FINAL DRAFT

AECOM

Greater Nottingham Strategic Flood Risk Assessment Addendum

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Nottingham City Council

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Quality Information

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Abbreviation Definition

AEP	Annual Estimated Probability
AStGWF	Areas Susceptible to Groundwater Flooding
BBC	Broxtowe Borough Council
CC	Climate Change
CIRIA	Construction Industry Research and Information Association
CRT	Canal and Rivers Trust
DCC	Derbyshire County Council
Defra	Department for Environment, Food and Rural Affairs
EBC	Erewash Borough Council
FAS	Flood Alleviation Scheme
FCERM	Flood and Coastal Erosion Risk Management
FRA	Flood Risk Assessment
FRMPs	Flood Risk Management Plans
FWMA	The Flood and Water Management Act
GBC	Gedling Borough Council
GIS	Geographical Information Systems
GNSFRA	Greater Nottingham Strategic Flood Risk Assessment
IDB	Internal Drainage Board
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
NCC	Nottingham City Council
NCoC	Nottinghamshire County Council
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RBC	Rushcliffe Borough Council
RFCCs	Regional Flood and Coastal Committee
SAB	Sustainable Drainage Systems Approval Body
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection
SPZ	Source Protection Zones
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plans
uFMfSW	Updated Flood Maps for Surface Water

1. Introduction

1.1 Background

Nottingham City Council on behalf of the Greater Nottingham Strategic Flood Risk Assessment Partnership, has commissioned AECOM to undertake a Strategic Flood Risk Assessment (SFRA) Addendum for the Greater Nottingham area. This area includes the administrative boundaries of Nottingham City Council, Broxtowe Borough Council, Gedling Borough Council, Rushcliffe Borough Council (all in Nottinghamshire), and Erewash Borough Council (Derbyshire).

Two SFRAs currently cover the Greater Nottingham area: (i) Greater Nottingham SFRA (GNSFRA) (2010)[1] that provided updates to the six technical report volumes produced for the 2008 Greater Nottingham SFRA[2]; and (ii) River Leen & Day Brook SFRA (2008). Given the long passage of time between the production of these reports and present day, an Addendum document is required to refresh studies to inform planners and developers with the latest flood risk policy, guidance and data availability.

1.2 Aims and Objectives

A concise SFRA Addendum document has been compiled to meet the requirements of the scope of works. Specifically, the report:

- **Summarises the new flood risk data provided by the Environment Agency for the purposes of the SFRA Addendum;**
- **Outlines the intended use of the SFRA Addendum GIS Package;**
- **Provides guidance to Local Planning Authorities (LPAs) on the use of the SFRA Addendum GIS Package in assessing site allocations and individual planning applications;**
- **Outlines the new climate change guidance, released in February 2016, and provides advice for the application of this guidance in the context of the SFRA;**
- **Summarises national policy that has been released since the completion of the existing SFRAs, including commentary on which policies included in the existing SFRAs are now superseded; and**
- **Provides a summary of locations where capital flood risk management schemes are planned as part of the Environment Agency's six year capital programme to aid developers in identifying where partnership working may be possible to facilitate development.**

1.3 Use of this Document

This Addendum document is comprised of two elements:

- **The Addendum Report: this has not been written to supersede the existing SFRA documents, but to improve the quality of information available to highlight development constraints and opportunities for environmental enhancement; and,**
- **The Addendum GIS Package: AECOM has provided Nottingham City Council with a GIS package to input into their GIS platform. The GIS package contains data that supersedes the current SFRA mapping, including updated hydraulic modelling results and flood outlines for the Greater Nottingham area.**

Combined, the GNSFRA (2010), River Leen & Day Brook SFRA (2008) and this SFRA Addendum (2017) meet the requirements of the National Planning Policy Framework.

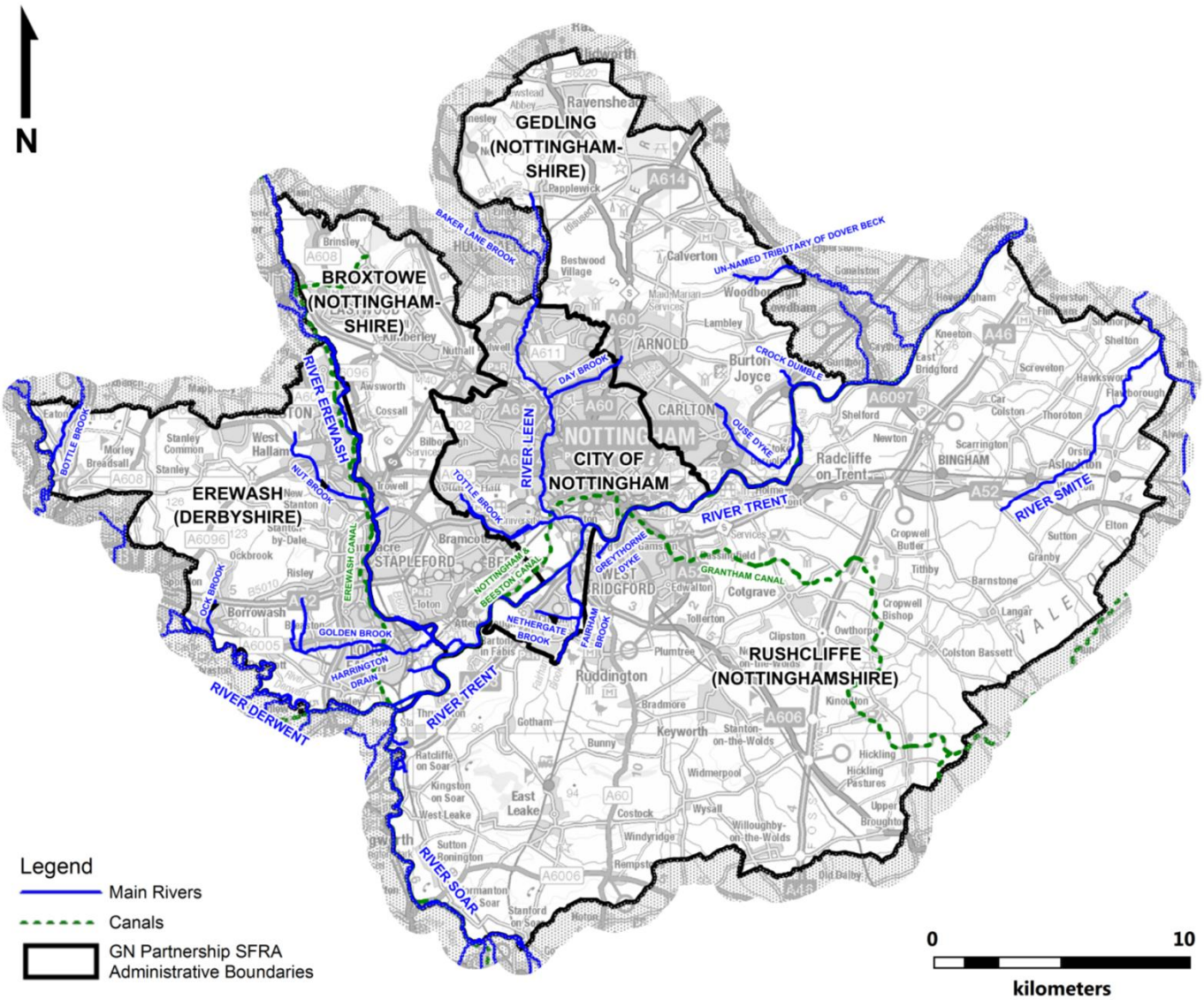
[1] Black & Veach (2010) Greater Nottingham Strategic Flood Risk Assessment.
[2] Black & Veach (2008) Greater Nottingham Strategic Flood Risk Assessment – Technical Reports Volumes 1-6.

1.4 Structure of this Document

The GNSFRA (2010) is separated into multiple volumes for each of the Broxtowe, Erewash, Gedling, Nottingham City and Rushcliffe administrative areas. This SFRA Addendum is structured into one document, and the identified changes in data and/or policy could relate to single or multiple volumes of the 2010 report or the 2008 SFRA study. Therefore, each section of this Addendum is clearly signposted to outline its relevance to the sister documents.

1.5 Study Area

Figure 1-1 illustrates the study area of this Greater Nottingham SFRA Addendum and the designated Main Rivers and canals within each LPA administrative boundary.



Contains Ordnance Survey Data © Crown Copyright and database right 2011

Figure 1-1: Greater Nottingham SFRA Addendum Study Area

2. National Policy & Guidance Updates

This section is to be read in conjunction with the 2008 SFRA and all volumes of the 2010 SFRA.

Numerous planning policies and guidance documents have been amended, introduced or superseded since production of previous reports. This section outlines the key changes at a national scale and describes how these changes impact the Greater Nottingham area in the context of flood risk. Each of these policies is important when implementing site allocation during the planning stage, and a selection remain relevant to guide the decision making process for determining permissions for individual planning applications, whether on allocated or non-allocated sites.

2.1 Flood Risk Regulations (2009)

As Lead Local Flood Authorities (LLFAs) Nottingham City Council (NCC), Nottinghamshire County Council (NCoC) and Derbyshire County Council (DCC) have legal obligations under the EU Floods Directive[3], which was transposed into UK Law through the Flood Risk Regulations (2009)[4] ('the Regulations'), to prepare a Preliminary Flood Risk Assessment (PFRA) report; NCC, NCoC and DCC delivered their respective PFRAs[5,6,7] in 2011.

PFRAs seek to provide a high level overview of flood risk from local flood sources and include flooding from surface water (i.e. rainfall resulting in overland runoff), groundwater, Ordinary Watercourses (smaller watercourses and ditches) and consideration of flooding from artificial sources (i.e. canals/ponds). Additionally, information on past flooding, where future flooding might occur across the area and the consequences it might have to people, properties and the environment is reported. However, PFRAs exclude flood risk from Main Rivers, the sea and reservoirs as these are assessed nationally by the Environment Agency in Flood Risk Management Plans (FRMPs).

LLFAs were also required to prepare FRMPs for formally identified Flood Risk Areas, reported in the PFRA, where the risk of flooding from local sources was deemed significant (Figure 2-1).

[3] European Union (2007) EU Floods Directive. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0060:EN:NOT
[4] HSMO (2009) The Flood Risk Regulations. Available at: http://www.legislation.gov.uk/uksi/2009/3042/contents/made
[5] JBA Consulting (June 2011) Nottinghamshire County Council Preliminary Flood Risk Assessment. Available at: http://www.nottinghamshire.gov.uk/enjoying/countryside/flooding/lead-local-flood-authority/pfra/
[6] Nottingham City Council (2011) Nottingham City Council Preliminary Flood Risk Assessment . Available at: http://www.nottinghamcity.gov.uk/environmental-health-and-safer-housing/safer-housing/lead-local-flood-authority/
[7] Derbyshire County Council (May 2011) Derbyshire County Council Preliminary Flood Risk Assessment. Available at: https://www.derbyshire.gov.uk/environment/flooding/prfa/default.asp

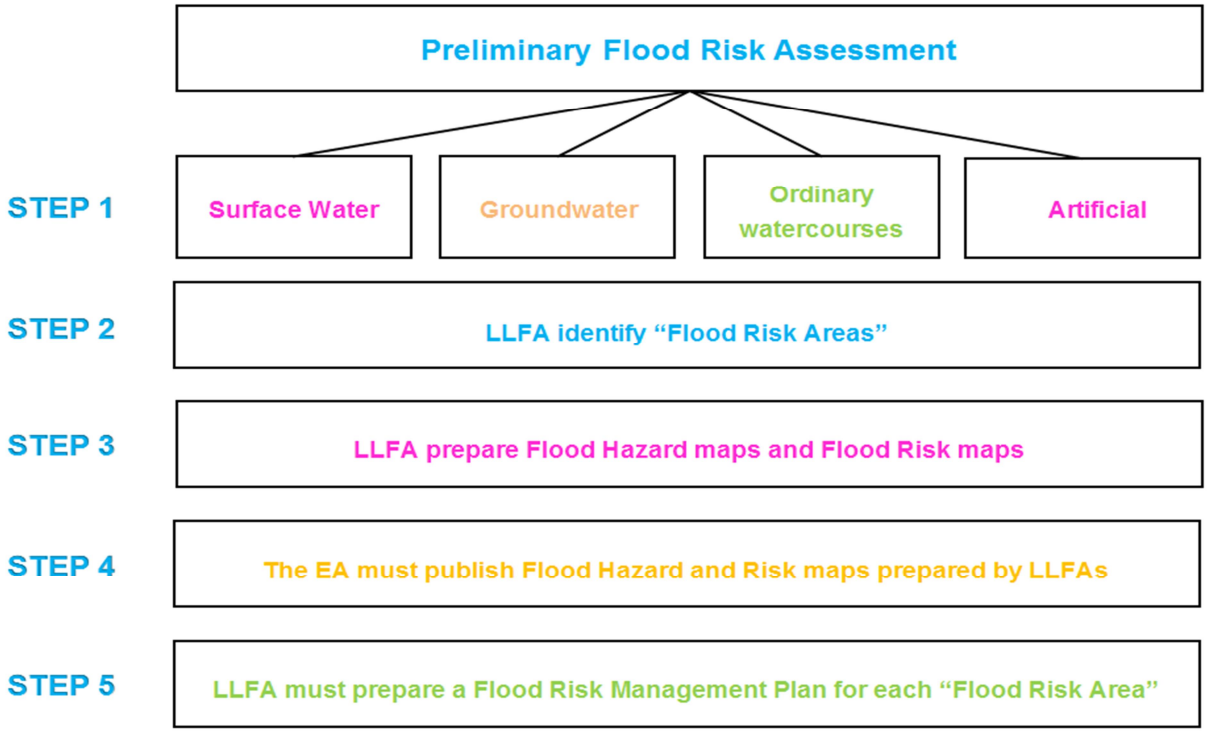


Figure 2-1: The LLFA, PFRA and FRMP Procedure

Analyses in the NCoC PFRA indicated that the city of Nottingham could be considered as a Flood Risk Area. However, the report also advised that Nottingham would be further considered in the NCC and NCoC Local Flood Risk Management Strategies (LFRMS), and that it was therefore unnecessary for NCC to prepare a FRMP. DCC have also produced a LFRMS, therefore it was also unnecessary for a FRMP. More information on the LFRMSs can be found in Section 2.6.

The Flood Risk Regulations are crucial for LLFAs when considering all stages of Flood Risk as shown in Figure 2-1.

2.2 Flood and Water Management Act (2010)

The Flood and Water Management Act 2010 (FWMA)[8], enacted by Government in response to The Pitt Review[9], designated NCC, NCoC and DCC as LLFAs. As LLFAs, NCC, NCoC and DCC have responsibilities to lead and co-ordinate local flood risk management for Nottingham City, Nottinghamshire County and Derbyshire County, respectively. Local flood risk is defined as the risk of flooding from surface water runoff, groundwater and small ditches and watercourses not designated as Main Rivers (collectively known as Ordinary Watercourses).

The FWMA formalises the flood risk management roles and responsibilities for other organisations including the Environment Agency, water companies and highways authorities. The responsibility to lead and co-ordinate the management of tidal and (Main River) fluvial flood risk remains that of the Environment Agency.

The FWMA initially gave LLFAs the role of Sustainable Drainage Systems (SuDS) Approval Body (SAB) where the LLFA was responsible for adopting and maintaining SuDS. However, as detailed below, the use of SuDS in new development is now enforced by LPAs through the planning system, and not through the

[8] HMSO (2010) The Flood and Water Management Act 2010 http://www.legislation.gov.uk/ukpga/2010/29/contents
[9] Cabinet Office (2008) Sir Michael Pitt Report 'Learning lessons learned from the 2007 floods'. Available at: http://www.environment-agency.gov.uk/research/library/publications/33889.aspx

LLFA SABs. However, LLFAs continual to play a pivotal role in the statutory consultee process in the planning phase of developments.

2.3 National Strategy for Flood and Coastal Erosion Risk Management (2011)

In accordance with the FWMA, the Environment Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England[10]. This Strategy provides a framework for the work of all flood and coastal erosion risk management authorities.

The National FCERM Strategy sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. It sets the context and informs the production of LFRMS by LLFAs, which in turn provide the framework to deliver local improvements needed to help communities manage local flood risk.

2.4 National Planning Policy Framework (2012)

The National Planning Policy Framework (NPPF)[11] was published in March 2012 together with accompanying Technical Guidance. The NPPF revoked most of the previous Planning Policy Statements (PPS) and Planning Policy Guidance, including PPS25: Development and Flood Risk Practice Guide[12].

The overall approach to flood risk is broadly summarised in NPPF Paragraph 103:

"When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- **Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location, and**
- **Development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems."**

The NPPF requires LPAs to undertake SFRAs and to use their findings, and those of other studies, to inform strategic land use planning.

2.5 National Planning Practice Guidance (2014)

The Technical Guidance accompanying NPPF was since replaced by a series of Planning Practice Documents referred to as the Planning Practice Guidance (PPG)[13] on 6th March 2014. The PPG: Flood Risk and Coastal Change document[14] outlines how LPAs should use a SFRA to:

- **Assess the flood risk to an area from all sources, both in the present day, and in the future. The impacts of climate change should be considered when assessing future flood risk;**
- **Determine the variations in risk from all sources of flooding across their areas, and also the risks to and from surrounding areas in the same flood catchment;**

[10] Defra, Environment Agency (2011) National Flood and Coastal Erosion Risk Management Strategy for England. Available at: https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england
[11] Department for Communities and Local Government (DCLG) (March 2012) National Planning Policy Framework. Available at: https://www.gov.uk/guidance/national-planning-policy-framework
[12] DCLG (2009) Planning Policy Statement 25: Development and Flood Risk Practice Guide
[13] DCLG (March 2014) Planning Practice Guidance. Available at: https://www.gov.uk/government/collections/planning-practice-guidance
[14] DCLG (March 2014) Planning Practice Guidance: Flood Risk and Coastal Change. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change#Strategic-Flood-Risk-Assessment-section

- **Inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies, including policies for flood risk management to ensure that flood risk is not increased;**
- **Apply the Sequential Test and, where necessary, the Exception Test when determining land use allocations;**
- **Identify the requirements for FRAs in particular locations, including those at risk from sources other than river and sea flooding;**
- **Determine the acceptability of flood risk in relation to emergency planning capability; and,**
- **Consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water.**

The previous SFRA documents include a brief description of flood risk from other sources throughout the Greater Nottingham area (Section 7 River Leen and Day Brook SFRA; Section 6 GNSFRA). The Addendum GIS Package provides a more detailed analysis by presenting updated GIS layers for multiple sources of flood risk (Section 4). The data provided in the accompanying GIS package will, when interpreted, assist in the decision making process by local planners.

2.5.1 Applying the Sequential Test in the Preparation of a Local Plan

The NPPF and PPG: Flood Risk and Coastal Change are applicable to all stages of the planning process, from development of a Local Plan through to compilation of a site-specific FRA. In preparation of this SFRA Addendum document, AECOM have been updated with the Local Plan progress for each of the GNSFRA Partnership LPAs:

- **Aligned Core Strategies have been adopted for Broxtowe Borough, Erewash Borough, Gedling Borough, Nottingham City and Rushcliffe Borough which form Part 1 of their Local Plans. With the exception of Erewash Borough these Councils are now preparing Part 2 Local Plans.**
- **NCC is at an advanced stage of Local Plan preparation and are shortly due to publish their revised version of their Local Plan Part 2. Local Plan preparation has been based on current flood risk information with the agreement of the Environment Agency, though SFRA Addendum mapping will assist in future Core Strategy review and Development Management decisions;**
- **Gedling Borough Council (GBC) has submitted the Local Plan Part 2 to the Secretary of State;**
- **Broxtowe Borough Council (BBC) is intending to publish its Local Plan Part 2 for consultation in early 2017. Whilst most allocations are outside of the current published flood zones, the SFRA Addendum information will assist in confirming the Council's approach and Development Management decisions;**
- **Rushcliffe Borough Council (RBC) is intending to publish its 'Preferred Option' in summer 2017, and the SFRA Addendum information will assist in site assessment, allocation and Development Management decision; and,**
- **Erewash Borough Council (EBC) does not intend to prepare a site allocations document at this stage but the SFRA Addendum mapping will inform the approach to any future Core Strategy and Development Management decisions.**

Despite the differing timescales for individual Local Plan reviews, the Sequential Test is designed to be applied as part of a systematic process (Figure 2-2).

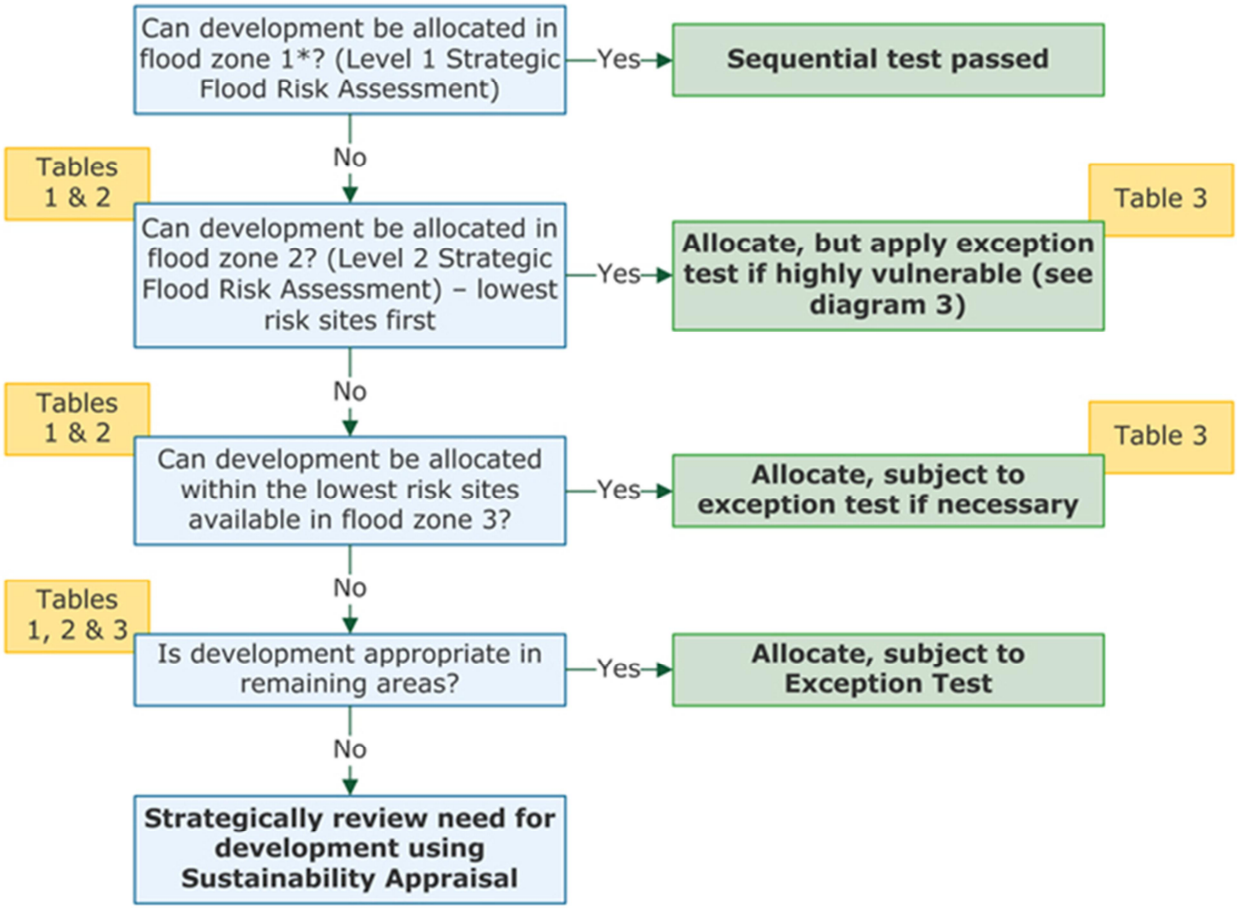


Figure 2-2. Applying the Sequential Test in Preparation of Local Plans (Diagram 2 from PPG para 020)15

The tables which Figure 2-2 refers to can be found in Appendix A. Additionally, these can be found in the PPG: Flood Risk and Coastal Change at: http://www.gov.uk/guidance/flood-risk-and-coastal-change under the subtitle "The sequential, risk-based approach to the location of development" (para 018).

Paragraph 022 of the PPG: Flood Risk and Coastal Change document clearly outlines how LPAs should approach site allocation having followed this process:

> ***"A LPA should demonstrate through evidence that it has considered a range of options in the site allocation process, using the SFRA to apply the Sequential Test and the Exception Test where necessary. This can be undertaken directly or, ideally, as part of the sustainability appraisal. Where other sustainability criteria outweigh flood risk issues, the decision making process should be transparent with reasoned justifications for any decision to allocate land in areas at high flood risk in the sustainability appraisal report. The Sequential Test can also be demonstrated in a free-standing document, or as part of strategic housing land or employment land availability assessments."***

2.5.2 Applying the Exception Test in the Preparation of a Local Plan and Site Specific Applications

Paragraphs 023, 024, 025 and 026 of the PPG: Flood Risk and Coastal Change document outline the requirements of the Exception Test; a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

[15] DCLG (March 2014) Planning Practice Guidance: Flood Risk and Coastal Change, Para 020 Applying the Sequential Test to individual planning applications, Diagram 2. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change

The Exception Test should only be applied as set out in Table 3 (see Appendix A) and following application of the Sequential Test. Figure 2-3 illustrates how the Exception Test should be applied in the preparation of Local Plans and may require details provided in a Level 2 SFRA and/or site specific FRA.

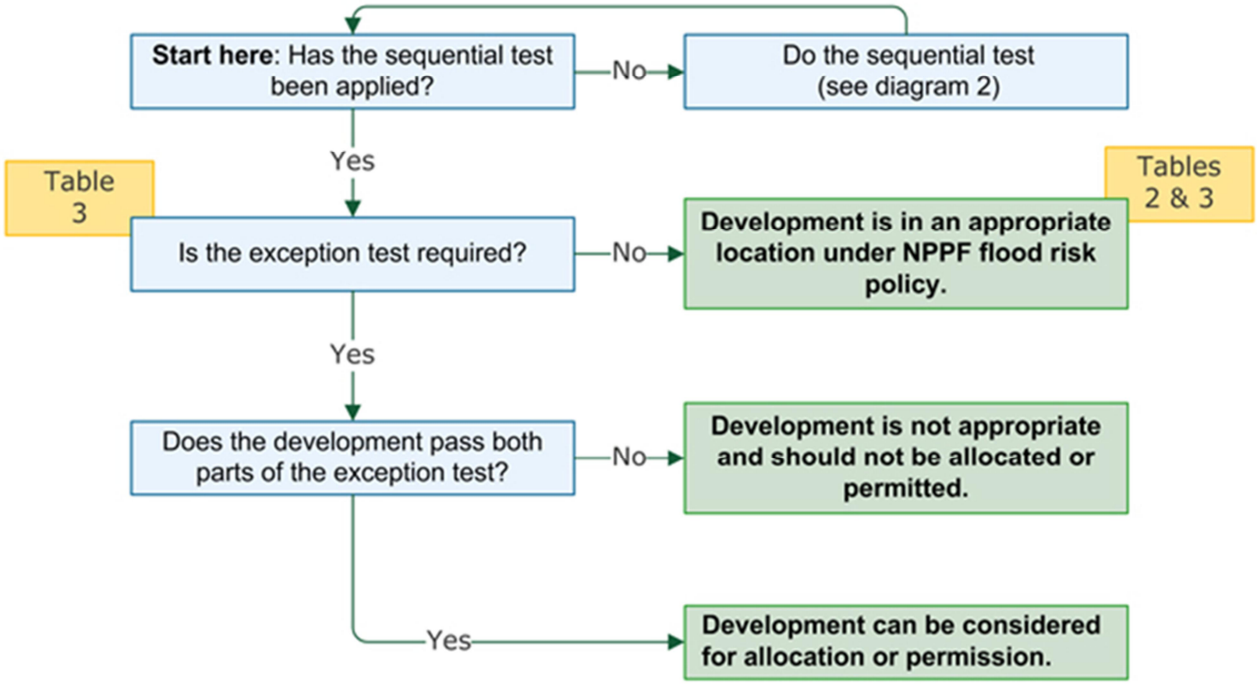


Figure 2-3. Applying the Sequential Test in Preparation of Local Plans (Diagram 3 from PPG para 020)16

Further guidance on SFRAs and application of the Sequential and Exception Tests is available through the referenced Gov.uk webpages.

2.6 National SuDS Standards (2015)

A set of National Non-Statutory Technical Standards (NS) were published by Defra in March 2015[17] setting the requirements for the design, construction, maintenance and operation of SuDS. The NS are intended to be used alongside the NPPF and PPG.

The NS that are of chief concern in relation to the consideration of flood risk to and from development relating to runoff destinations, peak flow control and volume control are presented in Table 2-1.

[16] DCLG (March 2014) Planning Practice Guidance: Flood Risk and Coastal Change, Para 027 Applying the Exception Test to individual planning applications, Diagram 3. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change

[17] **Department for Environment, Food and Rural Affairs. March 2015. Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems**. Available at https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards

Table 2-1: National SuDS Standards (2015)

Consideration	SuDS NS
Peak Flow Control	NS2 – "For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must not exceed the peak greenfield runoff rate for the same event"
	NS3 – "For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event".
Volume Control	SuDS NS4 – "Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event".
	SuDS NS5 – "Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event".
	NS6 – "Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with SuDS NS4 or SuDS NS5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk".
Flood Risk within the Development	NS7 – "The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event".
	NS8 – "The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development
	NS9 – "The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property"

2.7 Local Flood Risk Management Strategies (2015)

As LLFAs, NCC completed their LFRMS in 2015[18], NCoC completed theirs in 2016[19] and DCC completed theirs in 2015[20]. These documents provide an overview and assessment of local flood risk throughout the Greater Nottingham study area.

The documents set out 'Local Flood Hotspot Areas' that have been identified by comparing historic flood records and predicted flood outlines for fluvial and surface water sources; these, along with Surface Water Management Plans (SWMPs), should be reviewed during the production of site-specific Flood Risk Assessments (FRAs). Collectively, FCERM can aid local planners into site allocation details due to the nature of collating various data sets into a single document.

[18] Nottingham City Council (http://www.nottinghamcity.gov.uk/environmental-health-and-safer-housing/safer-housing/lead-local-flood-authority/

[19] Nottinghamshire County Council (September 2016) Nottinghamshire Local Flood Risk Management Strategy 2016-2021. Available at:http://www.nottinghamshire.gov.uk/planning-and-environment/flooding/the-councils-role

[20] Derbyshire County Council (December 2014/July 2015) Derbyshire's Local Flood Risk Management Strategy Part 1 and Part 2. Available at: https://www.derbyshire.gov.uk/council/have_your_say/consultation_search/Consultation_search_index/flood_risk_management_strategy.asp

2.8 Amendments to policy on Sustainable Drainage Systems (2015)

Rather than implementing Schedule 3 of the FWMA to establish SuDS Approval Bodies (SABs) outside the existing planning system, planning policy has been amended so that LPAs can give increased weight to the provision and maintenance of SuDS during the determination of planning applications for major development[21].

From 6 April 2015 LPAs are expected to ensure that local planning policies and decisions on planning applications include SuDS for the management of run-off, unless demonstrated to be inappropriate. LPAs within Nottinghamshire should consult NCoC, as LLFA, on the management of surface water for major development (excluding NCC and DCC who acts as their own LLFA). As a statutory consultee, NCoC will be under a duty to respond to the LPA and report on their performance on providing a substantive response within deadlines set out in legislation.

LPAs will be required to:

- **Satisfy themselves that the proposed minimum standards of operation are appropriate, and;**
- **Ensure, through the use of planning conditions or planning obligations, that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.**

LPAs are also advised to consult as appropriate:

- **The relevant sewerage undertaker where a connection with or into a public sewer is proposed;**
- **The Environment Agency, if the drainage system directly or indirectly involves the discharge of water into a Main River;**
- **The relevant highway authority for an affected road;**
- **The Canal and Rivers Trust (CRT), if the drainage system may directly or indirectly involve the discharge of water into or under a waterway managed by them; and,**
- **An Internal Drainage Board, if the drainage system may directly or indirectly involve the discharge of water into an Ordinary Watercourse (within the meaning of section 72 of the Land Drainage Act 1991) within the board's district.**

The decision on whether SuDS would be inappropriate in relation to a particular development proposal is a matter of judgement for the LPA. In making this judgement the LPA should seek advice from the relevant flood risk management bodies, principally the LLFA.

2.9 Amendments to Climate Change Guidance (2016)

The Environment Agency published updated climate change allowances[22] in February 2016 to support NPPF, which supersede all previous allowances written in NPPF or PPG: Flood Risk & Coastal Change and are predictions of anticipated change for:

- **Peak river flow by River Basin District;**
- **Peak rainfall intensity;**
- **Sea level rise; and,**
- **Offshore wind speed and extreme wave height.**

Specifically, this is supportive in terms of local planning when considering looking forward to future impacts from climate change on site specific allocations.

[21] DCLG (March 2015) Further changes to statutory consultee arrangements for the planning application process: Government response to consultation. Para 21, Pg 4. Available at: https://www.gov.uk/government/consultations/planning-application-process-statutory-consultee-arrangements

[22] Environment Agency (February 2016) Flood risk assessments: climate change allowances. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

2.9.1 Fluvial Climate Change Allowances

The referenced webpage[22] provides clear advice for all parties involved in the planning process, by outlining how and when allowances should be applied for FRAs and SFRAs. For proposed developments in areas of fluvial flood risk, the flood risk vulnerability classification, flood zone and lifetime of development are of particular importance to determine the correct climate change allowance (Table 2-2:).

Table 2-2: Assigning Appropriate Climate Change Allowance Categories (Fluvial)

	Water Compatible	Less Vulnerable	More Vulnerable	Highly Vulnerable	Essential Infrastructure
Flood Zone 2	NA	CA	Assess CA & HCA	Assess HCA & UEA	Assess HCA & UEA
Flood Zone 3a	CA	Assess CA & HCA	Assess HCA & UEA	X	UEA
Flood Zone 3b	CA	X	X	X	UEA

NA = No Allowance; CA = Central Allowance; HCA = Higher Central Allowance; UEA = Upper End Allowance; X = Development not permitted

Source: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Having determined a suitable allowance category, the Greater Nottingham SFRA Partnership can then confirm the corresponding percentages that should be assessed, as listed under the Humber River Basin District sub-heading (Table 2-3).

Table 2-3: Assigning Appropriate Climate Change Percentages (Fluvial)

Humber River Basin District	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End Allowance	20%	30%	50%
Higher Central Allowance	15%	20%	30%
Central Allowance	10%	15%	20%

Source: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

2.9.2 Pluvial Climate Change Allowances

For the anticipated changes in rainfall intensity, FRAs and SFRAs should assess both the central and upper end allowances to understand the range of impact and make suitable decisions to mitigate against pluvial flooding (Table 2-4).

Table 2-4: Assigning Appropriate Climate Change Percentages (Pluvial)

Applies across all England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End Allowance	10%	20%	40%
Central Allowance	5%	10%	20%

Source: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

When assessing a range of allowances for peak river flow or rainfall intensity, the following must be considered:

- **Likely depth, speed and extent of flooding for each of the assessed climate change allowances;**
- **Vulnerability of the proposed development types or land use allocations to flooding;**
- **'Built in' resilience measures used, for example, raised floor levels; and,**
- **Capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.**

2.10 Additional Guidance on Sustainable Drainage Systems and Natural Flood Management

The design of new development and redevelopment should avoid increasing flood risk and, where possible, reduce the risk of flooding to and from a site. Sustainable Drainage Systems (SuDS) and Natural Flood Management (NFM) provide a more sustainable approach to managing flood risk compared to hard engineered flood defences which have been the standard solution for a long time. These measures are discussed below in Sections 2.10.1 and 2.10.2.

2.10.1 Sustainable Drainage Systems

SuDS techniques aim to manage the quantity and quality of surface water runoff in both rural and urban areas of catchments, while providing additional benefits to amenity and biodiversity. There are many different SuDS techniques which can be incorporated into a development and each has its own specific advantages, for example surface water management at a site may need to prioritise water quality over water quantity. Table 2-5 summarises some of the main SuDS techniques and their potential to manage water quantity, quality, amenity and biodiversity.

Table 2-5: Summary of SuDS Techniques

SuDS Technique	Water Quantity Reduction Potential	Water Quality Treatment Potential	Amenity Potential	Biodiversity Potential
Subsurface Storage	High	Low	Low	Low
Pond/Wetlands	Medium	High	High	High
Infiltration Trench/Basins	High	High	High	Medium
Filter Strips	Low	High	Medium	Low
Swales	High	Medium	High	Medium
Rills	Low	Medium	High	Medium
Green Roofs	Low	Varies	High	High
Rainwater Harvesting	Medium	Low	Low	Low
Pervious Pavements	Medium	High	Medium	Low
Rain Gardens	Medium	Medium	High	High

In assessing which SuDS techniques may be appropriate on a specific site, there are many things to consider:

- **Current/proposed land use – residential, commercial, open space etc.**
- **Greenfield/brownfield**
- **Soil permeability**
- **Water table depth and vulnerability**
- **Site slope and topography**
- **Available space**
- **Existing utilities and services**

Example of SuDS in Nottingham

In May 2013, a series of rain gardens were constructed along Ribblesdale Road in Nottingham. The rain gardens are used to attenuate surface water runoff from the surrounding area flowing into Day Brook. The project was collaboration between the Environment Agency, NCC, Groundwork Greater Nottingham and Severn Trent Water.

Figure 2-4: Day Brook Rain Garden

Additional information relating to SuDS design and implementation can be found in the CIRIA C753 SuDS Manual (2015) which provides a detailed overview of many different SuDS techniques and guidance on how to implement them. In March 2015, Defra issued non-statutory technical standards for the design, operation and maintenance of SuDS to be used in conjunction with NPPF and PPG.

2.10.2 Natural Flood Management

Natural Flood Management (NFM) is defined as the alteration, restoration or use of landscape features as a means of reducing flood risk amongst other benefits including improvements to ecology, water quality and carbon sequestration.

NFM strategies vary depending on the location and distribution within a catchment, however the aim remains the same; to reduce the downstream maximum water level of a flood (the flood peak) or to delay the arrival of the flood peak, in order to increase the time available to prepare for a flood. Additionally, NFM should promote the avoidance of flood peaks from multiple sources coinciding at any one given time. The Parliamentary Office of Science and Technology[23] reviewed the underlying mechanisms of an effective NFM strategy, which can include a combination of the following:

- **Storing water by using, and maintaining the capacity of, ponds, ditches, embanked reservoirs, channels or land;**
- **Increasing soil infiltration, potentially reducing surface runoff, although this can be offset by greater subsurface flows. Free-draining soil will make saturation less likely, and evaporation from soil can also make space for water;**
- **Slowing water by increasing resistance to its flow, for example, by planting floodplain or riverside woods; and**
- **Reducing water flow connectivity by interrupting surface flows of water, for example, by water storage or planting buffer strips of grass or trees.**

[23] The Parliamentary Office of Science and Technology (2011) Natural Flood Management. Available at: www.parliament.uk/briefing-papers/POST-PN-396.pdf

3. Flood Risk Information Updates

This section should be read in conjunction with Volume 1, Chapter 3 of the GNSFRA, 2010.

3.1 Fluvial Hydraulic Model Updates

A number of hydraulic (flood) models along designated Main Rivers within the Greater Nottingham area have been updated since publication of the GNSFRA (2010). In order to provide a concise and detailed record of these updates, all significant watercourses mentioned within the sister SFRA documents have been compiled into one table below (Table 3-1). This outlines the watercourse names, location relative to the GNSFRA Partnership LPA administrative boundary within which they lie (see Figure 1-1), historic model availability and whether any updated modelling has been conducted since 2010.

Table 3-1: Hydraulic Model Availability

Watercourse Name	Relevant GNSFRA Boroughs	Previous Modelling (pre-2010 GNSFRA)	Updated Modelling (post-2010 GNSFRA)	Notes
Adbolton Brook Gamston Brook Polser Brook Grantham Canal	Rushcliffe	-	-	Not explicitly modelled. Included as potential flood flow routes in River Trent GNSFRA 2010 modelling.
Beauvale Brook	Broxtowe	-	-	Hydraulic Investigation Report 2003 (Haswell). Not explicitly modelled
Boundary Brook	Broxtowe	2003 – Hydraulic Investigation & Options Report, Haswell.	2013	Included in River Erewash SFRM2 model (Hyder). An updated model is being prepared as part of an Initial Assessment.
Crock Dumble	Gedling	-	2014	Nottingham Tributaries SFRM2 (JBA)
Dover Beck	Gedling	-	2014	Nottingham Tributaries SFRM2 (JBA)
Fairham Brook	Nottingham City; Rushcliffe	2008 – Flood Risk Management Study.	-	Environment Agency
Golden Brook	Erewash	-	2013	Included in River Erewash model SFRM2 (Hyder).
Greythorne Dyke	Rushcliffe	2008	-	Capita Symonds
Harrington Drain	Erewash	-	2013	Included in River Erewash SFRM2 model (Hyder).
Lambley Dumble	Gedling	-	-	Not explicitly modelled
Nut Brook	Erewash	-	2013	Included in River Erewash SFRM2 model (Hyder).
Ock Brook	Erewash	-	2014	Undertaken as part of the Derby City Tributaries SFRM2 (JBA).
Ouse Dyke	Gedling	2008	-	Was modelled as part of the GNSFRA 2010 study but the outputs are not used due to model issues.
Nethergate Brook	Nottingham City	2008 – Flood Risk Management Study	-	Environment Agency
River Derwent	Erewash	2010	2011	Lower Derwent 2011 model is the most up to date for this area An updated model is being prepared as part of the 'Our City Our River' scheme.

Table 3-1: Hydraulic Model Availability

Watercourse Name	Relevant GNSFRA Boroughs	Previous Modelling (pre-2010 GNSFRA)	Updated Modelling (post-2010 GNSFRA)	Notes
River Erewash	Broxtowe; Erewash	-	2013	SFRM2 (Hyder)
River Leen Day Brook	Gedling; Nottingham City	2008	2017	Environment Agency
River Trent	Broxtowe; Erewash; Gedling; Nottingham City; Rushcliffe	2010 – Environment Agency.	2016	Greater Nottingham River Trent Climate Change and Breach Scenarios, Environment Agency
Tinkers Leen Robins Wood Dyke	Nottingham City	-	-	Not explicitly modelled.
Tottle Brook	Nottingham City	-	-	Not explicitly modelled.

Source: Correspondence with Environment Agency DNL Officer (Communications from 16/01/2017 and 23/05/2017)

The results of all updated models (post-2010 GNSFRA) have been collated from the Environment Agency and are provided as part of the Greater Nottingham SFRA Addendum GIS Package (see Section 4).

3.1.1 Actual Risk

An actual risk of fluvial flooding is posed along undefended watercourses where the hydraulic capacity of the watercourse, drainage network or groundwater aquifer is exceeded. The modelled undefended outlines illustrate the actual risks where no defences are present. The defended outlines illustrate the actual flood risks where formalised defences are present and are represented in the hydraulic models.

3.1.2 Residual Risk

Behind raised defences, land and properties are considered to be at a residual risk of fluvial flooding when the magnitude of a flood event exceeds the design Standard of Protection (SoP) of the defence (i.e. the defences will be overtopped). A residual risk may also be posed where, for example, the capacity of a designated flood storage area is exceeded, or where the capacity of a pump draining a pumped catchment is exceeded.

Residual risks will also be posed if:

- **raised defences were to exhibit breach failure;**
- **a sluice gate control into/out from a flood storage area fails to open/shut respectively; or**
- **if a pumping station fails.**

The likelihood of this depends on the condition of the defences. The Environment Agency is responsible for managing and maintaining flood defence assets along designated Main Rivers. The LLFA is responsible for any such assets along Ordinary Watercourses.

The difference between the defended and the undefended outlines during a 1% AEP (1 in 100 year) event are identified in the 'Areas Benefitting from Defences' GIS layer (see Section 4.1.2).

The Environment Agency can be contacted for more details from the modelling reports on which defences they include in.

3.2 Historical Flood Data Updates

The GNSFRA Partnership LPAs were contacted as part of the SFRA Addendum consultation exercise, to determine any updates to historical flood records within the Greater Nottingham area since publication of the sister SFRA documents. All supplied data has been tabulated within the SFRA Addendum GIS Package and where possible, mapped.

3.3 Upgrades to Flood Risk Management Infrastructure

This section highlights the changes 'on the ground' (e.g. new flood risk management infrastructure) and in data availability since the previous SFRAs. Updates to flood risk infrastructure can impact the flood risk in certain areas by reducing the extent of flooding. Likewise, data updates in the form of hydraulic modelling studies can result in changes to the flood risk of an area as the flood risk is understood in more detail.

3.3.1 Nottingham Trent Left Bank Flood Alleviation Scheme

Nottingham has a long history of flooding, from anecdotal evidence, dating as far back as 1683. Following the flood event from 2000, the Environment Agency worked with partner organisations to study the flood risk over the entire length of the River Trent and its main tributaries. The Nottingham Left Bank Flood Alleviation Scheme (FAS) was subsequently developed by the Environment Agency[24].

The Nottingham Trent Left Bank FAS was designed to reduce the risk of flooding to 16,000 homes and businesses along a 27km stretch of the River Trent. The scheme, which was completed and fully operational in 2012 at a cost of £45 million, raised existing flood defences from Sawley to Colwick in order to provide a minimum 1 in 100 year Standard of Protection (SoP) along the left bank of the River Trent. The works were divided into six key stages (Figure 3-1). Detailed information pertaining to the works at each stage can be found on the Gov.uk website[25].

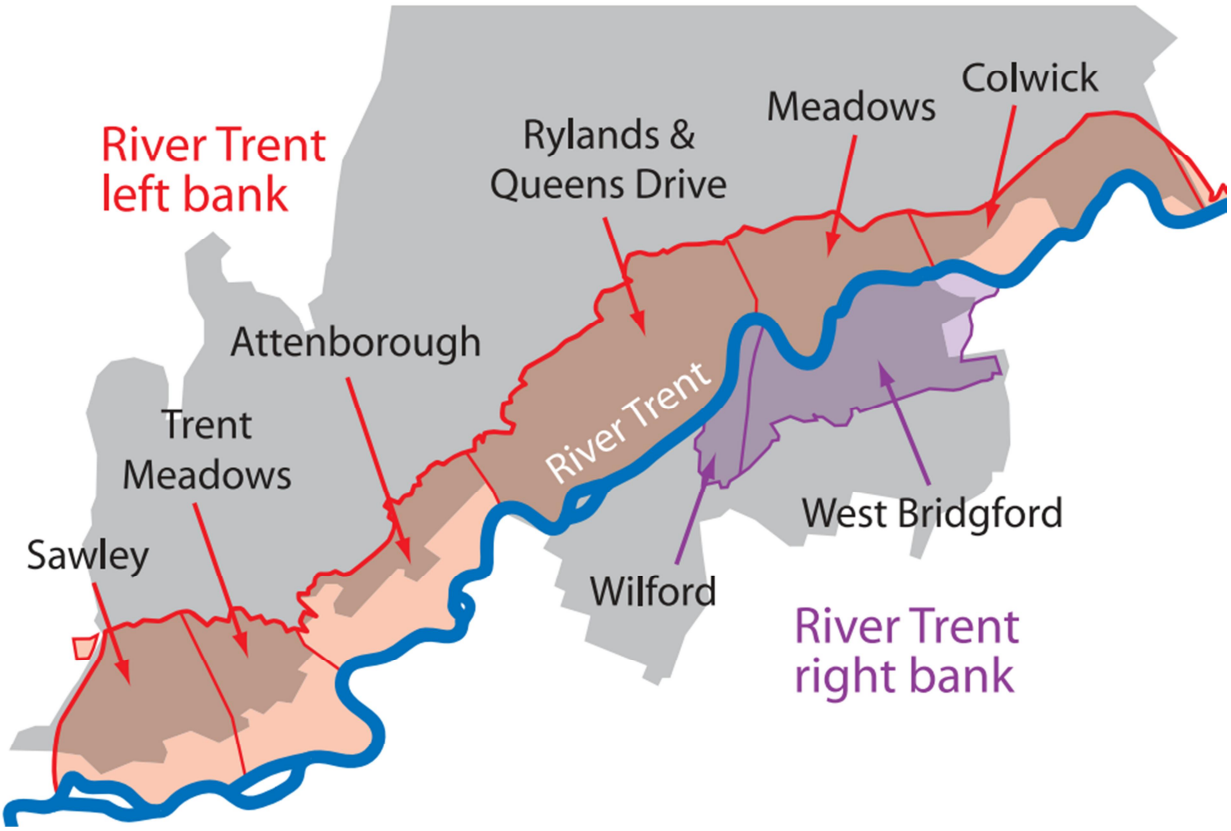


Figure 3-1: Nottingham Trent Left Bank FAS (Environment Agency, 2005[26])

Works to the defences on the Wilford and West Bridgford flood cells were completed as part of the West Bridgford Flood Alleviation Scheme in 2008, as detailed in The GNSFRA (2010).

[24].East Midlands Council (February 2015) The Changing Nature of Flooding in the East Midlands. Available at: http://www.emcouncils.gov.uk/write/Item_9(a)_-_Changing_Nature_of_Flooding_FOR_WEB.v4.pdf
[25] Environment Agency (January 2014) Nottingham Left Bank Flood Risk Management Scheme. Available at:: https://www.gov.uk/government/publications/nottingham-left-bank-flood-risk-management-scheme
[26] Environment Agency (November 2005) Nottingham Trent left bank Flood Alleviation Scheme – An Outline. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291530/gemi1105bqun-e-e.pdf

3.4 GIS Dataset Updates and Data.Gov.uk

During 2015, a number of Environment Agency datasets were published online as part of an Open Government Licence (OGL) initiative; it is now possible to view, review the availability, download and interrogate various GIS data free-of-charge from https://data.gov.uk, including LiDAR and Flood Zone outlines. Other new flood risk management GIS datasets have been created since publication of the sister SFRA documents; the most relevant of which are detailed below.

3.4.1 Hydrometric Monitoring Points

Created in 2012, this dataset shows the (approximate) location of all current sites used for hydrometric monitoring, including groundwater, rivers, lakes, estuaries and rainfall.

3.4.2 OS Open Rivers

Published in 2015, this dataset is a two-dimensional topologically connected link and node watercourse network of Great Britain. The geometry of the links approximates the central alignment of the watercourse. Attribution indicates the flow direction and name of the watercourse.

3.4.3 Reservoir Flood Map

Initially published in 2009 and superseded in 2010, this dataset provides an indication of the areas that could be affected by reservoir flooding in the event of breach or dam failure. Together with local knowledge, these maps can be used to prioritise areas for evacuation/early warning and to help reservoir owners produce on-site plans and Local Resilience Forums (LRFs) to produce off-site plans.

3.4.4 Spatial Flood Defences (including standardised attributes)

This particular dataset was originally created in 2015 by the Environment Agency and is updated on a quarterly basis, this dataset shows flood defences (those owned and maintained by the Environment Agency) protecting against river flooding with a 1% AEP (1 in 100) chance of occurring each year, together with some, but not all, defences which protect against smaller flooding probabilities. The dataset contains linear features that act to prevent flood water from flowing inland; typically these can be man-made embankments and walls but also naturally occurring processes such as shingle ridges and dunes.

This data is continually updated by the Environment Agency Asset Performance team so it could quickly become out of date if it is not maintained regularly by the Local Authority. It could also be misleading where there is high ground rather than an actual raised defence if it is not easy to differentiate between the two. The Environment Agency has therefore recommended that they be contacted directly for information on defences in areas of interest so that they can then provide the most up to date information to review against potential development sites.

3.4.5 Updated Flood Map for Surface Water (uFMfSW)

Created in 2013 and also known as the Risk of Flooding from Surface Water (RoFfSW), this dataset shows the extent of flooding from surface water that could result from three different design rainfall events:

- **High Probability - 3.3% AEP (1 in 30 chance of flooding in any one year);**
- **Medium Probability - 1% AEP (1 in 100 chance of flooding in any one year); and**
- **Low Probability - 0.1% AEP (1 in 1,000 chance of flooding in any one year).**

The uFMfSW modelling methodology represents a significant improvement on previous generation mapping (namely the FMfSW (2011) and the Areas Susceptible to Surface Water Flooding (AStSWF) (2008), for example:

- **Increased model resolution to a 2 m grid providing a more detailed representation of ground levels;**
- **Representation of varying infiltration rates taking into account the land use and soil type;**
- **Representation of buildings and flow routes along roads, and manual editing of the model terrain to include structural floodplain features such as subways, flyovers, embankments etc.;**
- **Use of 3 storm scenarios;**
- **Incorporation of appropriate local mapping, knowledge and flood incident records; and**
- **Local validation by LLFAs where flood records were available.**

However, it should be noted that this national mapping has the following limitations:

- **Use of a single rainfall event, and a single drainage rate for all urban areas;**
- **It does not show the susceptibility of individual properties to surface water flooding (varying thresholds);**
- **The mapping has significant limitations for use in flat catchments;**
- **No explicit modelling of the interaction between the surface water network, the sewer systems, large subsurface drainage elements and watercourses (such as flood relief culverts and flood storage and it does not include representation of canals);**
- **In a number of areas, modelling has not been validated due to a lack of surface water flood records; and**
- **As with all models, the uFMfSW is affected by a lack of, or inaccuracies in available data.**

It should be noted that this dataset is not suitable for identifying whether an individual property will flood. Equally, these GIS layers are not appropriate to act as the sole evidence for any specific planning/regulatory decision or assessment of risk in relation to flooding without further supporting studies or evidence.

3.5 Proposed Capital Works (FCERM Programmes)

The Environment Agency has produced a FCERM (Section 2.3) Programmes of Work document (last updated in August 2015), in consultation with Regional Flood & Coastal Committees (RFCCs), which lists all projects planned between April 2015 and March 2021 to reduce the risks of flooding or coastal erosion throughout England. Projects relevant to the Greater Nottingham area are shown in Table 3-2.

Table 3-2: Greater Nottingham FCERM Programmes of Works

Project Name	Risk Management Authority	Estimated Earliest Construction Start
Boundary Brook/Stapleford Pumping Station	Environment Agency	2018-2021
Breaston Flood Alleviation Scheme (Derbyshire)	Environment Agency	Beyond 2021
Broxtowe Park Brook: Capital Maintenance and Flood Risk Management	Nottingham City Council	Beyond 2021
Dam Brook Flood Alleviation Scheme, Breadsall, Derbyshire	Derbyshire County Council	2017
Daron Gardens/Edern Gardens, Top Valley Surface Water Management Scheme	Nottingham City Council	2017
Day Brook Flood Alleviation Scheme, Old Basford, Nottingham	Environment Agency	2018-2021
Greythorne Dyke Pumping Station Refurbishment	Environment Agency	2016-2018
Mapperley Park Surface Water Management Scheme	Nottingham City Council	2018-2021
Nottingham City Council Individual Property Protection Programme	Nottingham City Council	2016
Nottingham Derby Metro Blue Green Infrastructure Project	Nottingham City Council	2018
Ock Brook Flood Alleviation Study, Ockbrook, Derbsyhire	Derbyshire County Council	2017
Our City Our River' Derby Flood Risk Management Scheme	Derby City Council	2017
River Leen Bobbers Mill Flood Alleviation	Nottingham City Council	Beyond 2021
River Leen, Queens Medical Centre Embankment	Environment Agency	2016-2018
Titchfield Park Brook Surface Water Scheme, Hucknall, Nottinghamshire	Nottinghamshire County Council	2017
Tottle Brook Flood Alleviation Scheme, Nottingham	Nottingham City Council	Beyond 2021
Woolsington Close, Strelley Surface Water Management Scheme	Nottingham City Council	2015

Source: https://www.gov.uk/government/publications/programme-of-flood-and-coastal-erosion-risk-management-schemes

Construction Programme: Projects already completed or in construction; fully funded projects scheduled to start construction in the coming financial year; and projects scheduled to start construction in the coming financial year, subject to securing other funding contributions.

Development Programme: Projects in development with full funding packages agreed, expected to start construction in future years, subject to approval of a full business case; and projects in development, expected to start construction in future years, subject to approval of a full business case and securing other funding contributions.

Pipeline Programme: Project proposals that are likely to qualify for some government funding before 2021 and have been given an indicative allocation (but have not yet identified sufficient contributions and/or do not have a sufficiently well-developed business case to enter the Development Programme).

For those programmed FCERM projects that have not yet secured full funding contributions, the opportunity for partnership working with developers could facilitate future development in these areas.

4. SFRA Addendum GIS Package

4.1 Information contained within the GIS Package

No new paper / PDF maps have been produced as part of this SFRA Addendum. Instead, as noted above, a GIS Package was provided containing layers that contain flood risk information for the entire study area. This section describes the content and the structure of that GIS package.

4.1.1 Data Log

The data log within the GIS package contains a register of each file in the GIS package, its origin and the folder it is in within the new GIS package. GIS layers have been renamed for ease of use, and the original naming structure can be seen in the data log for each file.

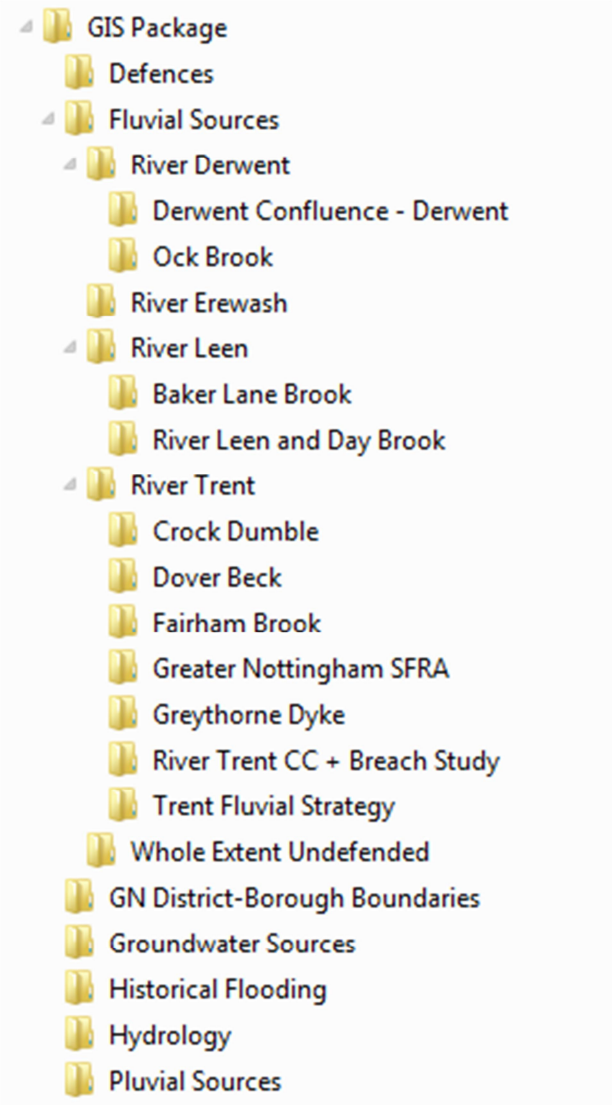


Figure 4-1 – Layout of the GIS Deliverable package, showing the various sources of flooding

4.1.3 Defences

Data contained within the 'Defences' subfolder is as follows:

- **Flood Storage Areas - Areas that act as a balancing reservoir, storage basin or balancing pond. Their purpose is to attenuate an incoming flood peak to a flow that can be accepted by the downstream channel.**
- **Areas Benefiting from Defences - Areas that would benefit from the presence of flood defences in a 1 in 100 (1% AEP) probability fluvial flood event.**
- **Flood Alert Areas - Areas which are issued with flood alerts when flooding is possible.**
- **Flood Warning Areas - Areas which are issued with flood alerts when flooding is expected.**

4.1.4 Fluvial Sources

The 'Fluvial Sources' subfolder contains Flood Zones 2 and 3. These are national scale flood outlines that illustrate the combined risk of fluvial and tidal flooding in an undefended scenario. Flood Zone 3 is the area at risk of flooding during a 1 in 100 year (1% AEP) fluvial flood event or a 1 in 200 year (0.5% AEP) tidal flood event, while Flood Zone 2 is the area at risk during a 1 in 1000 year (0.1% AEP) fluvial flood event. These GIS layers cover the whole extent of the GNSFRA study area and are taken from the countrywide dataset provided by the Environment Agency.

GIS layers illustrating either defended or undefended fluvial flood risks as determined by detailed hydraulic models have been separated into the four Main Rivers (River Trent, River Derwent, River Erewash and River Leen) with sub-folders for their Main River tributaries. Where these layers contain outputs from flood models that included defences, they therefore show smaller extents than the same return period for an undefended runs. These results include the extents of flooding for Flood Zone 3b (1 in 20 year, 5% AEP), Flood Zone 3a (1 in 100 year, 1% AEP), Flood Zone 3 + climate change (1 in 100 year + CC, 1% AEP+CC) and Flood Zone 2 (1 in 1000 year, 0.1% AEP) where available.

4.1.5 Groundwater Sources

The 'Groundwater Sources' subfolder contains the 'Areas Susceptible to Groundwater Flooding' (AStGWF) GIS layer that illustrates the susceptibility of land to groundwater flooding across 1 km grid squares. Each grid square has been attributed a percentage value of the amount of land within the cell which is deemed susceptible to groundwater flooding. This layer was obtained directly from the Environment Agency for the Greater Nottingham study area.

Fluctuations in groundwater levels could be attributed to from a decline in industry and the subsequent ceasing of groundwater extractions.

4.1.6 Historical Flooding

Historical flooding incidents for Nottingham City were provided by NCC, showing the locations and details of individual flooding observations, of which reports are anecdotal. This data has been georeferenced so it can be spatially analysed. The package also includes the Environment Agency's National Historic Flood Map which shows the maximum extent of all individual Recorded Flood Outlines from rivers, the sea and groundwater springs, i.e. showing areas of land that have previously been subject to flooding. Records began in 1946 when predecessor bodies to the Environment Agency started collecting detailed information about flooding incidents.

4.1.8 Hydrology

Data contained within the 'Hydrology' subfolder is as follows:

- **Hydrometric Monitoring Points – Sites used for hydrometric monitoring, (including groundwater, rivers, lakes, estuaries and rainfall)**
- **Canals - centrelines**
- **Main Rivers - centrelines**
- **Watercourses – includes both Main Rivers and additional Ordinary Watercourse centrelines**
- **Reservoirs**
- **Embankments – associated with canals**
- **Source Protection Zones - These zones show the risk of groundwater contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk.**

4.1.9 Pluvial Sources

The Environment Agency's Updated Flood Map for Surface Water (uFMfSW) (2013) illustrates the risk from surface water runoff during high magnitude rainfall events (see Section 3.4.5). These GIS layers cover the whole extent of the GNSFRA study area and are taken from the national dataset provided by the Environment Agency.

4.2 Intended use of the GIS Package

The GIS package (in ESRI shapefile format) is intended to be developed into a GIS platform by the Greater Nottingham LPAs which will host the most up to date flood risk data for the entire study area. This information can then be used to assist in managing flood risk across the area and to provide guidance to the Councils and developers when assessing the suitability of sites for development in areas at risk of flooding.

Colour profiles for the individual layers should follow the guidance provided by the Environment Agency; where available, these guidance documents are provided within the appropriate subfolder of the database).

This data is strategic (i.e. high level) and it is not suitable, in isolation, in assessing flood risk at a site specific level or informing design. A site specific FRA will be required for any site identified as a potential development area, which will assess the specific flood risk from all sources in greater detail. A site specific FRA where necessary may also include new modelling to further inform design.

The data provided is intended for the use of NCC, BBC, EBC, GBC and RBC. The data downloaded from Gov.uk was provided by the Environment Agency under an 'Open Government Licence for public sector information' agreement. The uFMfSW and AStGWF layers were provided by the Environment Agency to the Councils under a 'Conditional Licence'[27], and the detailed modelling outputs were provided under a 'Standard Notice - Non Commercial' licence between the Councils and the Environment Agency. These must not be provided to third parties.

The data presented is considered the most up to date information at the time of publication (July 2017). However, as a number of the datasets are updated quarterly, it is advised that the Environment Agency be contacted to ensure the latest information is reviewed in relation to emerging potential development sites.

NOTE - The historical flooding spot location information provided by NCC must not be published in a format overlaid on OS maps at scale of greater detail than 1:50,000 to meet data protection obligations.

[27] **Environment Agency (2016). Environment Agency Conditional Licence**. Available at: https://www.gov.uk/government/publications/environment-agency-conditional-licence/environment-agency-conditional-licence

4.3 Guidance to LPAs on use of the GIS Package in assessing Site Allocations and Individual Applications

As part of the Sequential Test it is necessary to understand the risk of flooding at sites under consideration for development. The main criteria influencing site allocation is the location in relation to the National Flood Zones 1 (<0.1% AEP), 2 (>0.1% AEP), 3a (>1% AEP) and 3b (>5% AEP). The aim of the Sequential Test is to steer development towards areas of lowest probability of flooding first, before allocating development within areas of higher flood risk. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding.

The Environment Agency Flood Zones show the risk of flooding without defences in place. It is therefore useful to also consider the risk of flooding with defences in place. The GIS Package contains modelled maximum flood extents for defended scenarios on the River Trent, River Erewash, River Leen and Day Brook, River Derwent Confluence and Greythorne Dyke.[28]

Within the GIS Package there are layers showing all Main River and Ordinary Watercourse across the GNSFRA study area. When assessing site allocations and individual planning applications, there may be areas which are shown to be in Flood Zone 1 (low risk of flooding) yet are within close proximity to a watercourse. This is likely to be the case for non-Main River (i.e. Ordinary Watercourses) which have not been modelled. New modelling may therefore be required as part of a site-specific Level 3 FRA to assess the level of flood risk across the site. Flood modelling may also be used to demonstrate that new development does not increase the risk of flooding to third parties.

[28] **Where there are no modelled flood extents including an allowance for climate change, Flood Zone 2 should be used as a conservative proxy for future flood risk. This is relevant for areas covered by national Flood Zones 2 and 3 but not Flood Zone 3+CC. In these cases, Flood Zone 3+CC is to be assumed equivalent to Flood Zone 2, meaning that in order for the site to be considered for development it must pass proceed with the relevant exception test for Flood Zone 3+CC or detailed modelling can determine the true extent of Flood Zone 3+CC to prove that the site lies in Flood Zone 2.**

5. GIS Analysis and Interpretation

5.1 Broxtowe Borough Council

The major difference in the flood extents since the 2010 Greater Nottingham SFRA has resulted from the completion of the Trent Left Bank Flood Alleviation Scheme in 2012. These defences contribute to significant reductions in residual risk across the Attenborough, Chilwell and Beeston Rylands areas of Broxtowe Borough. The River Trent Climate Change and Breach modelling (2017) however identifies new areas at a residual risk of flooding resulting from the Trent Left Bank Flood Alleviation Scheme.

Along the River Erewash, the most recent modelled results (SFRM2, 2013) show more detailed outlines for Flood Zone 2 and 3 than in the 2010 Greater Nottingham SFRA, although there are no major reaches where any large areas has moved into a higher/lower risk band.

The uFMfSW illustrate the greatest pluvial flooding risk along the lower elevations of the Ordinary Watercourse and Main River valleys. Where obstructions in the floodplain are present (for example road embankments, bridges, canals and railways), where there is a high proportion of impermeable land use and the ground levels flatten out, a greater extent of ponding is exhibited.

The AStGWF map illustrates areas with the greatest susceptibility to groundwater emergence along the River Trent corridor, followed by areas along the corridor of the River Erewash.

5.2 Erewash Borough Council

The 2012 Trent Left Bank Flood Alleviation Scheme has reduced the area at risk of flooding in Erewash Borough, particularly in Long Eaton within the Sawley and Trent Meadows areas. Along the River Erewash more detailed modelling has refined the Flood Zones since previous SFRAs. These changes are also due to the construction of the 2012 Trent Left Bank Flood Alleviation Scheme. The River Trent Climate Change and Breach modelling (2017) however identifies new and larger areas at a residual risk of flooding resulting from the Trent Left Bank Flood Alleviation Scheme.

Updated modelling along the River Derwent (SFRM2, 2011) shows that some properties in Draycott have moved out of Flood Zone 2. These updates are solely due to updated modelling and not as a result of flood defences. Updated modelling along Ock Brook (SFRM, 2012) shows a reduction in the extent of Flood Zone 3 but a greater Flood Zone 2 extent. These updates are solely due to updated modelling approach and not as a result of any new flood defences.

The uFMfSW illustrate the greatest pluvial flooding risk along the lower elevations of the Ordinary Watercourse and Main River valleys. Where obstructions in the floodplain are present (for example road embankments, bridges, canals and railways), where there is a high proportion of impermeable land use and the ground levels flatten out, a greater extent of ponding is exhibited.

The AStGWF map illustrates areas with the greatest susceptibility to groundwater emergence along the River Derwent and River Trent corridors, followed by areas along the corridor of the River Erewash.

5.3 Gedling Borough Council

The 2012 Trent Left Bank Flood Alleviation Scheme has reduced the area at risk of flooding in Erewash Borough, particularly in the Colwick and Netherfield areas. Detailed modelling as part of the Nottingham Tributaries SFRM2 (2014) study of the Crock Dumble and the Dover Beck has provided more detailed outlines in the Woodborough and Burton Joyce areas. The River Trent Climate Change and Breach modelling (2017) however identifies new areas at a residual risk of flooding resulting from the Trent Left Bank Flood Alleviation Scheme.

The uFMfSW illustrate the greatest pluvial flooding risk along the lower elevations of the Ordinary Watercourse and Main River valleys. Where obstructions in the floodplain are present (for example road

embankments, bridges, canals and railways), where there is a high proportion of impermeable land use and the ground levels flatten out, a greater extent of ponding is exhibited.

The AStGWF map illustrates areas with the greatest susceptibility to groundwater emergence along the River Trent corridor, followed by areas along the corridor of the headwaters of the River Leen and Baker Lane Brook.

5.4 Nottingham City Council

The 2012 Trent Left Bank Flood Alleviation Scheme has reduced the area at risk of flooding in Nottingham City, particularly in the Beeston Rylands, Nottingham University, Lenton, Queens Drive and Meadows areas. The River Trent Climate Change and Breach modelling (2017) however identifies new and larger areas at a residual risk of flooding resulting from the Trent Left Bank Flood Alleviation Scheme.

There have also been updates to the fluvial modelling of the River Leen and Day Brook since publication of the River Leen and Day Brook SFRA (2008) and the Greater Nottingham SFRA in 2010. The extent of the model has increase upstream through Bulwell, and the extent of the functional floodplain (5% AEP, Flood Zone 3b) has increased in the Old Basford area. The Flood Zone 3a (1% AEP, 1 in 100 year) flood extent has increased in the Old Lenton area surrounding the hospital, in playing fields and industrial depots between Orston Drive and Triumph Road and within the marina north of The Mornings road. Flood Zone 2 (0.1 % AEP event) has reduced in the Castle Quay Close area and along Harrimans Lane south of the railway line, but reduced in the area of the University Park Tennis Centre.

The uFMfSW illustrate the greatest pluvial flooding risk along the lower elevations of the Ordinary Watercourse and Main River valleys. Where obstructions in the floodplain are present (for example road embankments, bridges, canals and railways) and the ground levels flatten out, a greater extent of ponding is exhibited. This occurs widely in Nottingham within the predominantly urban floodplains comprising shallower topography and a high proportion of impermeable land use.

The AStGWF map illustrates areas with the greatest susceptibility to groundwater emergence along the River Trent corridor, followed by areas along the corridor of Tottle Brook.

5.5 Rushcliffe Borough Council

The River Trent Climate Change and Breach modelling (2017) identifies marginally larger areas at a residual risk of flooding resulting from the Trent Left Bank Flood Alleviation Scheme.

The uFMfSW illustrate the greatest pluvial flooding risk along the lower elevations of the Ordinary Watercourse and Main River valleys. Where obstructions in the floodplain are present (for example road embankments, bridges, canals and railways) and the ground levels flatten out, a greater extent of ponding is exhibited. This occurs widely in Rushcliffe within the predominantly rural floodplains comprising shallower topography.

The AStGWF map illustrates areas with the greatest susceptibility to groundwater emergence along the River Soar and River Trent corridors, followed by areas along the corridor of the River Smite.

6. Guidance on Flood Risk Management Measures

6.1.1 Sequential Approach within Development Sites

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development and to ensure flood risk is not increased elsewhere. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas e.g. residential developments should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on lower ground with a higher probability of flooding. Whilst traditionally applied to the risk of river flooding, this approach should also be implemented when considering the risk of surface water flooding across a site.

6.2 Site-specific FRA Guidance

6.2.1 Overview

This Greater Nottingham SFRA Addendum provides a high level assessment of the flood risk posed to the Greater Nottingham study area. However, this document has a strategic scope and therefore it is essential that site-specific FRAs are also developed for individual development proposals where required, and that where necessary and appropriate, suitable mitigation measures are incorporated.

A site-specific FRA is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and, where possible, and to ensure that, where necessary, appropriate mitigation measures are included in the development will reduce flood risk overall in accordance with the NPPF and PPG.

6.2.2 When is a Flood Risk Assessment required?

The NPPF states that a site-specific FRA is required in the following circumstances:

- **For proposals of 1 hectare or greater in Flood Zone 1;**
- **All proposals for new development (including minor development[29] and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency); and,**
- **Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.**

The Environment Agency Standing Advice for FRAs[30] in Flood Zone 1 should be consulted for advice on the approach and content of a site-specific FRA.

[29] **According to the PPG (2014), minor development means:**
minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m2.
alterations: development that does not increase the size of buildings e.g. alterations to external appearance.
householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

[30] **Defra/Environment Agency (2017) Flood risk assessment: standing advice. Available at:** https://www.gov.uk/guidance/flood-risk-assessment-standing-advice.

6.2.3 What should a Flood Risk Assessment address?

The NPPF states that site-specific FRAs should always be proportionate to the degree of flood risk and make optimum use of readily available information, for example the mapping presented within this SFRA. FRAs should also be appropriate to the scale, nature and location of the development.

The PPG outlines that the objectives of a site-specific FRA are to establish:

- **whether a proposed development is likely to be affected by current or future flooding from any source;**
- **whether it will increase flood risk elsewhere;**
- **whether the measures proposed to deal with these effects and risks are appropriate;**
- **the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;**
- **whether the development will be safe and pass the Exception Test, if applicable.**

The CIRIA publication C624[31] presents a staged approach to the preparation of site-specific FRAs, and identifies typical sources of information that can be used.

6.2.4 Finished Floor Levels

Where developing in Flood Zones 2 and 3 is unavoidable, the recommended method of mitigating flood risk to people, particularly with 'More Vulnerable' and 'Highly Vulnerable' land uses, is to ensure internal finished floor levels are raised a minimum freeboard level above the modelled 1 in 100 annual probability (1% AEP) flood level including an allowance for climate change flood level. The Environment Agency should be contacted directly to ascertain their requirements for such a freeboard, as these may vary across defended and undefended areas.

In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. In these cases, the Environment Agency and/or the LPA should be approached to discuss options for a reduction in the minimum internal ground floor levels provided flood resistance measures are implemented up to an agreed level. There are also circumstances where flood resilience measures should be considered first. These are described further below. For both Less and More Vulnerable developments where internal access to higher floors is required, the associated plans showing the access routes and floor levels should be included within any site-specific FRA.

Table 6-1 provides an overview of the requirements for finished floor levels for development in Greater Nottingham.

[31] CIRIA, 2004, Development and flood risk – guidance for the construction industry C624.

Table 6-1: Guidance for Finished Floor Levels in Greater Nottingham

Development Type	Flood Zone 3	Flood Zone 2
Minor Development (i.e. non-residential extensions with a floor space <250m^2 and householder developments)	Provide evidence to the LPA that EITHER: Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development has been incorporated where appropriate. Details of flood proofing / resilience and resistance techniques to be included in accordance with 'Improving the flood performance of new buildings' DCLG (2007). OR, Floor levels within the extension will be set 300 mm above the known or modelled 1 in 100 annual probability river flood (1%) in any year including climate change. This flood level is the extent of the Flood Zones. Applicants should provide a plan showing floor levels relative to flood levels. All levels should be stated in relation to Ordnance Datum.	Provide evidence to the LPA that: Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development has been incorporated where appropriate. Details of flood proofing / resilience and resistance techniques to be included in accordance with 'Improving the flood performance of new buildings' DCLG (2007).
New Residential Development (e.g. More Vulnerable)	Where appropriate, subject to there being no other planning constraints (e.g. restrictions on building heights), finished floor levels should be set a minimum of 300 mm above the 1% annual probability flood level (1 in 100 year) including climate change. The design flood level should be derived for the immediate vicinity of the site (i.e. relative to the extent of a site along a watercourse as flood levels are likely to vary with increasing distance downstream) as part of a site-specific FRA. Sleeping accommodation should be restricted to the first floor or above to offer the required 'safe places'. Internal ground floors below this level could however be occupied by Less Vulnerable commercial premises, garages or non-sleeping residential rooms (e.g. kitchen, study, lounge) (i.e. applying a sequential approach within a building).	
New Non-Residential Development (e.g. Less Vulnerable)	Finished floor levels may not need to be raised. For example, Less Vulnerable developments can be designed to be floodable instead of raising floor levels, and this may be beneficial to help minimise the impact of the development on the displacement of floodwater and the risk of flooding to the surrounding area. However, it is strongly recommended that internal access is provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. Such refuges will have to be permanent and accessible to all occupants and users of the site and a Flood Warning and Evacuation Plan should be prepared to document the actions to take in the event of a flood.	

6.2.5 Flood Resilience and Resistance

Water Inclusion Strategy

There is a range of flood resistance and resilience construction techniques that can be implemented in new developments to mitigate potential flood damage. The Department for Communities and Local Government have published a document; 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[32], which aims to provide guidance to developers and designers on how to improve the resistance and resilience of new properties to flooding through the use of suitable materials and construction details.

Water Entry Strategy

For flood depths greater than 0.6m, it is likely that structural damage could occur in traditional masonry construction due to excessive water pressures. In these circumstances, the strategy should be to allow water into the building, but to implement careful design in order to minimise damage and allow rapid re-occupancy. This is referred to as the 'Water Entry Strategy'. These measures are appropriate for uses where temporary disruption is acceptable and suitable flood warning is received.

Materials should be used which allow the passage of water whilst retaining their structural integrity and they should also have good drying and cleaning properties. Alternatively sacrificial materials can be included for internal and external finishes; for example the use of gypsum plasterboard which can be removed and replaced following a flood event. Flood resilient fittings should be used to at least 0.1m

[32] DCLG (2007) Improving the Flood Performance of New Buildings, Flood Resilient Construction

above the design flood level. Resilience measures are either an integral part of the building fabric or are features inside a building that will limit the damage caused by floodwaters.

Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[32].

6.2.6 Safe Access and Egress

Safe access and egress is required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out any necessary duties during periods of flood.

A safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g. within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances. This is of particular importance when contemplating development on sites located on dry islands. Dry islands are small areas within the floodplain where the ground levels are slightly higher and which are therefore less likely to flood than the land around them. These areas can sometimes be identified by looking at the Flood Zone map; for example an area of Flood Zone 1 or 2, surrounded by land designated as Flood Zone 3. When considering the flood risk to these areas, the risk to the surrounding area should be taken into account.

Guidance prepared by the Environment Agency uses a calculation of flood hazard to determine safety in relation to flood risk. Flood hazard is a function of the flood depth and flow velocity at a particular point in the floodplain along with a suitable debris factor to account for the hazard posed by any material entrained by the floodwater[33].

6.2.7 Safe Refuge

In exceptional circumstances, dry access above the 1% AEP (1 in 100 year) event flood level including climate change may not be achievable. In these circumstances the Environment Agency and LPAs should be consulted to ensure that the safety of the site occupants can be satisfactorily managed. This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed egress route. For example, this may entail the designation of a safe place of refuge on an upper floor of a building, from which the occupants can be rescued by emergency services. It should be noted that sole reliance on a safe place of refuge is a last resort, and all other possible means to evacuate the site should be considered first. Provision of a safe place of refuge will not guarantee that an application will be granted.

6.2.8 Compensatory Flood Storage in Defended Areas

Where proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water, and should seek opportunities to provide betterment with respect to floodplain storage. Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced.

All new development within Flood Zone 3+CC must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

A FRA must demonstrate that there is no loss of flood storage capacity and include details of an appropriate maintenance regime to ensure mitigation continues to function for the life of the development.

[33] Defra / Environment Agency (October 2005) 'Framework and Guidance for Assessing and Managing Flood Risk for New Development', Flood Risk Assessment Guidance for New Development. FD2320 R&D Technical Report 2. Defra London. Table 13.1, Pg. 118

Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624[34].

The requirement for no loss of floodplain storage means that it is not possible to modify ground levels on sites which lie completely within the floodplain (when viewed in isolation), as there is no land available for lowering to bring it into the floodplain. It is possible to provide off-site compensation within the local area e.g. on a neighbouring or adjacent site, or indirect compensation, by lowering land already within the floodplain, however, this would be subject to detailed investigations and agreement with the Environment Agency to demonstrate (using an appropriate flood model where necessary) that the proposals would improve and not worsen the existing flooding situation or could be used in combination with other measures to limit the impact on floodplain storage.

The Environment Agency currently reviews applications in defended areas in the Midlands against the following guidance.

Carry Out a Sensitivity Test

In defended areas the need for compensation should be based on the results of a sensitivity test. The test can be assessed in three parts:

- **What increase in flood levels may result from development in the defended area if the defences were breached or overtopped?**
- **What is the effect of this change, how much better or worse will flooding be to properties in particular?**
- **Are the affects acceptable, and in reality, what mitigation measures can the developer implement to offset the impacts?**
- **Compensation will be an appropriate solution if the principle of development in the area is in accordance with the NPPF.**

This evidence will need to be provided by the developer for review.

Identify the Changes

A site specific FRA for development proposals must identify the resulting change. Rather than stating what the impact on flood levels will be, it must also include what the impacts are as a result of the change (i.e. how many more properties will be at risk of flooding). If the increase in flood level means that water exceeds a building threshold, then it is likely the proposals will be unacceptable. If however, the increase in flood level is very small, such that no additional properties will be at risk, then the proposals may be considered acceptable.

In principle, flood risk must be reduced up to the design flood (as defined in PPG: Flood Risk and Coastal Change[10]) including allowances for climate change (Section 2.9) and people must remain 'safe' from flooding during an extreme event.

Extra Risk Assessment

Further assessment may be required as part of a development's site specific FRA. Additional topographical survey may be required to identify the extent of flooding or the numbers of houses at increased risk (e.g. a threshold or floor level survey). The developer would undertake this extra work at their own expense.

[34] CIRIA (January 2004) CIRIA Report 624: Development and Flood Risk - Guidance for the Construction Industry

6.2.10 Flood Routing

In order to demonstrate that 'flood risk is not increased elsewhere', development in the floodplain will need to prove that flood routing is not adversely affected by the development, for example giving rise to backwater affects or diverting floodwaters onto other properties.

Potential overland flow paths should be determined and appropriate solutions proposed to minimise the impact of the development, for example by configuring road and building layouts to preserve existing flow paths and improve flood routing, whilst ensuring that flows are not diverted towards other properties elsewhere.

Careful consideration should be given to the use of fences and landscaping walls so as to prevent causing obstruction to flow routes and increasing the risk of flooding to the site or neighbouring areas.

All new development in Flood Zones 2 and 3 should not adversely affect flood routing and thereby increase flood risk elsewhere. Opportunities should be sought within the site design to make space for water, such as:

- **Removing boundary walls or replacing with other boundary treatments such as hedges, fences (with gaps).**
- **Considering alternatives to solid wooden gates, or ensuring that there is a gap beneath the gates to allow the passage of floodwater.**
- **On uneven or sloping sites, consider lowering ground levels to extend the floodplain without creating ponds. The area of lowered ground must remain connected to the floodplain to allow water to flow back to river when levels recede.**
- **Create under-croft car parks or consider reducing ground floor footprint and creating an open area under the building to allow flood water storage.**
- **Where proposals entail floodable garages or outbuildings, consider designing a proportion of the external walls to be committed to free flow of floodwater.**

6.2.11 Riverside Development Byelaw Zone

Under Section 109 of the Water Resources Act 1991 and/or Environment Agency Byelaws, any works within 8 metres of any statutory Main River (both open channels and culverted sections) requires Environment Agency consent. Whilst Flood Defence Consents are dealt with outside of the planning process, since requirements of the consenting process in relation to flood risk, biodiversity and pollution may result in changes to development proposals or construction methods, the Environment Agency aims to advise on such issues as part of its statutory consultee role in the planning process. Should proposed works not require planning permission the Environment Agency can be consulted regarding permission to do work on or near a river, floor or sea defence by contacting enquiries@environment-agency.gov.uk.

As of 6 April 2012 responsibility for the consenting of works by third parties on Ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) has transferred from the Environment Agency to LLFAs (NCoC and DCC). They are now responsible for the consenting of works to ordinary watercourses and have powers to enforce un-consented and non-compliant works. This includes any works (including temporary) within 8 m that affect flow within the channel (such as in channel structures or diversion of watercourses).

6.2.13 Flood Warning Systems

The Environment Agency provides a free flood warning service for many areas at risk of flooding from rivers and the sea. In some parts of England the Environment Agency may be able to provide warnings when flooding from groundwater is possible. The Environment Agency free flood warning service can provide advance notice of flooding and can provide time to prepare for a potential flood event.

If a flood alert from groundwater is available this does not mean that a particular property is definitely at risk. It is very difficult to predict the exact location of flooding from groundwater as it is often related to local geology. To help people, the Environment Agency provides flood alerts for large areas that could be affected if groundwater levels were high.

Flood Warning and Flood Alert Areas can be viewed on the Environment Agency website[35]. The Environment Agency issue flood warnings to homes and businesses when flooding to properties is expected. Upon receipt of a flood warning, occupants should take immediate action. The Environment Agency also issue flood alerts when flooding to low lying land and roads is expected. Flood alerts cover larger areas than flood warnings and are issued more frequently. Upon receipt of an alert, occupants should be prepared for flooding and to take action. Flood warnings and flood alerts are signed up to separately, however when signing up for flood warnings homes and businesses must agree to receive flood alerts.

6.2.14 Emergency Planning

It is recommended that NCoC and DCC's major incident protocols are reviewed and, if necessary, updated in light of the findings of this SFRA to ensure that it is informed by the most up-to-date flood risk information available.

It is further recommended that the Greater Nottingham Strategic Partnership works with the Environment Agency to promote the awareness of flood risk and encourage communities at risk to sign-up to the Environment Agency Flood Warning Service.

[35] **Environment Agency (2016) Flood Warning and Alert Areas. Available at:** https://flood-warning-information.service.gov.uk/

7. Conclusions

7.1 Policy Changes

Many changes in policies have occurred since the previous Greater Nottingham SFRA (2008/2010) and the River Lean and Day Brook SFRA (2008). The most critical change being that the previous 'Planning Policy Statement 25: Development and Flood Risk Practice Guide' is now superseded by the National Planning Policy Framework, Planning Practice Guide.

Further policies recommend the increased use of SuDS and Natural Flood Management techniques to provide more sustainable flood risk management schemes in respect of the latest climate change projections.

7.2 Local Plan Site Allocation Policy Recommendations

The Local Plans and supporting guidance documents should continue to include policies to:

- **Protect the functional floodplain (Flood Zone 3b) from development;**
- **Direct vulnerable development away from flood affected areas taking account of all flood sources;**
- **Ensure all new development is 'safe' for its lifetime. Dry pedestrian access to and from the development must be possible without passing through flood waters where the hazard is greater than "very low" according to Defra / Environment Agency guidance FD2320/TR2, and emergency vehicular access must be possible;**
- **Ensure that all new developments do not cause flood risk to be increased elsewhere;**
- **Promote the use of strategic, integrated and maintainable SuDS in all Flood Zones for both brownfield and greenfield sites, with space set-aside for SuDS; and**
- **Reduce flood risk from all sources where possible, for example through reduction of surface water runoff rates and volumes, increasing floodplain storage, setting development back from watercourses and de-culverting of watercourses.**

7.3 Flood Risk Management and Site Specific FRA Guidance

Section 6 details guidance for LPAs and developers on flood risk management measures that should be considered as part of strategic site allocation policies and site specific FRAs respectively. Proposed development will need to be made safe by including appropriate mitigation measures, where necessary ensure that they will not increase flood risk elsewhere, and where possible, reduce flood risk overall in accordance with the NPPF and PPG.

7.4 Flood Risk in Greater Nottingham

The flood risk data produced by additional and improved hydraulic modelling studies since publication of the 2010 Greater Nottingham SFRA has demonstrated a reduction in flood risk across the LPAs where the new Trent Left Bank Flood Alleviation Scheme defences have been constructed, and provided more confidence in the flood extents for a greater number of magnitude events.

The new updated Flood Maps for Surface Water (uFMfSW) have highlighted a number of areas at risk from pluvial flooding not previously modelled, and allow LPAs to better assess the risk of flooding from both pluvial flooding as a source, and by multiple sources of flooding when viewed in combination with the fluvial and groundwater flood risk data.

7.5 Future Flood Risk in Greater Nottingham

A number of capital flood risk management schemes are planned to be undertaken over the next few years by the Environment Agency, LLFAs and LPAs aiming to further reduce the risk posed by both fluvial and pluvial sources. These will help facilitate further development schemes.

Appendix A – Supplementary Information for the Sequential and Exception Tests

PPG: Flood Risk and Coastal Change Table 1 – Flood Zone Definitions and Probabilities (as referred to in Figure 2-2 of the main report) (2014)

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.(Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

PPG: Flood Risk and Coastal Change Table 2 – Flood Risk Vulnerability Classification (as referred to in Figure 2-2 and Figure 2-3 of the main report) (2014)

VULNERABILITY CLASSIFICATION	DEVELOPMENT USES
Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure").
More Vulnerable	• 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	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • 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.

PPG: Flood Risk and Coastal Change Table 3 – Flood Risk Vulnerability and Flood Zone Compatibility (as referred to in Figure 2-2 and Figure 2-3 of the main report) (2014)

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Notes to table 3:

- This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

" * " In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, 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.

Appendix B - Derbyshire County Council Historical Flooding Records in Erewash

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