study.

5.2.4 Where detailed hydraulic modelling has been undertaken, the flood outlines provided by the EA have been replaced. EA J-Flow modelling software has a lower level of accuracy than detailed hydraulic modelling. EA flood outlines using J-Flow cover areas where no detailed hydraulic modelling has been completed. However, the EA's flood outlines in the District are sometimes based on detailed hydraulic modelling. This is the case for the Flood Zone 3 outline along the stretch of the Trent that is fluvial; under these circumstances the EA's outline remains.

5.2.5 The EA have also advised that parts of this Flood Zone 3 outline relating to undefended areas along the fluvial Trent, are based on projections (estimates), as opposed to hydraulically modelled data. Under these circumstances, the outline may be of a lower level of accuracy in comparison to modelling which included undefended areas.

Flood Alleviation Schemes

5.2.6 The Brewers Wharf Flood Defence scheme in Newark has been described in section 4.7.2.

5.2.7 NAIDB have confirmed that the proposed improvement works described in the Cocker Beck, Lowdham Feasibility Study of January 2000 have been implemented. These works take the form of a Flood Storage Area; however, the EA are considering alternatives, as this scheme was overwhelmed during the 2007 floods. The scheme was originally designed for a 1 in 75 year standard of protection.

5.2.8 As previously stated, NSDC and the EA are currently discussing the possibilities of funding flood defences within the District through a variety of sources.

Hydraulic Structures

5.2.9 Information on hydraulic structures throughout the District has been provided by the EA (see Appendix C). The potential for hydraulic structures to block or fail causing flooding to upstream or downstream areas should be assessed in greater detail as part of a Level 2 study.

Sewer Infrastructure

5.2.10 Details of flooding from the sewerage systems were obtained from Severn Trent Water via NSDC. It should be noted that this data excludes information of flooding that occurred more than ten years ago.

5.2.11 Severn Trent Water have advised us that there are seventeen sewage treatment works in the District. Anglian Water have an additional two in the District. Details relating to discharge consent and scope for expansion of local sewage treatment works should be assessed in greater detail as part of a Level 2 SFRA.

5.3 DETAILED METHODOLOGY

5.3.1 A strategic assessment of the principal sources of flood risk within the District has been made based upon the data collected. The sections below set out the findings for each area of the catchment which has been identified as having further development potential in line with the Council's proposed settlement hierarchy. It highlights the likely constraints to future development growth arising from the various flood risk sources;

5.4 FLUVIAL FLOOD RISK

NEWARK AND BALDERTON

5.4.1 Flooding in Newark is principally from the River Trent which flows south west to north east predominately to the west of existing developed areas. Flood levels in the Trent directly influence the flood levels in its tributaries, principally the River Devon. The River Devon and its own tributaries (in particular the Middle Beck) are also shown to be at risk of flooding. Extracts from the EA's FZM are shown in Appendix D. The EA have advised that the EA's flood extent for (FZ3), is principally based on the detailed hydraulic modelling that was undertaken along the River Trent by Black and Veatch consultancy.

5.4.2 The extent of flood defences in this area are illustrated in Appendix B. A network of embankments along the Trent provide a degree of protection (1 in 100 year) to areas in the south west part of Newark. However, modelled flood extents taking into consideration the presence of the defences, would indicate that the defences along the Trent in some places are overtopped for the 1 in 100 year event; the effects of climate change are likely to increase this risk. These defences are maintained by the EA. Channel capacity along stretches of the Trent would provide a certain level of protection to Newark as opposed to formal raised defences.

5.4.3 Flooding from the River Trent extends across extensive areas of the Trent valley through the District. The River Trent bifurcates into two channels at Upper Water Mouth to the west of Newark with the western channel forming the boundary to the majority of development of Newark. The two channels join to the north of Newark at Winthorpe Rack. The floodplain for the Trent predominantly covers the extensive areas of agricultural land between the two channels and extends west and is predicted to cover the majority of the villages of Kelham and South Muskham extending in total approximately 2.8 km across to the west of Newark.

5.4.4 Predicted flooding to the east of the River Trent along the western edge of Newark tends to be limited by the presence of higher ground along the B6166 North

Gate/Lincoln Road. Some existing properties are shown to be at risk along the river edge.

5.4.5 Bridge crossings over the Trent in Newark are clear spanning and do not appear to cause significant hydraulic constrictions. However, the presence of the A46 and railway line embankment are expected to act as deflector barriers to the passage of flood waters to a certain extent.

5.4.6 The floodplain of the River Devon to the south of Newark merges with the floodplain of the River Trent. There are small isolated 'islands' of dry land above the floodplain notably at Hawton village.

5.4.7 The floodplain of the Middle Beck (a tributary of the River Devon), generally extends from the confluence with the River Devon upstream along the watercourse to the route of the disused railway. Upstream of the former railway the areas at risk of flooding (emanating from Sodbridge Drain), gradually diminish to the south of Beacon Hill Road, Newark.

5.4.8 Lowfield Drain flows in an east to west direction east of the railway embankment, south of Balderton. Though not shown on the flood maps, there is a degree of flood risk emanating from this watercourse. Detailed hydraulic modelling would need to be undertaken in order to confirm the exact extent of the flood plain.

5.4.9 The principal fluvial flood risk to Balderton and the village of Fernwood is from the River Witham and its tributaries to the east of Newark. The River Witham is shown to benefit from raised flood defences. Flooding from Shire Dyke is predicted to extend beyond its banks; however it is not shown to affect residential properties to the east of Balderton. There are no formal flood defences relating to Shire Dyke, shown in the vicinity of Balderton and Fernwood.

OLLERTON AND BOUGHTON

5.4.10 Flood mapping provided in Appendix D identifies the principal sources of fluvial flooding that affect Ollerton and Boughton are from the River Maun and its tributaries, namely Rainworth Water and the Boughton Dyke. The flood outlines shown in Appendix D are derived from the JBA hydraulic modelling.

5.4.11 The River Maun flows in a north easterly direction to the west of Ollerton. However, flooding from the River Maun is predicted to be contained to the undeveloped agricultural land either side of the river. The Rainworth Water and River Maun confluence is immediately upstream of a bridge structure to the south west of Ollerton and appears to cause a backwater effect with flooding to agricultural areas.

5.4.12 There are several other bridge structures through Ollerton which impact upon the floodplain of the River Maun, however, most of the flooding is predicted to be contained to the western bank of the river. Numerous properties on the eastern bank, including a hotel, are shown to be affected by flooding.

5.4.13 Flooding from the Boughton Dyke is not predicted to extend far beyond the banks of the river and subsequently does not affect existing properties to the east of Boughton. The predicted floodplain of the Maun does not encroach on Boughton to any great extent.

5.4.14 There are no formal flood defences in the vicinity of Ollerton and Boughton. According to the EA's NFCDD database, the EA regularly maintains the River Maun channel. Under these conditions the capacity of the channel would provide a certain level of protection as opposed to formal defences.

SOUTHWELL

5.4.15 The principal sources of flooding that could affect Southwell are from the River Greet and its tributaries. These are Westhorpe Dumble/Potwell Dyke and Halam Beck

to the north west of Southwell. The flood mapping data is located in Appendix D and is derived from detailed hydraulic modelling undertaken by Halcrow.

5.4.16 The River Greet flows in a south easterly direction towards a point that is to the east of Southwell. The floodplain extends to approximately 200m in width and is restricted to undeveloped land either side of the river bank. However, the presence of a bridge with culvert structures under the A612 are shown to act as hydraulic throttles to causes back water effects upstream.

5.4.17 The confluence of Potwell Dyke and River Greet is immediately downstream of the A612 bridge. Flooding is also shown to affect a small number of properties downstream of the bridge.

5.4.18 Flooding from the Potwell Dyke is predicted to affect some existing properties to the east and north east of Easthorpe. There are several hydraulic throttles along the river channel that will each have a localised effect on flooding. Flooding is predicted to weir across Church Street (A612) where the river is culverted for approximately 200m prior to the confluence with the River Greet. Predicted flooding of Church Street corresponds with historic flooding highlighted by the Town Council.

5.4.19 Halam Beck to the north and west of Southwell flows through Halam before outfalling into the Greet to the north of Maythorne. The associated floodplain is relatively minor in extent. Hydraulic structures along the watercourse are likely to cause restrictions with local backwater effects. Flooding is shown to progress over Mansfield Road in Halam and affects some existing properties where the river has been culverted. Predicted flooding of Mansfield Road corresponds with historic flooding highlighted from the NAIDB.

5.4.20 Channel capacity along the Greet may afford a limited amount of protection to sites adjacent to the watercourse in the eastern part of Southwell.

COLLINGHAM

5.4.21 The principal flood risk associated with Collingham is from the River Trent to the west of the village. Fluvial flooding can also emanate from the River Fleet. The land immediately to the west of Low Street is in Flood Zones 2 and 3 as indicated by the detailed hydraulic modelling outlines produced by Black and Veatch.

5.4.22 According to the EA, raised defences exist along the Trent to the west of the village. These take the form of a continuous flood embankment; however these defences only provide a level of protection up to the 1 in 3 year event (see Appendix C).

SUTTON-ON-TRENT

5.4.23 The tidal floodplain of the River Trent extends into the centre of the village. Flood defences are shown on the EA Flood Zone Maps to the east of the rural centre (see Appendix C). The EA maintained defences take the form of raised flood embankments along the Trent that is tidal at this point. The only exception to this is a small hard defence that runs in an east to west direction adjacent to Ingram Lane. Modelled flood extents for the 1 in 100 year event show that these defences are not overtopped. This is confirmed by the NFCDD (see Appendix C) that states the defences provide a 1 in 100 year level of protection. According to the Newark Area IDB, Sutton on Trent was badly affected by flooding from local watercourses in 2007.

FARNDON

5.4.24 The village of Farndon is in the floodplain of the River Trent. The River Devon is located to the east of the village. There are flood defences along the River Trent in the south west, west and north of the village. The rural centre is surrounded by Flood Zone 3 that extends into the village in certain areas, particularly in the south west and north eastern sectors. Flood Zone 2 extends across the central section of the village in

an easterly direction. According to the NFCDD (see Appendix C) the raised defences in this area do not provide a 1 in 100 year level of protection.

5.4.25 The flood defences are generally maintained by the EA and take the form of raised embankments. In certain places the capacity of the river channel provides a degree of protection from flooding.

LOWDHAM

5.4.26 The principal source of flooding to affect Lowdham is the Cocker Beck. To a lesser extent the Dover Beck, Car Dyke and River Trent floodplains also impact upon parts of Lowdham. The flood mapping information is located in Appendix D.

5.4.27 The Cocker Beck flows from the west of Lowdham before being routed south east through the settlement. The floodplain is not predicted to extend far beyond its banks up to where it is routed south where it extends to approximately 100m in width. The watercourse is culverted and crossed by several bridge structures through Lowdham. Each of these is likely to create backwater effects, however the flood zone mapping appears to indicate that flows weir over the structures in a relatively unrestricted manner. The flooding from the Cocker Beck is predicted to affect existing properties to the north east of the A6097. Predicted flooding locations correspond well with reported historic flooding.

5.4.28 To the south west of Lowdham the Cocker Beck floodplain meets with the River Trent floodplain and extends to Caythorpe Road.

5.4.29 According to EA data (see Appendix C), channel capacity would provide a certain level of protection from flooding along Cocker Beck. The EA also maintains some small schemes such as concrete floodwalls that defend individual properties.

TRENT SIDE VILLAGES

5.4.30 The NSDC proposed settlement hierarchy identifies villages that can accommodate small scale development. Many of the villages are located within the Trent valley and are at significant risk of flooding. Trent side villages that could potentially accommodate small growth include Thurgarton, Bleasby, Fiskerton, East Stoke, Rolleston, Upton, Averham, Kelham, North Muskham, Cromwell, Carlton-on-Trent and Besthorpe.

5.4.31 Many of these villages are significantly affected by the River Trent floodplain.

5.4.32 The River Trent floodplain generally extends between approximately 2.5 and 4.4 km along the Trent valley. Refer to flood mapping in Appendix D.

5.4.33 The villages of Upton and East Stoke are predicted to lie beyond the fringes of the Trent floodplain.

5.4.34 The villages of Little Carlton, South Muskham, Girton, Gunthorpe and Hoveringham are covered entirely by the River Trent floodplain as shown on the flood zone mapping.

5.4.35 In general, predicted flood extents and areas designated as being at risk of fluvial flooding, correspond well with historic fluvial flooding (Appendix B) locations highlighted during the study.

5.5 GROUNDWATER

5.5.1 Information was provided by the EA relating to groundwater levels in the District. Groundwater levels within various towns in the District such as New Ollerton, Edwinstowe and Rainworth averaged at about 15.36 metres below ground level (mbgl).

5.5.2 The western part of the NSDC area is located on the geological formation of the Nottingham Castle Sandstone. This formation is classed as a major aquifer; the EA

continually monitor groundwater levels within this aquifer. Groundwater levels though high in places, average at about 17 (mbgl) which is low.

5.5.3 Some anecdotal evidence was obtained from discussion with residents of the southern part of Newark and the villages adjacent to the River Devon. They indicated that ground water levels can fluctuate quite significantly depending on the preceding weather conditions. In places accounts were received of groundwater levels typically in the region of 200mm to 300mm below the ground surface.

5.5.4 The EA have stated that they have no records of any incidents of groundwater flooding within Newark and Sherwood District. NSDC were able to provide a small number of records relating to groundwater flooding which occurred in tandem with other forms of flooding. These events were recorded at Bleasby, Egmanton and Staythorpe and are shown in table 4A.

5.6 OTHER SOURCES

5.6.1 Potential sources of flood risk from overland flow, sewers and water mains would need to be assessed by developers at the planning stage as part of a site specific Flood Risk Assessment. For the purposes of a strategic level study, incidents of pluvial and sewer flooding have been provided in Table 4B and graphically illustrated in Appendix B.

5.6.2 The ability for individual developments to increase flood risk to off site areas has been assessed in Table 10A.

5.6.3 Based on the principles of SuDS, greenfield development will be required to manage surface water runoff in a sustainable way so as to mimic the existing (pre-development) situation. Development on brownfield land, will be required to manage surface water runoff mimicking the existing situation or providing a reduction in runoff rates (betterment). These measures reduce the level of flood risk to the site and to off – site areas.

5.6.4 The clustering of sewer flooding incidents in Lowdham, Boughton and Southwell may be as a result of capacity issues. However, this is difficult to establish without more detailed records of these events. The records provided in table 4B indicate that sewer flooding is not a particular issue in Newark. Lowdham experiences the greatest amount of sewer flooding in the District.

5.6.5 Records relating to pluvial flooding are difficult to record, as they are often combined with flooding relating to surface water runoff from other sources. Extensive sewer and surface water flooding was experienced in the District during the 2007 flooding events. Much of this would have been derived directly from rainfall runoff. As illustrated in table 4B pluvial (surface water) flooding events are noted in Blidworth, Newark and Halam. The effects of pluvial flooding tend to be localised and can be reduced at a site specific level by the correct application of SuDS. Research findings on the impacts of overland flooding are continuously being produced. It is imperative that the risks of pluvial flooding are taken into consideration at the early stages of future land use planning decisions. Current research should be reviewed when assessing the risk of flooding from this source,

5.6.6 The Government's Pitt Report (2008), which came as a direct response to the 2007 floods, makes several recommendations relating to the responsibility of local authorities in managing flood risk. One of the most important recommendations is that local authorities should take the lead on the management of local flood risk, with the support of the relevant organisations such as the EA. Some of the key recommendations of the report that relate to surface water/sewer flooding are as follows;

- Local authorities should positively tackle local problems of flooding by working with all relevant parties, establishing ownership and legal responsibility;

- Local authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and conditions;
- Local Surface Water Management Plans, as set out under PPS25 and coordinated by local authorities, should provide the basis for managing all local flood risk.

5.6.7 As the Pitt Review highlights, local authorities should work in partnership with the various stakeholders (i.e. the EA and IDBs) so that the various sources of flood risk within the District are effectively managed.

5.7 SURFACE WATER MANAGEMENT PLANS

5.7.1 Surface Water Management Plans (SWMPs) are defined as a tool to manage surface water flood risk on a local basis by improving and optimising coordination between relevant stakeholders. A Surface Water Management Plan will build on an SFRA by providing a basis for local stakeholders to develop a common understanding of surface water flood risk. This will include setting out priorities for action, maintenance needs and links into LDFs and Emergency Plans.

5.7.2 The SFRA will provide a core understanding of these issues in the event that NSDC are required to produce a SWMP. One of the key findings of the River Trent CFMP Pre-Publication Report (September 2008), is that the main opportunities for flood risk reduction in the catchment will come from reducing run-off through land use change and attenuation across rural areas.

6 Assessment of the Impact of Climate Change

6.1 CLIMATE CHANGE WITHIN THE DISTRICT

6.1.1 No specific allowance for climate change is currently incorporated within the information illustrated in the EA Flood Zone Maps, shown on their web-site. Neither do those plans show any protection provided by existing defences except where they are less than 5 years old. Hydraulically modelled climate change extents for the 1 in 100 year event have been provided for the River Trent (Fluvial), River Maun, River Meden and River Greet (see Appendix D).

6.1.2 PPS25 recommends a precautionary approach that involves allowance for specific and quantified climate change factors based on currently available evidence. This approach is particularly relevant where a development site could result with multiple landowners as in the case of a residential development.

6.1.3 As mentioned in section 2.3.6, the tidal effects of the Trent in the district are considered to be minimal.

6.1.4 PPS25 (Annex B- table B.2) provides indicative sensitivity ranges for different parameters affecting the likely severity of projected flooding.

6.1.5 This Level 1 SFRA should be used to assist NSDC in performing the Sequential Test to steer development towards sites of least flood risk (Flood Zone 1). The later sections of this report assess each of the proposed development parcels and make reference to the flood risk zone(s) in which each is situated (see Appendix E). Where available, climate change extents have been taken into consideration.

6.1.6 Any detailed flood modelling and mapping to be undertaken as part of a Level 2 SFRA, will need to account for climate change over the expected lifetime of the development. Residential development is typically expected to have a lifetime of 100 years and commercial development a lifetime of 60 years.

6.1.7 Hydraulically modelled climate change outlines illustrate that some of the development areas fall within these extents; sites at Ollerton and Edwinstowe are examples. Where doubt remains, a precautionary approach should be taken whereby the extent of Flood Zone 2 should be taken as being the extent of the 1 in 100 year outline incorporating climate change.

6.1.8 The Pitt Report (2008) recommends that priority should be given to both adaptation and mitigation, when coping with the effects of climate change. Climate change should be taken into consideration and mitigated against within any new development proposals.

7 Flood Management Areas

7.1 STANDARD OF PROTECTION OF FLOOD DEFENCES

7.1.1 Further investigations are required in consultation with the EA to confirm the Standard of Protection (SoP) provided by their flood risk management defences and also any information they have regarding key third party defences. The majority of defences in the District are 'soft' and come in the form of earth embankments. The Hydraulic Structures and Defences plan provides the various defences levels throughout the District where available (see Appendix C). As stated in section 4.6.2, it has been demonstrated with the modelled flood extents, that the defences in some places provide a lower level of protection than their original design standard. This should be assessed in greater detail as part of the Level 2 SFRA. 'Engineered' channel capacity will afford a certain level of protection as opposed to formal raised defences in many places. According to the NFCDD (see Appendix C), in some places the standard of protection along the defences is only adequate to protect against the 1 in 3 year event. The EA have advised, this level of protection is considered suitable for agricultural land.

7.1.2 According to the River Trent CFMP Pre-Publication Report (September 2008), many of the defence assets along the Trent and it's tributaries are no longer providing the level of protection that they were originally designed for. Many of these defences have been in place for more than 30 years.

7.1.3 One of the key findings of the Trent CFMP study is that many defences protecting urban areas will need improving or refurbishing due to the affects of climate change.

7.1.4 Advice will be sought from the EA regarding their projected future Flood Risk Management investment plans for the provision of new or improvements to existing flood defences. This process should continue throughout the life of the SFRA document to ensure that all changes to the SoP against flooding, are taken into account when assessing potential development.

7.2 TRANSPORT INFRASTRUCTURE

7.2.1 Engineered earth embankments relating to highways and railways etc. within the District, would provide a degree of protection to areas against flooding. These embankments act as a barrier to the passage of flood waters in extreme events or in the event of a breach to a major flood defence. The degree of protection that these provide needs to be determined. Existing hydraulic models/studies should be assessed to extract information wherever possible as part of the Level 2 study. A detailed analysis of the EA's NFCDD database should be undertaken during the Level 2 study, to extract all available information.

7.2.2 The function, performance and integrity of any flood risk protection provided by transport infrastructure, should also be assessed by developers at the planning stage, as part of a site specific Flood Risk Assessment.

7.3 FLOOD ALLEVIATION SCHEMES

7.3.1 These have been discussed in sections 4.7.2 and 5.2.6. Flood Alleviation Schemes should be assessed in greater detail as part of a Level 2 study.

7.4 FLOOD WARNING AND EVACUATION

7.4.1 Within the Newark and Sherwood District, as elsewhere in England, the responsibility for flood warning rests primarily with the EA. The EA provides flood warnings for designated Flood Warning Flood Risk Areas across the District; these warnings only cover fluvial and tidal flooding. Primarily the EA issue flood warnings by loudhailer, telephone and emergency officers on the ground.

7.4.2 The following table provides a summary of the Flood Warning Catchment Areas in the vicinity of the Trent;

EA Region	River	Newark & Sherwood District Towns & Villages
Anglian Region	Witham and Tributaries	South Witham to Claypole
Midlands Region	Trent	Averham and Staythorpe
Midlands Region	Trent	Bleasby and Gibsmere
Midlands Region	Trent	Caythorpe
Midlands Region	Trent	Farndon
Midlands Region	Trent	Fiskerton
Midlands Region	Trent	Fiskerton Mill
Midlands Region	Trent	Gunthorpe
Midlands Region	Trent	Holme
Midlands Region	Trent	Hoveringham
Midlands Region	Trent	Kelham
Midlands Region	Trent	Lowdham
Midlands Region	Trent	Newark
Midlands Region	Trent	North Muskham
Midlands Region	Trent	Rolleston
Midlands Region	Trent	South Muskham
Midlands Region	Trent	Little Carlton
Midlands Region	Trent	Thurgarton
Midlands Region	Trent	Winthorpe

7.4.3 As stated in section 4.11, Newark and Sherwood District Council have produced a Flood Emergency Plan (March 2007). This document provides useful information about pre-emptive and reactionary measures to be taken to minimise the effects of flooding in the District. NSDC have also issued information on Flood Evacuation Guidance. This provides details on the EA flood warnings and how to prepare for a flood event.

7.5 POTENTIAL ZONES OF RAPID INUNDATION

7.5.1 Many parts of the District do not rely upon, or benefit from, raised flood defences. As a result, many areas are not at risk from rapid inundation in the event of defence failure. According to information provided by the EA, there are seven raised reservoirs in the District that would act as hydraulically significant impounding structures (see Appendix B). It is important to note that defence failure is considered to be a residual risk when assessing flood risk and development.

7.5.2 Some parts of the District benefit from a degree of protection from fluvial flooding, through maintained river channels; Edwinstowe and Ollerton are examples (see Appendix C). Under these conditions, the capacity of the channel affords a level of protection to adjacent development.

7.5.3 Development situated behind flood defences such as raised earth embankments (see Appendix C), may be at risk of falling into a Zone of Rapid Inundation in the event of defence failure. However, according to the NFCDD the maximum height of the flood banks in the District are no more than (approx.) 2.5 m high. Typically a Zone of Rapid Inundation is defined as being within 500 - 1000m of a raised flood defence such as an earth embankment (refer to DEFRA Guidance FD2320/TR2). The area of rapid inundation will depend on variables such as topography and the height of the defences. DEFRA guidance states that for small defences (2m high or less), the Zone of Rapid Inundation will only extend for the first few hundred metres in the event of a breach.

7.5.4 From a desk based study, potential areas that may be at risk from rapid inundation in the event of a failure in the raised defences are as follows; development area Land North of River Trent, Land at Kelham Road Depot, Newark Lorry Park and Cattle Market and Mount Place - Lowdham. In Sutton on Trent, the following sites may also be at risk, Hemplands Lane, Land between Bulham Lane & High Street, Sutton on Trent, Land at Rear of 24 Main Street, Sutton on Trent, Millfield, Main Street, Sutton on Trent, Palmer Road, Sutton on Trent, Grange Field Great North Road, Sutton on Trent and Barrel Hill Road, Sutton on Trent. Finally, in Balderton, Lowfield Lane. These areas should be assessed in greater detail as part of a Level 2 SFRA.

7.5.5 The majority of Newark is not at risk from defence failure and rapid inundation, as there are only a small number of raised defences in this area.

7.5.6 The potential for reservoirs and defences within the District to breach, should be assessed in greater detail as part of a stage 2 SFRA.

7.5.7 The potential for a failure in the flood defences would need to be assessed by developers as part of a site specific Flood Risk Assessment, prepared to support their proposals with a planning application.

8 Sustainable Drainage Systems (SuDS)

8.1 GEOLOGICAL CONDITIONS

8.1.1 Tables 8A and 8B below give a general description of each of the underlying geological strata encountered in the study area and of the strata's drainage potential. A 'broad brush' simplified indication of SuDS infiltration feasibility has been depicted geographically in Appendix C.

Table 8A: Drift Geology

Geology Name	Generic description	Soakaway potential
Alluvium	Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present. Groundwater is likely to be present at shallow depth.	**No**
River Gravel	Gravel and sand of fluvial origin.	**Yes**
Older River Gravel	Gravel and sand; of fluvial origin; older than 'River Gravel' in the same map area.	**Yes**

Table 8B: Solid Geology

Geology Name	Generic description	Soakaway potential
Lower Lias	Grey, fossiliferous, fissile mudstones and siltstones with subordinate thin beds of shelly limestone in the lower part, and fine-grained carbonate-cemented sandstone in the upper part; argillaceous limestone concretions occur throughout.	**No**
Mercia Mudstone Group; (Formerly Keuper Marl)	Dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum/anhydrite widespread; sandstones are also present.	**No**

Geology Name	Generic description	Soakaway potential
Tarporley Siltstone Formation; (Formerly Keuper Waterstones)	Heterolithic, comprising interlaminated and interbedded siltstones, mudstones and sandstones in approximately equal proportions. The siltstones are micaceous and interlaminated with mudstones or sandstones; most of the mudstones appear structureless. The sandstones are mostly very fine to fine-grained, well sorted, and micaceous. They are typically cemented by ferroan calcite or dolomite. Sandstone beds are commonly less than 0.5m thick, though composite units, consisting of several individual sandstone beds, may reach over 5m thick. Intraformational mudclast conglomerates are common, with mudclasts concentrated at the bases of sandstone beds. Most mudstone and siltstone beds are reddish brown, though green-grey mottles and laminae are common. Gypsum occurs sporadically in the mudstones as small nodules. The sandstones are grey-brown and substantially paler than the siltstones and mudstones.	**Uncertain**
Kidderminster Formation; (formerly Bunter Pebble Beds)	Pebble conglomerates and reddish brown sandstones. The sandstones are cross-bedded and pebbly. The conglomerates have a reddish brown sandy matrix and consist mainly of pebbles of brown or purple quartzite, with quartz conglomerate and vein quartz.	**Yes**

8.1.2 SuDS techniques can be used to reduce the rate and volume of surface water discharges from sites to the receiving environment (i.e. natural watercourses or public sewer etc), as well as improve the water quality. Various SuDS techniques are available, however the techniques operate on two main principles;

- Infiltration
- Attenuation

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

8.1.4 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 many cases a combination of both infiltration and attenuation methods may be applied.

8.1.5 The underlying ground conditions of a site will need to be determined through ground investigations; these assess the permeability of the underlying soil. An initial assessment of a site's suitability to the use of SuDS infiltration techniques can be obtained from the review of the available soils / geological survey of the area presented in Tables 8A and 8B.

8.1.6 SuDS infiltration feasibility mapping has been provided in Appendix C. This illustrates the ground conditions found in the Newark and Sherwood District in terms of permeability and appropriateness for the use of SuDS infiltration techniques. These definitions are based on a desk study review of available information and our experience; this should not supersede site-specific data and ground investigations.

8.1.7 In the design of any drainage system and SuDS approach, consideration should be given to site-specific characteristics and where possible be based on primary data from site investigations. The information presented in the Tables 8A and 8B is provided as a guide and should not be used to accept or refuse SuDS infiltration techniques. The location of Source Protection Zones (Appendix C) should also be taken into consideration.

8.1.8 Further advice must also be sought on the application of SuDS in terms of information relating to water resources, contaminated land, archaeology, and ecology etc.

9 Strategic Infrastructure

9.1 WATER CYCLE STUDY

9.1.1 A District wide Water Cycle Study is currently being undertaken in order to assess the existing water infrastructure within the District and its capacity to cope with additional growth. The study will review Water Services Infrastructure implementation through an assessment of the environment and infrastructure capacity for:

- water supply;
- sewage disposal;
- flood risk management;
- surface water drainage.

9.1.2 The Water Cycle Study will also consider the impact of efficiency measures, and will provide an estimate of cost for any identified solution and any identified infrastructure improvements required.

9.1.3 District wide sewer records can be viewed at NSDC's Environmental Services department.

9.1.4 The location of key sewerage infrastructure such as pumping stations and sewage treatment works should be provided as part of a Level 2 SFRA. Severn Trent Water have confirmed that there are seventeen sewage treatment works in the Newark and Sherwood District. These are located at Balderton, Bilsthorpe, Boughton, Collingham, Crankley, Cromwell, Eakring, Edwinstowe, Farndon, Farnsfield, Halam, Kirklington, Kneesall, Laxton, Perlethorpe, Rainworth and Southwell. Anglian Water operate two sewage treatment works in the District at Barnby in the Willows and Harby.

9.1.5 Meetings should be held with Severn Trent Water and Anglian Water in order to obtain further information on any capacity issues at local sewage treatment works, and to assess the likely impact of future growth upon the existing infrastructure. Much of this information may be taken from the Water Cycle Study.

9.1.6 Population equivalent data for the impact of future growth at STW's has not been available for this stage but should be as part of a Level 2 assessment.

Capacity Issues

9.1.7 Severn Trent Water have confirmed that they would not oppose development on the grounds of capacity. If additional development is proposed in the District, Severn Trent Water would undertake the necessary upgrades to their existing works if required.

Recommendations

9.1.8 Information found within this section will be provided once a detailed analysis of the strategic infrastructure within the District has been undertaken. This should be done through the Water Cycle Study and as part of a Level 2 SFRA.

10 Planning and Development Issues

10.1 SEQUENTIAL TEST

10.1.1 A sequential risk-based approach to determining the suitability of land for development in flood risk areas is central to PPS25 and should be applied at all levels of the planning process.

10.1.2 NSDC as part of the LDF process of allocating land for development, should apply the Sequential Test. The aim of the test is to demonstrate that there are no reasonably available sites in areas of lower probability of flooding that would be appropriate to the type of development or land use proposed.

10.1.3 Table D.1, Annex D of PPS25 (below) provides definitions for the flood zones, referring to the probability of fluvial and tidal flooding, ignoring the presence of defences.

PPS25 Table D.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. See Annex E for minimum requirements.

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

The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone.

Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 are only appropriate in this zone if the Exception Test (see para. D.9.) is passed.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

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 in Table D.2 are appropriate in this zone.

The highly vulnerable uses in Table D.2 should not be permitted in this zone.

The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test (see para. D.9) 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. See Annex E for minimum requirements.

Policy aims

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

i. 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;

ii. relocate existing development to land in zones with a lower probability of flooding; and

iii. 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. SFRAs should identify this Flood Zone (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, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in Table D.2 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. See Annex E for minimum requirements.

Policy aims

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

i. 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

ii. relocate existing development to land with a lower probability of flooding.

10.1.4 A sequential approach should be used in areas known to be at risk from other forms of flooding.

10.1.5 The EA's Flood Zone Maps form the basis for the sequential testing of PPS25 whereby land is categorised as being in one of a range of zones, Flood Zone 1 to Flood Zone 3, according to the probability of flooding to the land. PPS25 advises on the appropriate planning response for different types of development in relation to the flood risk as categorised by the various Flood Zones.

10.1.6 Flood Zone Mapping for the NSDC study area has been taken from the Environment Agency's FZM. Maps showing the various flood zones have been prepared across the study area for each specific site (see Appendix E) and are the starting point for the sequential approach. Where possible the EA's Flood Zone Map outlines have been replaced with detailed hydraulic modelling (see section 5.2.4). As stated in section 4.1.7 hydraulic models that have been combined with the EA's outlines are along the following watercourses; the River Trent-Fluvial (Black and Veatch 2004), River Trent-Tidal (Black and Veatch 2005) the River Maun (JBA Consulting 2007), the River Meden (JBA Consulting 2008) and the River Greet (Halcrow 2008).

10.1.7 It is important to highlight that this Level 1 SFRA does not attempt to provide a comprehensive assessment of the Sequential Test. The information provided in Table 10A should be used by NSDC as guidance in relation to flood risk and the development potential of the 72 sites.

10.1.8 As set out within Annex D of PPS25, the aim of the Sequential Test is to steer new development to areas at the lowest probability of flooding. Preference should be given to locating development in Flood Zone 1. If there are no reasonably available sites in Flood Zone 1, the flood vulnerability of the proposed development (see Table D.2, Annex D PPS25 below) can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3.

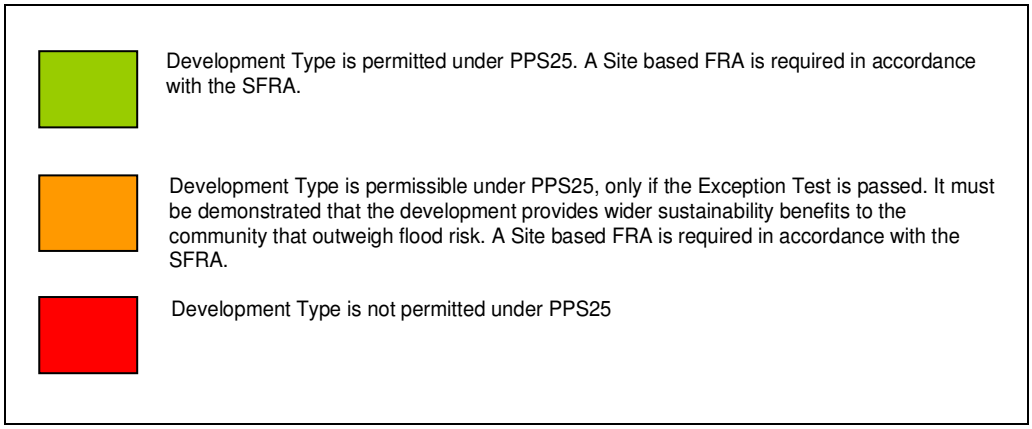
PPS25 Table D.2 : Flood Risk Vulnerability Classification

Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• 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.
More Vulnerable	• 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, subject to a specific warning and evacuation plan.

Less Vulnerable	• 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 plants. • Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	• 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.

10.1.9 Flood Zone 'compatibility' (see Table D.3, Annex D PPS25 below) forms the basis for the Sequential Test to be undertaken. Note that 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.

10.1.10 To add visual means of rapidly identifying the compatibilities a 'traffic light' system developed and implemented in other SFRAs has been adopted. A series of three colours are used to represent the compatibility criteria as summarised below:



PPS25 Table D.3. Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification (see Table D.2)		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (See Table D.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

10.2 EXCEPTION TEST

10.2.1 PPS25 expands on the Sequential Test by incorporating an Exception Test whereby if, following application of the Sequential Test, 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.

10.2.2 The Exception Test is appropriate when there are large areas in Flood Zones 2 and 3, where the Sequential Test alone cannot deliver acceptable sites, but where some continuing development is necessary for wider sustainability reasons. This would take into account the need to avoid social or economic blight and the need for essential civil infrastructure to remain operational during floods. It may also be appropriate to use it where restrictive national designations (e.g. Sites of Special Scientific Interest) prevent the availability of unconstrained sites in lower flood risk areas.

10.2.3 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. Where required, the Level 2 SFRA should provide key supporting information for undertaking this test.

10.2.4 For development to be allocated or permitted, all three elements of the Exception Test criteria (set out below) will have to be passed:

10.2.5 It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage (see p21 of PPS12: Local Development Frameworks) the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;

10.2.6 The development should be on developable previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and

10.2.7 An FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

10.2.8 This SFRA study 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 NSDC as part of their Sequential Test and Exception Test procedure, as required.

10.3 APPROPRIATENESS OF PROPOSED LDF FUTURE GROWTH AREAS

10.3.1 This section seeks to provide a policy direction in relation to flood risk to allow NSDC to make informed judgements in allocating land using the Sequential Test philosophy. The principal areas of focus are related to the Council's evolving settlement hierarchy and the ability of settlements to accommodate future growth.

10.3.2 The following is a regional based summary of the various flooding issues affecting development in relation to the specific sites.

NEWARK AND BALDERTON

10.3.3 As stated within the Regional Plan, Newark has been nominated as a new growth point; there are approximately 17 potential development sites within the Newark area (see Appendix A). Based upon current information and the predicted extent of the River Trent floodplain to the west of Newark, no additional 'more vulnerable' or 'highly vulnerable' uses of development should be considered for allocation. Less vulnerable development could be acceptable however safe access and egress issues and floodplain displacement issues will require detailed consideration and assessment. Areas to the west of Newark are shown to fall within the defended functional floodplain (Zone 3b) outline and the defended 1 in 100 year plus climate change outline (see Appendix D). Any development to the south of Newark is at risk of flooding from the River Devon, Middle Beck and the Trent.

10.3.4 Most of the potential brownfield sites identified by the NSDC brief to the east of the Trent are shown to be at risk of flooding to varying degrees. However, sites in the north east corner of Newark are shown not to fall within flood risk areas.

10.3.5 Sites in Newark that are in close proximity to the small number of raised defences, fall within Zones of Rapid Inundation. As stated in section 5.4, channel capacity also provides a degree of protection to parts of Newark.

10.3.6 The principal source of flood risk in Balderton and Fernwood is Shire Dyke. Development along the western bank of Shire Dyke is prone to flooding as the area is shown to be undefended. As these areas are undefended then they are not at risk from rapid inundation in the event of defence failure. Site specific flood risk assessments will indicate the full extent of the floodplain and the risk that this poses to the proposed development. Less vulnerable development could be acceptable in this area, however safe access and egress and floodplain displacement issues will require detailed consideration and assessment.

SOUTHWELL

10.3.7 The River Greet to the north and east of Southwell means that any significant development should ideally be considered only to the west of the village. Six of the proposed development sites are located within the village (see Appendix A). Protection from flooding in the form of channel capacity is provided to the east of the village centre along the River Greet. There are no raised defences in this area. Any development in the south of the village would need to take into consideration the Potwell Dyke floodplain. The functional floodplain and 1 in 100 year climate change outlines are shown to affect areas to the north east and south east of the village.

OLLERTON AND BOUGHTON

10.3.8 Development should only occur to the north, east and south, because of the River Maun floodplain to the west. The functional floodplain and 1 in 100 year plus climate change outlines are shown to encroach on parts of Ollerton and Boughton. The EA maintain the river channel along this stretch of the Maun, therefore channel capacity provides a certain level of protection. Boughton Dyke flows in a south to northerly direction to the east of Boughton. Any development within this area (i.e. to the east of Boughton) needs to assess the level of flood risk emanating from this watercourse. Nine of the proposed development sites are situated within Ollerton and Boughton. Sites to the north of the centre of Boughton and south and east of the centre of Ollerton, do not appear to be at risk from fluvial flooding.

COLLINGHAM

10.3.9 Development within this area should be restricted to the east, south or, to a lesser extent, the north of the village to avoid the floodplain of the River Trent and River Fleet to the west. Four of the proposed development sites fall within the vicinity of Collingham. Raised flood embankments to the east of the Trent, provide a low level of protection to the agricultural land adjacent to the Trent. The exact level of protection that these defences provide would need to be confirmed as part of a more detailed study. In theory, Collingham is at risk from the effects of tidal flooding from the Trent as it is downstream of Cromwell Weir; however, as previously stated, the EA have advised that the tidal effects at this point are minimal. One of the proposed development sites falls within the Trent floodplain. Based on the 1 in 1000 year flood outline for the Trent (see section 6.1.7), parts of Collingham may be prone to the effects of fluvial flooding brought about by the impacts of climate change.

SUTTON-on-TRENT

10.3.10 Any development in this area should be restricted to the west, south or, to a lesser extent, the north of the village to avoid the floodplain of the River Trent to the east of the village. Eight of the development sites are in Sutton on Trent. The River Trent is tidal up to Cromwell Lock. However, the EA have advised us that in practice the predominantly tidal influence only stretches as far as downstream of Gainsborough Bridge. Raised defences are present along the Trent to the east of the village. Site specific flood risk assessments will indicate the full extent of the floodplain and the risk that this poses to the proposed development. The tidal Trent floodplain is shown to extend into the centre of the village. Floodplain displacement as well as safe access and egress should be taken into consideration. As previously stated, parts of Sutton on Trent may be prone to rapid inundation in the event of a breach in the defences. Several of the proposed development sites fall within the tidal Trent's floodplain. Based on the 1 in 1000 year outline, parts of Sutton on Trent may be prone to the effects of fluvial flooding brought about by the impacts of climate change.

LOWDHAM

10.3.11 Development in the area to the south of Dover Beck floodplain is acceptable providing the location of the floodplain is taken into consideration. Development south of A6097 is considered to be suitable providing the location of the floodplain is taken into consideration. Development towards the south east (i.e: south of the railway line) is considered to be inappropriate as the area is prone to extensive flooding from the River Trent, Car Dkye, Dover Beck and Cocker Beck. As stated in section 5.4 the defences along Cocker Beck are comprised of a mixture of raised embankments and channel capacity which provides a degree of protection. Two of the proposed development sites are located in Lowdham. Parts of Lowdham are prone to the effects of fluvial flooding brought about by the impacts of climate change. This is based on the 1 in 1000 year flood outline for Cocker Beck.

EDWINSTOWE

10.3.12 Any development within this community must take into account the flood risk from the River Maun. The southern part of Edwinstowe falls within the Functional Floodplain of the Maun. The northern part of the village falls outside of the flood risk zones; however much of the village is within flood zones 2 and 3. Any development in the flood zone must make allowance for compensatory floodplain storage mitigation measures and be of an appropriate use. A mixture of natural and maintained channel capacity provide a certain level of protection along this stretch of the Maun. Four of the proposed development sites are located within Edwinstowe. Parts of Edwinstowe are shown to fall within the 1 in 100 year plus climate change and Functional Floodplain outline associated with the River Maun.

FARNSFIELD

10.3.13 Cotton Mill Dyke that flows into the River Greet runs through the central and southern part of the village. Development areas to the north of the village are situated away from Flood Zones 2 and 3. The village does not benefit from flood defences. Based on the Cotton Mill Dyke 1 in 1000 year extent, parts of Farnsfield are prone to the effects of fluvial flooding brought about by the impacts of climate change. Three of the proposed development sites are located in Farnsfield.

BILSTHORPE

10.3.14 There are seven proposed development sites in and around the village of Bilsthorpe. The floodplain of Rainworth Water is located to the west of the village. The vast majority of the village of Bilsthorpe is situated in Flood Zone 1; the risks posed by fluvial flooding are considered to be minimal. The floodplain of a small unnamed tributary to Rainworth Water flows to the south of the village.

CLIPSTONE

10.3.15 The village is situated to the south of the River Maun and to the north of Vicar Water. The flood maps for this area indicate that the Maun floodplain does not encroach on the village itself. Three of the proposed development areas are situated in the village. Development situated adjacent to Vicar Water will need to take into consideration the level of flood risk posed by this watercourse.

RAINWORTH

10.3.16 The northwest corner of Rainworth falls within the floodplain of Rainworth Water. The level of flood risk posed to Rainworth and Blidworth from Rainworth Water is considered to be minimal. The three proposed development areas within Rainworth are located in Flood Zone 1.

BLIDWORTH

10.3.17 An unnamed watercourse flows into the River Greet to the south east corner of Blidworth. All four of the proposed development areas within the village are located in Flood Zone 1.

10.4 FLOOD RISK MANAGEMENT HIERARCHY

10.4.1 When assessing a site's development potential, careful attention should be paid to the Flood Risk Management Hierarchy set out in the PPS25 Practice Guidance. 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);
- Step 5- Mitigate (e.g. Flood resilient construction).

10.4.2 A summary of each of the site specific areas identified by NSDC is provided overleaf in Table 10A. This assessment does not replace the need for the Sequential Test to be undertaken. Once a site's land use has been determined, reference should be made to its Flood Risk Vulnerability classification as set out in table D3 of PPS25. The Exception Test should be applied where necessary. Table 10A should also be read in conjunction with the individual site plans, provided in Appendix E.

Table 10A: SITE ASSESSMENT

Ref:	LDF Site	Comments
1	Land South of Westhorpe, Southwell	The entire site is located in Flood Zone 1 south of Flood Zones 2, 3a and 3b. These flood zones emanate from Potwell Dyke. The River Greet to the east poses no fluvial flood risk to the proposed development area. Detailed modelling shows that flows are contained within the channel along Potwell Dyke. The correct implementation of SuDS to any proposed development on this site, could prevent any possible direct or indirect increase in flood risk to downstream areas along Potwell Dyke.
2	Land South of Rainworth Bypass, Rainworth	The whole of the site is located in Zone 1 and should be suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Rainworth Water.
3	Land at Wellow Road, Ollerton	The whole of the site is located in Zone 1 and should be suitable for all forms of development. A small drain is shown running in close proximity to the site to the north. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along this drain.
4	Land North of Petersmiths Drive, Ollerton	A significant portion of the site (approx 40%) falls within the functional floodplain (flood zone 3b) and flood zones 2 and 3a emanating from the River Maun. The eastern and southern parts of the site fall within flood zone 1. The site is also shown to fall within the 1 in 100 year climate change flood outline. According to PPS25 vulnerable and less vulnerable land uses are not permitted within the Functional Floodplain. Any proposed development needs to take into careful consideration the full extent of Flood Zone 3. The site does not benefit from formal flood defences. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Maun.
5	Land South of Brake Lane, Boughton	The whole development area is located in Zone 1 and should be suitable for all forms of development.
6	Land North of River Trent, Newark	The site is located entirely within the Trent floodplain. Only approx. 5% is in Zone 1, approx. 80% in Zone 3 and 15% in Zone 2. The site does not benefit from any formal flood defences associated with the River Trent along its eastern boundary. Formal flood defences are shown along the northern part of the site boundary. Safe access and egress and floodplain displacement are potential issues that would need to be considered. The raised railway embankment running through the site in a west to northerly direction, may provide a level of protection to areas in the northern part of the site. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Trent.

Ref:	LDF Site	Comments
7	Land at the River Maun, Edwinstowe	The northern section of the site is situated within Zones 2, 3a, 3b and the 1 in 100 year climate change outline. The remainder (approx. 80%) is in Zone 1. This land will be appropriate for most forms of development as the majority of the land is situated within FZ1. Ideally development should occur south of the railway line. In accordance with PPS25, vulnerable and less vulnerable land uses are deemed inappropriate in Flood Zone 3b. The site does not benefit from any formal flood defences. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Maun.
8	Land at Clipstone Colliery	Whilst the vast majority of the site is located in Zone 1 and should be suitable for all forms of development, particular attention needs to be paid to the eastern boundary as it is immediately adjacent to Zones 2 and 3. These flood zones emanate from Vicar Water which flows along the eastern boundary. The south east corner of site falls into Flood Zones 2 and 3. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Vicar Water.
9	Land South of New Lane, Blidworth	The whole of the site is located in Zone 1 and should be suitable for all forms of development.
10	Land West of Kirklington, Bilsthorpe	The whole of the site is located in Zone 1 and should be suitable for all forms of development. The site is in close proximity to a small drain to the west. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas associated with this drain.
11	Land South of Newark	Land to the south of Grange Road has been identified as a potential future growth area. This land will be appropriate for most forms of development as the majority of the land is situated within FZ1 (approx. 70%). The remainder is in Zones 2 and 3. The site is constrained to the south by the Middle Beck floodplain and to the south west by the River Devon. The floodplain of Sodbridge Drain flows along the eastern boundary of the western portion of the site. Raised flood defences are shown along the Devon. The site may be at risk of the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas of the surrounding watercourses.

Ref:	LDF Site	Comments
12	Land South of Beacon Hill Road, Newark	Adopting the Sequential approach, the land south of Beacon Hill Road should be looked upon favourably, as the vast majority of the land bounded by the railway and A1 is located within FZ1. A minor part of site to the south is in Flood Zone 3 (approx. 5%). The site has steeply sloping ground surface profiles which rise away from the floodplain. Any proposed development should be steered away from Flood Zone 3. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas of the drain that is in close proximity to the eastern boundary.
13	Land North of Maltkin Lane, Newark	The site is located adjacent to the floodplain of the Trent and does not benefit from formal flood defences. Approximately 50% of the sites falls into Flood Zones 2 and 3. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Trent.
14	Land West of Northgate, Newark	The site is located within Zones 1, 2 and 3; Zones 2 and 3 are associated with the River Trent. The site does not benefit from formal flood defences. This site offers potential for some forms of development. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Trent.
15	Land at Cow Lane, Newark	The site is entirely within Zone 3 (Trent floodplain) and does not benefit from formal flood defences. Potential uses are very restricted. Safe access and egress and flood plain displacement are potential issues that would need to be considered. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Trent. The site may be at risk from the effects of flooding due to climate change.
16	Land at Millgate Wharf, Newark	The site is located within Zones 1 (approx.15%) and 3 (Trent floodplain). Due to the scale and location of the site, potential uses are limited. The site does not benefit from formal defences. This site offers potential for some forms of development, The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Trent.

Ref:	LDF Site	Comments
17	Land at Kelham Road Depot, Newark	Without taking into consideration the presence of flood defences, the site is shown to be entirely within Flood Zone 3 associated with the River Trent. Some forms of development may be acceptable; however, safe access and egress and floodplain displacement issues will require detailed consideration and assessment. The site is in close proximity to a small drain. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas associated with this drain. The site may be at risk from the effects of flooding due to climate change.
18	Newark Lorry Park and Cattle Market	Some forms of development may be acceptable however safe access and egress and floodplain displacement issues will require detailed consideration and assessment. Without taking into consideration the presence of flood defences, the site is shown to be within Flood Zone 2 and 3 (approx 99%). The raised A46 embankment to the north and the railway line to the south may provide a level of defence to the site from fluvial flooding. The site may be at risk from the effects of flooding due to climate change. The site is in close proximity to several small drains. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas associated with these watercourses.
19	Balderton Hospital, Newark	The majority of the site (approx. 70%) is located in Zone 1 and should be suitable for all forms of development. The site does not benefit from any formal flood defences. The area along the eastern perimeter adjacent to Shire Dyke falls within Flood Zones 2 and 3. Any development should be steered away from Flood Zone 3. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Shire Dyke.
20	NSK Bearings, Newark	The whole of the site is located in Zone 1 and should be suitable for all forms of development.
21	Lowfield Lane, Balderton	The entire site is located in Zone 1 and should be suitable for all forms of development. Sodbridge Drain flows in close proximity to the west of the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along this drain.
22	Bowbridge Road, Newark	The entire site is located in Zone 1 and should be suitable for all forms of development. The floodplain of Sodbridge Drain is in close proximity to the eastern boundary of the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along this drain.

Ref:	LDF Site	Comments
23	Wellow Road, Ollerton	As with Land at Wellow Road, this site is located in Flood Zone 1 and should be suitable for all types of development. A small drain is shown running adjacent to the eastern part of the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along this drain.
24	Eakring Road, Bilsthorpe	The site is located in Flood Zone 1 and should be suitable for all forms of development. However, an unnamed watercourse that flows into Rainworth Water is located close to the southern boundary of the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along this watercourse.
25	Kirklington Road, Bilsthorpe	The entire site is located in Flood Zone 1 and should be suitable for all forms of development.
26	Mansfield Road, Blidworth	The entire site is located in Flood Zone 1 and should be suitable for all types of development.
27	Cavendish Way, Clipstone	The entire site is located in Flood zone 1 and is therefore suitable for all types of development.
28	Ollerton Road, Edwinstowe	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development.
29	Beacon Hill Road, Newark	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development.
30	Main Road, Boughton	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development.
31	Land at Great North Road, South of Balderton, Fernwood	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Shire Dyke.
32	Cross Lane, Collingham	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development. A small drain is shown running close to the southern site boundary. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along this drain.
33	Manor Road, Collingham	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development.
34	Station Road, Collingham	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development. A small drain is shown running adjacent to the eastern site boundary. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along this drain.

Ref:	LDF Site	Comments
35	Hemplands Lane, Sutton on Trent	Approximately 30% of the site is located in Flood Zone 1; the remainder of the site is located in Flood Zone 2 and 3. A small corner of the north east part of the site falls within the 1 in 200 year tidal extent of the Trent (FZ3). The EA have advised that the Tidal effects on the Trent at this point are minimal. Sutton on Trent is shown to benefit from raised flood defences along this part of the Trent. The site may be at risk from the effects of flooding due to climate change. A small drain is shown running adjacent to the eastern site boundary. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas.
36	Mount Place, Lowdham	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Cocker Beck to the south, and Dover Beck to the north.
37	Eakring Road, Bilsthorpe	The site is located in Flood Zone 1 and is considered suitable for all forms of development.
38	Land off Farnsfield Road, Bilsthorpe	The site is considered suitable for all forms of development as it is located in Flood Zone 1. The site is located adjacent to a small drain to the north. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the drain.
39	Land at Eakring Road/Swish Lane, Bilsthorpe	The site is located in Flood Zone 1 and is considered suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Rainworth Water to the west.
40	Land Adjacent to Dale Lane & Haywood Oaks Lane, Blidworth	The entire site is located in Flood Zone 1 and is considered suitable for all forms of development.
41	Land to North of Kirks Croft, Fishpool Road, Blidworth	The site is located in Flood Zone 1 and is considered suitable for all forms of development.
42	Land off Baulker Lane, Clipstone	The site is located in Flood Zone 1 and is considered suitable for all forms of development. However, the western site boundary is adjacent to flood risk areas emanating from Vicar Water. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Vicar Water.

Ref:	LDF Site	Comments
43	Land Adjacent to Rufford Comp. School, Mansfield Road, Edwinstowe	The site is situated in close proximity to the River Maun floodplain; however, the majority of the site is located in Flood Zone 1. A small southern part of the site (approx. 3%) is located in Flood Zone 2. Any potential development should take into consideration the location of the various flood zones associated with the Maun. The site does not benefit from any formal flood defences. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Maun.
44	Land at Villa Real Farm, Mansfield Road, Edwinstowe	The entire site is situated in Flood Zone 1 and therefore all forms of development are considered suitable.
45	Brownhills Motor Homes, A1/A46 Junction, Newark	The entire site is situated in Flood Zone 1 and therefore all forms of development are considered suitable. The site is located adjacent to a small drain to the south. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the drain.
46	Land off Claypole Lane, Fernwood	Approximately 50% of the site falls within Flood Zones 2 and 3 of Shire Dyke. As with the Balderton hospital site, development should be steered away from Flood Zone 3. The site does not benefit from any formal flood defences. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Shire Dyke.
47	Land off Lincoln Road, Newark	The entire site is situated in Flood Zone 1 and therefore all forms of development are considered suitable. The site is located adjacent to a small drain to the east. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the drain.
48	Land between A46 and A1, Bridge House, Newark	Approximately 80% of the site is shown to fall within Flood Zone 2 and 3 of the Trent's floodplain. Potential uses are restricted. The site does not benefit from any formal flood defences. The site may be at risk from the effects of flooding due to climate change. The site is also located adjacent to a small drain to the east. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the drain or the Trent.

Ref:	LDF Site	Comments
49	Land at Quibells Lane, Newark	The entire site is shown to fall within Flood Zone 3a. Less vulnerable development may be acceptable however safe access and egress issues and floodplain displacement issues will require detailed consideration and assessment. The site does not benefit from formal flood defences. The site may be at risk of flooding due to the effects of climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the Trent.
50	Land off Station Road, Ollerton	The entire site is shown to fall into Flood Zone 1; however, the Rainworth Water floodplain is shown to be in close proximity to the western boundary of the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Rainworth Water.
51	Land East of Harrow Lane, Boughton	The majority of the site is located in Flood Zone 1 (approx. 95%); however a small section running along the eastern boundary falls within the floodplain (Flood Zones 2 and 3), of Boughton Dyke. This site offers potential for some forms of development. Any development should be steered away from Flood Zone 3. The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the dyke.
52	Land Kirk Drive, Stepnall Heights, Hallam Road, Boughton	The entire site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development.
53	Church Lane, Boughton	The entire site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Boughton dyke.
54	Land off Southwell Road East/Farnsfield Road, Rainworth	The site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. A small drain runs adjacent to the eastern boundary of the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the drain.
55	The Archer PH and Land Adjoining Warsop Lane, Rainworth	The entire site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development.

Ref:	LDF Site	Comments
56	Halam Road, Southwell	The site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. A small drain runs adjacent to the site to the north. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the drain.
57	Land off Fiskerton Road, Southwell	The site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site, could prevent any possible direct or indirect increase in flood risk to downstream areas along Potwell Dyke.
58	Land off Crew Lane, Southwell	The entire site is shown to be located in Flood Zone 1 and is therefore considered suitable for all forms of development. However, the floodplain of the River Greet is in close proximity to the northern site boundary. The correct implementation of SuDS to any proposed development on this site, could prevent any possible direct or indirect increase in flood risk to downstream areas along the Greet.
59	Rear of High Gables, Lower Kirklington Road, Southwell	The site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site, could prevent any possible direct or indirect increase in flood risk to downstream areas along the Greet to the north.
60	Land at Crew Lane, Southwell	The entire site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site, could prevent any possible direct or indirect increase in flood risk to downstream areas along Potwell Dyke.
61	Field to the South of South End, Collingham	Approximately 70% of this site is located in Flood Zone 1. The remaining 30% of the site falls within Flood Zone 2 and 3 of the tidal Trent floodplain. Some forms of development may be deemed appropriate providing the necessary mitigation measures are implemented. Raised flood defences exist along this stretch of the Trent, however they provide a very low level of protection. The site may be at risk from the effects of flooding due to climate change. A small drain runs adjacent to the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along this drain.
62	Ash Farm, Cockett Lane, Farnsfield	The entire site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Cotton Mill Dyke.

Ref:	LDF Site	Comments
63	Land off Cockett Lane, Farnsfield	The entire site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Cotton Mill Dyke.
64	Land off Milldale, Ridgeway Estate, Farnsfield	The entire site is located in Flood Zone 1 and is therefore considered to be suitable for all forms of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along Cotton Mill Dyke.
65	Barrell Hill Road, Sutton on Trent	The entire site is located in Flood Zone 1 and is therefore suitable for all types of development. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along the drain to the east.
66	Grange Field Great North Road, Sutton on Trent	The majority of the site is located in Flood Zones 2 and 3 (approx. 90%). Safe access and egress issues would need to be assessed in detail. Raised flood defences provide a level of protection to the site along this part of the Trent. The site may be at risk from the effects of flooding due to climate change. A small drain runs adjacent to the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas of the drain.
67	Barrel Hill Road and Great North Road, Sutton on Trent	The majority of the site is located in Flood Zone 1; however approximately 30% lies in Flood Zone 2. Most forms of development are considered appropriate. Sutton on Trent is shown to benefit from raised flood defences along this part of the Trent. A small drain runs adjacent to the site to the east. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas of the drain. The site may be at risk from the effects of flooding due to climate change.
68	Land between Bulham Lane & High Street, Sutton on Trent	Approximately 90% of the site is located in Flood Zone 2 and 3 associated with the tidal Trent floodplain. Safe access and egress issues would need to be assessed in detail. Approximately 10% of the site falls into Flood Zone 3. Any proposed development needs to take into careful consideration the full extent of this flood zone. Sutton on Trent is shown to benefit from raised flood defences along this part of the Trent. The site may be at risk from the effects of flooding due to climate change. A small drain runs adjacent to the site to the east. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas of the drain.

Ref:	LDF Site	Comments
69	Palmer Road, Sutton on Trent	Approximately 60% of the site is located in Flood Zone 2. Safe access and egress issues would need to be assessed in detail. Sutton on Trent is shown to benefit from raised flood defences along this part of the Trent. The site may be at risk from the effects of flooding due to climate change. A small drain runs adjacent to the site to the east. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas.
70	Land at Rear of 24 Main Street, Sutton on Trent	The entire site is located in Flood Zones 2 and 3. Approximately 40% of the site falls within Flood Zone 3. Some forms of development may be considered appropriate providing development is steered away from Zone 3. Safe access and egress issues would need to be assessed in detail. Raised flood defences provide a level of protection to Sutton on Trent along this part of the Trent. The site may be at risk from the effects of flooding due to climate change. A small drain runs adjacent to the site. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas.
71	Millfield, Main Street, Sutton on Trent	The entire site is located in Flood Zones 2 and 3. Approximately 70% of the site falls within Flood Zone 3. Safe access and egress issues would need to be assessed in detail. Raised flood defences provide a level of protection to Sutton on Trent along this part of the Trent. The site may be at risk from the effects of flooding due to climate change. Two small drains run adjacent to the site to the east and west. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas along these drains.
72	Land off Southwell Road, Lowdham	Approximately 70% of the site is located in Flood Zones 2 and 3 associated with Cocker Beck, Dover Beck, Car Dyke and the River Trent. Any proposed development needs to take into careful consideration the full extent of Flood Zone 3. Safe access and egress issues would need to be taken into consideration The site may be at risk from the effects of flooding due to climate change. The correct implementation of SuDS to any proposed development on this site could prevent any possible direct or indirect increase in flood risk to downstream areas.

10.4.3 A summary of the appropriateness of potential growth areas has been provided on the next page in table 10B. Clearly, the suitability of all sites in flood risk terms will be subject to ratification by the EA, a detailed site-specific Flood Risk Assessment being prepared to support any planning application, and demonstration that surface water runoff will pose no detrimental impact to off-site areas. This assessment does not replace the need to undertake the Sequential Test as set out in PPS25.

Table 10B: DEVELOPMENT POTENTIAL AND FLOOD RISK

Ref	Potential Growth Area	Flood Zone	Summary
1	Land South of Westhorpe, Southwell	1	Site is located entirely in Flood Zone 1
2	Land south of Rainworth Bypass, Rainworth	1	Site is located entirely in Flood Zone 1
3	Land at Wellow Road, Ollerton	1	Site is located entirely in Flood Zone 1
4	Land North of Petersmiths Drive, Ollerton	1, 2, 3a and 3b	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
5	Land South of Brake Lane, Boughton	1	Site is located in Flood Zone 1
6	Land North of River Trent, Newark	1,2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3. Flood outlines show the northern part of the site to be defended. Safe access and egress is likely to be an issue
7	Land at the River Maun, Edwinstowe	1,2,3a and 3b	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
8	Land at Clipstone Colliery	1,2 and 3	Parts of the site may suitable for development subject to steering development away from Flood Zones 2 and 3
9	Land South of New Lane, Blidworth	1	Site is located in Flood Zone 1
10	Land West of Kirklington, Bilsthorpe	1	Site is located in Flood Zone 1
11	Land South of Newark	1,2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
12	Land South of Beacon Hill Road, Newark	1, 2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zone 3
13	Land North of Maltkin Lane, Newark	1,2 and 3	Parts of the site may suitable for development subject to steering development away from Flood Zones 2 and 3

Ref	Potential Growth Area	Flood Zone	Summary
14	Land West of Northgate, Newark	1,2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
15	Land at Cow Lane, Newark	3	Possibly, however most types of development are deemed to be inappropriate. Safe access and egress is likely to be an issue
16	Land at Millgate Wharf, Newark	1, 2 and 3	Possibly, however most types of development are deemed to be inappropriate
17	Land at Kelham Road Depot, Newark	3	Possibly suitable for development as flood outlines show that the site is defended. Safe access and egress is likely to be an issue
18	Newark Lorry Park and Cattle Market	2 and 3	Site is possibly suitable for development as flood outlines show that the site is defended. Safe access and egress is likely to be an issue
19	Balderton Hospital, Newark	1,2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
20	NSK Bearings, Newark	1	Site is located entirely in Flood Zone 1
21	Lowfield Lane, Balderton	1	Site is located entirely in Flood Zone 1
22	Bowbridge Road, Newark	1	Site is located entirely in Flood Zone 1
23	Wellow Road, Ollerton	1	Site is located entirely in Flood Zone 1
24	Eakring Road, Bilsthorpe	1	Site is located entirely in Flood Zone 1
25	Kirklington Road, Bilsthorpe	1	Site is located entirely in Flood Zone 1
26	Mansfield Road, Blidworth	1	Site is located entirely in Flood Zone 1
27	Cavendish Way, Clipstone	1	Site is located entirely in Flood Zone 1
28	Ollerton Road, Edwinstowe	1	Site is located entirely in Flood Zone 1

Ref	Potential Growth Area	Flood Zone	Summary
29	Beacon Hill Road, Newark	1	Site is located entirely in Flood Zone 1
30	Main Road, Boughton	1	Site is located entirely in Flood Zone 1
31	Land at Great North Road, South of Balderton, Fernwood	1	Site is located entirely in Flood Zone 1
32	Cross Lane, Collingham	1	Site is located entirely in Flood Zone 1
33	Manor Road, Collingham	1	Site is located entirely in Flood Zone 1
34	Station Road, Collingham	1	Site is located entirely in Flood Zone 1
35	Hemplands Lane, Sutton on Trent	1, 2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
36	Mount Place, Lowdham	1	Site is located entirely in Flood Zone 1
37	Eakring Road, Bilsthorpe	1	Site is located entirely in Flood Zone 1
38	Land off Farnsfield Road, Bilsthorpe	1	Site is located entirely in Flood Zone 1
39	Land at Eakring Road/Swish Lane, Bilsthorpe	1	Site is located entirely in Flood Zone 1
40	Land Adjacent to Dale Lane & Haywood Oaks Lane, Blidworth	1	Site is located entirely in Flood Zone 1
41	Land to North of Kirks Croft, Fishpool Road, Blidworth	1	Site is located entirely in Flood Zone 1
42	Land off Baulker Lane, Clipstone	1	Site is located entirely in Flood Zone 1
43	Adjacent to Rufford Comp. School, Mansfield Road, Edwinstowe	1 and 2	Parts of the site may be suitable for development subject to steering development away from Flood Zone 2
44	Land at Villa Real Farm, Mansfield Road, Edwinstowe	1	Site is located entirely in Flood Zone 1
45	Brownhills Motor Homes, A1/A46 Junction, Newark	1	Site is located entirely in Flood Zone 1

Ref	Potential Growth Area	Flood Zone	Summary
46	Land off Claypole Lane, Fernwood	1,2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
47	Land off Lincoln Road, Newark	1	Site is located entirely in Flood Zone 1
48	Land between A46 and A1, Bridge House, Newark	1,2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
49	Land at Quibells Lane, Newark	3	Possibly, however most types of development are deemed to be inappropriate. Safe access and egress is likely to be an issue
50	Land off Station Road, Ollerton	1	Site is located entirely in Flood Zone 1
51	Land East of Harrow Lane, Boughton	1,2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
52	Land Kirk Drive, Stepnall Heights, Hallam Road, Boughton	1	Site is located entirely in Flood Zone 1
53	Church Lane, Boughton	1	Site is located entirely in Flood Zone 1
54	Land off Southwell Road East/Farnsfield Road, Rainworth	1	Site is located entirely in Flood Zone 1
55	The Archer PH and Land Adjoining, Warsop Lane, Rainworth	1	Site is located entirely in Flood Zone 1
56	Halam Road, Southwell	1	Site is located entirely in Flood Zone 1
57	Land off Fiskerton Road, Southwell	1	Site is located entirely in Flood Zone 1
58	Land off Crew Lane, Southwell	1	Site is located entirely in Flood Zone 1
59	Rear of High Gables, Lower Kirklington Road, Southwell	1	Site is located entirely in Flood Zone 1
60	Land at Crew Lane, Southwell	1	Site is located entirely in Flood Zone 1

Ref	Potential Growth Area	Flood Zone	Summary
61	Field to the South of South End, Collingham	1, 2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
62	Ash Farm, Cockett Lane, Farnsfield	1	Site is located entirely in Flood Zone 1
63	Land off Cockett Lane, Farnsfield	1	Site is located entirely in Flood Zone 1
64	Land off Milldale, Ridgeway Estate, Farnsfield	1	Site is located entirely in Flood Zone 1
65	Barrel Hill Road, Sutton on Trent	1	Site is located entirely in Flood Zone 1
66	Grange Field Great North Road, Sutton on Trent	1, 2 and 3	Part of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
67	Barrel Hill Road and Great North Road, Sutton on Trent	1 and 2	Parts of the site may be suitable for development, subject to steering development away from Flood Zone 2
68	Land between Bulham Lane & High Street, Sutton on Trent	1, 2 and 3	Part of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3
69	Palmer Road, Sutton on Trent	1 and 2	Part of the site may be suitable for development, subject to steering development away from Flood Zone 2
70	Land at Rear of 24 Main Street, Sutton on Trent	2 and 3	The entire site is located in Flood Zones 2 and 3
71	Millfield, Main Street, Sutton on Trent	2 and 3	The entire site is located in Flood Zones 2 and 3
72	Land off Southwell Road, Lowdham	1,2 and 3	Parts of the site may be suitable for development subject to steering development away from Flood Zones 2 and 3

10.5 SITE SPECIFIC FRA TOOLKIT

10.5.1 A Flood Risk Assessment toolkit has been set out in Appendix F.

10.5.2 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 NSDC and future developers of sites in the study area. A SuDS Infiltration Feasibility Plan has been provided in Appendix C.

10.5.3 Site specific FRA requirements are offered as guidance only and will be subject to EA approval and current policy, at the time of submission of a planning application.

10.6 WINDFALL SITES

10.6.1 Windfall sites are classified as those sites that are not specifically allocated for development in a development plan but become available for development during the lifetime of the plan. The Sequential Test is applicable throughout the planning lifecycle and should equally apply to windfall sites as much as it does to the forward planning process. A Sequential approach should be adopted when reviewing these sites in terms of flood risk, referencing the SFRA.

10.7 MINERALS AND WASTE

10.7.1 Waste and mineral development within the District should be sensitive to flood risk. Sites should take into consideration the location of flood zones and should not adversely affect flood regimes.

11 Recommendations

11.1 RECOMMENDATIONS

11.1.1 Newark and Sherwood District Council are required to carry out the Sequential Test for allocating land for future development based upon supporting evidence and information set out in Section 5 of this report and the Flood Zone Maps in Appendix E. The Sequential test should be undertaken in relation to the test criteria set out within Section 10.1. The following key recommendations should be taken into consideration;

- NSDC should ensure developers and their consultants make reference to this SFRA study prior to the formulation of development proposals and planning applications. This is to ensure that the key requirements of PPS25 (supplemented by recommendations within the SFRA) are met.
- NSDC should ensure developers carry out site specific FRA's for their proposals in line with the EA's latest standing advice on flood risk and the requirements of a site specific FRA. Specific reference is made to the FRA 'Toolkit' provided in Appendix F.
- NSDC should seek to implement strategic flood mitigation opportunities (where possible) by way of developer contributions, planning conditions, or S106 agreements. This should be assessed in greater detail as part of a Level 2 SFRA.
- NSDC should maintain an up to date Emergency and Flood Evacuation Plan for the District.
- NSDC should support the implementation of SuDS by way of robust planning conditions and / or Section 106 (S106) agreements.

11.1.2 To safeguard the future operation and function of flood defences and flood risk management related infrastructure, responsibility and management for any new facilities should be adopted by the relevant Internal Drainage Board or a maintenance body within NSDC. The Marston Vale Surface Waters Plan (Bedfordshire) is a potential option to follow whereby the Bedford Group of Drainage Boards control watercourses, implement, maintain and control strategic flood defence infrastructure by way of a developer contribution (applied per m^2 of impermeable development). This is in return for a more favourable discharge rate to the watercourse. This contribution could equally be applied per property by way of a 'roof tax' or similar.

11.1.3 NSDC 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 to safeguard the future of existing settlements that are deemed to be at risk of flooding currently, and in the future taking into account climate change.

11.2 AREAS FOR FURTHER INVESTIGATION

11.2.1 Areas for further investigation following the completion of the Level 1 Strategic Flood Risk Assessment study, principally focus upon refinements to the existing hydraulic modelling data and include the following key elements;

11.2.2 The existing models have been reviewed by WSP based on the received modelling reports and flood outlines. A Level 2 study would allow a review of the actual models themselves; this would provide confirmation that all the physical features including hydraulic structures have been depicted. Refining existing models and undertaking additional modelling will help enhance the flood zone maps in the District.

11.2.3 It is recommended that as part of a Level 2 SFRA, a site walkover is undertaken in order to assess the existing rivers and hydraulic structures across river channels. If any discrepancies are noticed then the existing models should be updated accordingly.

11.2.4 The River Trent Fluvial model should be run for the 1 in 1000 year design event in order to produce the Zone 2 (extreme) flood outline. The model should also be run for the 1 in 100 year event, to produce a Zone 3 outline excluding defences.

11.2.5 The undefended Functional Floodplain (Zone 3b) outline, should be generated for both the fluvial and tidal Trent.

11.2.6 The undefended (Zone 3a) climate change extent (which does not take into consideration the presence of defences), has been provided for the river Maun, Meden and Greet; however it should also be generated for both the fluvial and tidal extents of the Trent.

11.2.7 WSP produced a TUFLOW 2D model for the River Devon and its tributaries, which is waiting for EA approval. This model should be run for the 1 in 20 and 1 in 1000 year design horizon. The extreme events and functional floodplain flood outlines (Zone 2 and Zone 3b) should be produced from these modelled results.

11.2.8 Lowfield Drain and Sodbridge Drain should be modelled based on the requirements of PPS25.

11.2.9 Cocker Beck and its tributaries should be modelled based on the requirements of PPS25.

11.2.10 Where required, a Level 2 SFRA should assess land contamination issues within the District in relation to the application of SuDS infiltration techniques.

11.2.11 The extent and level of protection of the flood defences should be assessed in greater detail in relation to the key development areas in the District. Potential Zones of Rapid Inundation should be assessed.

11.2.12 The undefended Functional Floodplain and climate change outlines have been provided for the River Maun, Meden and Greet (see Appendix D). No further modelling needs to be undertaken in relation to the functional floodplain and climate change extents along these watercourses.

11.2.13 Ongoing consultation will be undertaken with the EA with regards to the future delivery of Flood Alleviation Schemes. These schemes could potentially affect flood outlines as shown on the EA's flood maps. Such schemes offer the potential to release more land for development. Flood Alleviation Schemes should be assessed in light of any modelling that may be undertaken as part of a Level 2 study.

11.2.14 Where required, the Level 2 SFRA should provide key supporting information for the Exception Test to be undertaken (see section 10.2). This relates to sites that fall into areas of medium to high flood risk.

12 Conclusion

12.1 SUMMARY

12.1.1 A 'Level 1' strategic assessment of flood risk issues has been carried out across the NSDC study area as defined in Appendix A. This is to assist NSDC with their risk-based approach to the allocation of land for development as part of their ongoing LDF process.

12.1.2 Particular reference should be made to the Flood Risk Constraints maps (see Appendix D), when appraising future growth areas as part of the LDF process.

12.1.3 Land allocations must be made with reference to the Sequential Test and, where appropriate, the Exception Test, as set out within PPS25. A Level 2 SFRA, will be a key document in helping to assess flooding in relation to sites that fall under the Exception Test.

12.1.4 Recommendations should be set out as part of a Level 2 SFRA that highlight land areas that potentially offer strategic flood mitigation opportunities and wider community benefit.

12.1.5 A site specific FRA 'toolkit' has been provided to assist NSDC, the EA and future developers in identifying the key flood risk issues within the study area. This will also help to assist with the formulation of solutions to the management of flood risk and surface water runoff that are of benefit strategically rather than locally.

12.1.6 This Level 1 SFRA has been based upon planning policies and information available at the time of report issue (July 2009). Flood risk classifications may be subject to change in line with future planning policy. Flood zoning may be subject to change following consideration of detailed topographical information, and investigation of site specific Flood Risk Assessments accompanying planning applications.

12.1.7 It is strongly recommended that the Level 2 study is prepared during the ongoing LDF process to help inform and reinforce the land allocation decisions made in the near future. The Level 2 document is key in providing guidance on sustainable development within the District. A sufficient amount of information has been gathered at the Level 1 stage to allow the Level 2 SFRA to progress.

12.1.8 All stakeholders involved in the production of the SFRA have provided the necessary information and guidance in order to complete this detailed study. It is important to note that the scope of the SFRA has grown considerably since the study was commissioned in 2006. This is due to a significant increase in the number of sites needed to be reviewed, as a result of the Strategic Housing Land Availability Assessment.

12.1.9 The schedule of potential areas for development that have been assessed is included within Appendix E.

13 Key Data Sources

A46 Newark to Widmerpool Improvement- Hydraulic Modelling Report, KBR, 2005

Cocker Beck Lowdham Feasibility Study – Stage 2 Report, JBA Consulting, 2000

Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft,' Department for Communities and Local Government, 2008

Draft East Midlands Regional Plan, East Midlands Regional Assembly, 2006

East Midlands Regional Plan- Proposed Changes, Government Office for the East Midlands, 2008

Flood Risk Mapping Study- River Meden, JBA Consulting, 2008

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Appendices, Figures & Tables

Appendix A Assessment Area, Potential Development Areas, CFMP Policy Units

Appendix B

Existing Watercourses,
Water Authority Regions,
Reservoir Locations,
Historical Flooding,
Severn Trent Water Correspondence

Appendix C

Hydraulic Structures and Defences, SuDS Infiltration Feasibility Plan, Source Protection Zone Maps, EA Warning Areas

Appendix D Flood Risk Constraints Mapping

Appendix E Potential Development Sites

Appendix F Site Specific FRA 'Toolkit,' Data Register