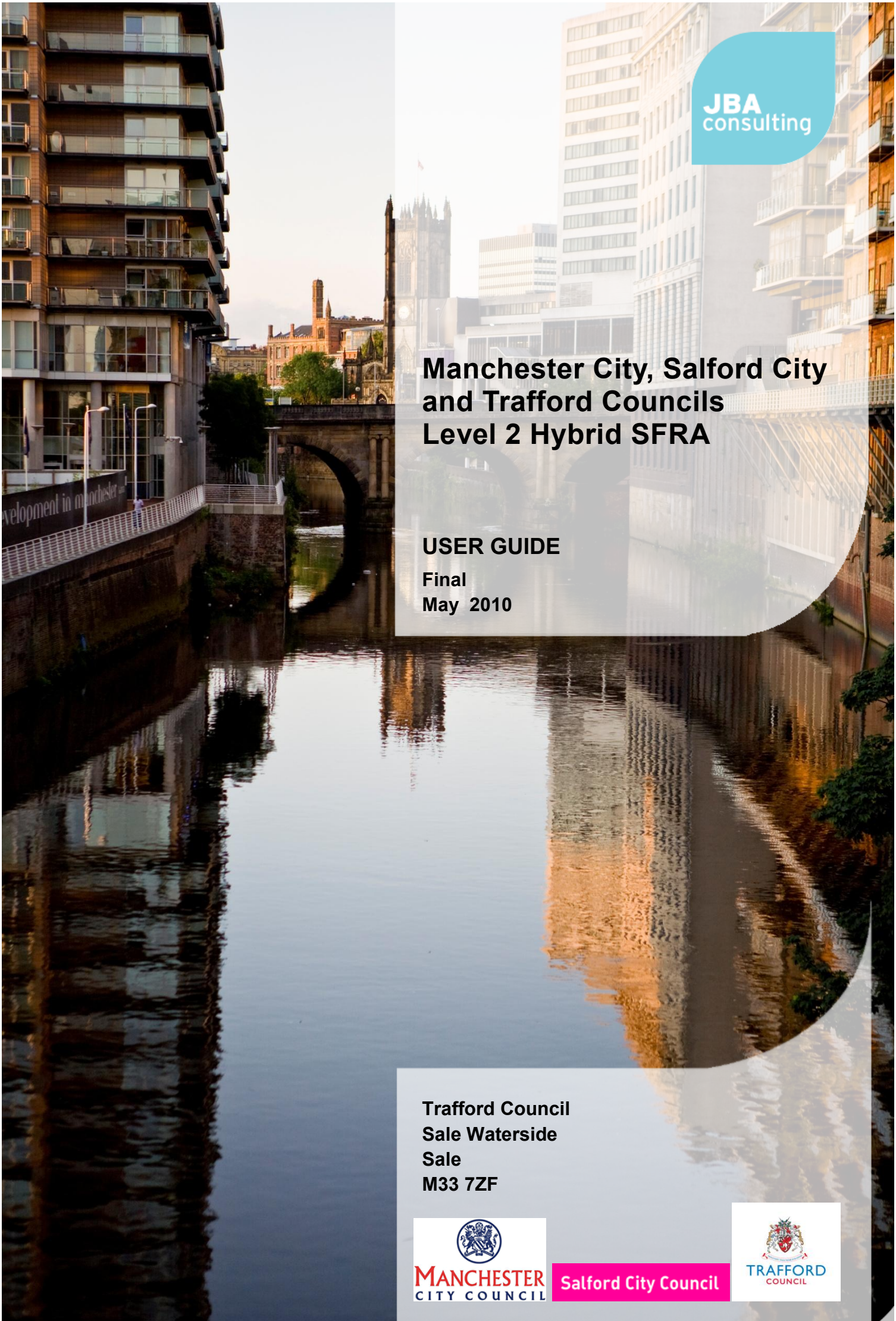

Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

USER GUIDE

Final
May 2010

Trafford Council
Sale Waterside
Sale
M33 7ZF

Structure of the Manchester, Salford and Trafford SFRA

The Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA is supplied as four Volumes, described in the table below. Readers should refer to SFRA User Guide for guidance on how to use the information provided in the SFRA.

SFRA Volume	Contents
User Guide	**This provides detailed guidance for Policy Planners, Development Control Officers and Emergency Planners on their responsibilities within regional and local flood risk management as defined within PPS25 and the use of the SFRA as a supporting tool.**
Level 1 SFRA	The Level 1 SFRA has used mostly existing data to make an assessment of flood risk from all sources now and in the future and builds on the Association of Greater Manchester Authorities (AGMA) Sub-Regional SFRA. It looks at the risk of flooding from rivers, canals, reservoirs, groundwater and surface water / sewers. It provides evidence for LPA officers to apply the Sequential Test and identify the need to pass the Exception Test where required.
Level 2 SFRA	The Level 2 SFRA provides more detailed information on flood risk from rivers (The Lower Irwell, Grey Irwell, Rivers Irk, Medlock and Mersey and the Corn Brook), canals (Manchester Ship Canal and the Bridgewater, Rochdale and Ashton Canals) and surface water / sewers. It also looks at the impacts of development on flood risk and the interactions between different sources of flooding. The additional detail can also inform a sequential approach to development allocation within flood risk areas, the likelihood of sites passing the Exception Test and mitigation options where appropriate.
Maps	This volume collates the map outputs for the SFRA and provides a Maps Index.

JBA Consulting
The Brew House
Wilderspool Park
Greenall's Avenue
Warrington
WA4 6HL

JBA Project Manager

Hannah O'Callaghan

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Final (May 2010)	EA comments	Colin Moss (TC), Fiona Moss (SCC), Helen Best (MCC) and Helen Telfer (EA)

Contract

This report describes work commissioned by Trafford Council, on behalf of Manchester City, Salford City and Trafford Councils, by a letter dated 26 May 2009. Trafford's representative for the contract was Colin Moss. Hannah O'Callaghan and Christoff Power of JBA Consulting carried out this work.

Prepared by ..... Hannah O'Callaghan BSc MCIWEM C. WEM
Senior Flood Risk Policy Analyst

Reviewed and approved by ..... Jonathan Cooper BEng MSc CEng MICE MCIWEM MIoD DipCD

Purpose

This document has been prepared as a Final SFRA User Guide for Manchester City, Salford City and Trafford Councils. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Manchester City, Salford City and Trafford Councils.

Acknowledgments

JBA Consulting would like to acknowledge the support of the SFRA steering group: Colin Moss, Steve Hark (Trafford BC), Fiona Moss, Nigel Openshaw, Will Horsfall (Salford CC), Helen Best, Andrew Parkin (Manchester CC), Helen Telfer and Chris Waring (Environment Agency).

We would also like to thank Neil D'Arcy at British Waterways for his contribution in understanding the risk of flooding from canals and the Manchester Ship Canal Company.

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Executive Summary

Introduction

Manchester City, Salford City and Trafford Councils are required to undertake a Strategic Flood Risk Assessment (SFRA) as an essential part of the pre-production/evidence gathering stage of the Local Development Framework (LDF) and in preparing their Local Development Documents (LDDs). The SFRA provides baseline information for use in the preparation of the Sustainability Appraisal (SA) of LDDs for the scoping and evaluation stages.

The requirement for and guidance on the preparation of SFRAs is outlined in Planning Policy Statement 25 Development and Flood Risk (PPS25) and its Practice Guide. This requires Local Planning Authorities (LPAs) to take a more dominant role in local flood risk management and to demonstrate that due regard has been given to the issue of flood risk at all levels of the planning process to avoid inappropriate development. The minor revisions to PPS25 in March 2010 are of no significance to the content of the SFRA. Any future changes to national guidance will of course be considered in terms of their impact on the SFRA.

Local authority planners must demonstrate that a risk based, sequential approach has been applied in preparing development plans and that flood risk has been considered during the planning application process. This must be achieved through the application of the Sequential and Exception Test as outlined in PPS25.

By providing a central store for data, guidance and recommendations for flood risk issues at a local level, the SFRA is an important planning tool that enables the LPA to carry out the Sequential and Exception Test and to select and develop sustainable site allocations with regard to flood risk.

SFRAs can also provide a much broader and inclusive vehicle for integrated, strategic and local Flood Risk Management (FRM) assessment and delivery, by providing the linkage between Catchment Flood Management Plans (CFMPs), Regional Flood Risk Appraisals (RFRAs) and Surface Water Management Plans (SWMPs) and site specific Flood Risk Assessments (FRAs). The suite of flood risk policy issues and information on the scale and nature of the risks in these various documents needs to be brought into “real” settings with the SFRA tasked with improving the understanding of flood risk across the districts.

The Manchester, Salford and Trafford (MST) Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) is presented across four separate report volumes:

- User Guide
- Level 1 SFRA
- Level 2 SFRA
- Maps

This User Guide has been developed to provide guidance for Local Authority users of the SFRA. Each user specific section links to the evidence provided in the Level 1 and Level 2 SFRAs and their associated mapping. The guidance within this document does not supersede or replace relevant national or regional policy or guidance, but is intended to provide tailored and supplementary information to help Local Authorities to use the SFRA effectively. Developers may also find some elements of the guidance useful in interpreting the other SFRA documents.

It is recognised that this Hybrid Level 2 SFRA has functional hydraulic and other links to the other Hybrid SFRAs in other parts of Greater Manchester, and beyond in the wider catchments, and that it is important that users also consider these wider links.

It is also recognised that flood risk is one of a number of key issues that Local Authorities will need to consider in exercising their statutory functions, consistent with relevant legislation.

MST SFRA Mapping

The Level 1 and Level 2 SFRAs have produced a suite of strategic flood risk maps that are contained in the Maps Volume. These maps show areas at risk of flooding from different sources and will be an important element of the evidence base used to inform Planning and Investment decisions consistent with PPS25.

Use of SFRA Data

It is anticipated that the SFRA report (all volumes) and associated maps will be made available via each Council website.

Each LPA will be able to use the modelled output (depths, hazards and outlines) for internal use. The use of this information must consider the context within which it was produced (as a strategic output for planning purposes). The use of this data will fall under the license agreement between the LPA and the Environment Agency as it has been produced using Environment Agency data. This license agreement covers Environment Agency data that has been passed to the LPA. It should be remembered that the modelling undertaken for the SFRA is of a strategic nature and more detailed FRAs should seek to refine the understanding of flood risk from all sources to any particular site, in accordance with PPS25 and with regard to the Hybrid SFRA and other relevant information.

SFRA data should not be passed on to third parties outside of the LPA. Any third party wishing to use existing Environment Agency flood risk datasets should contact External Relations in the Environment Agency North West Region. A charge is likely to apply for the use of this data.

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Abbreviations

ABD	Areas Benefiting from Defences
AEP	Annual Exceedance Probability
AGMA	Association of Greater Manchester Authorities
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plans
CLG	Communities and Local Government
COW	Critical Ordinary Watercourses
CRR	Community Risk Register
CSO	Combined Sewer Overflow
DPDs	Development Plan Documents
EA	Environment Agency
EU	European Union
FCERM	Flood and Coastal Erosion Risk Management
FRA	Flood Risk Assessment
FRM	Flood Risk Management
GI	Green Infrastructure
GMRF	Greater Manchester Resilience Forum
LDDs	Local Development Documents
LDF	Local Development Framework
LRF	Local resilience Forum
LIDAR	Light Detection and Ranging
LPAs	Local Planning Authorities
MCC	Manchester City Council
MST	Manchester Salford Trafford
NFCDD	National Fluvial and Coastal Defence Database
PPS	Planning Policy Statement
RFRA	Regional Flood Risk Assessment
RBMP	River Basin Management Plans
RPB	Regional Planning Bodies
RPG	Regional Planning Guidance
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SCC	Salford City Council
SCI	Statement of Community Involvement
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment
SMP	Shoreline Management Plans
SoP	Standard of Protection
SUDS	Sustainable (Urban) Drainage Systems
SWMP	Surface Water Management Plan
TC	Trafford Council
UDP	Unitary Development Plan
UKCIP	United Kingdom Climate Impacts Programme
UKCP	United Kingdom Climate Projections
UU	United Utilities
WCS	Water Cycle Study
WFD	Water Framework Directive

1 Introduction

1.1 Background

JBA Consulting was commissioned in May 2009 by Manchester City, Salford City and Trafford Councils to undertake a Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) following on from the Greater Manchester Sub-Regional SFRA completed in August 2008[1]. This is a hybrid SFRA as it fills in the gaps from the Level 1 SFRA and fulfils the criteria for a Level 2 SFRA.

The Hybrid SFRA has been prepared in accordance with current best practice, Planning Policy Statement 25 Development and Flood Risk (PPS25)[2] and the PPS25 Practice Guide[3].

This document is centred on providing guidance for critical users of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA and should be read alongside the Level 1 and 2 SFRAs and the Maps Volume, as well as PPS25 and other relevant documents.

1.1.1 Flood Risk Assessment

Flooding is a natural process and does not respect administrative boundaries; it is influenced principally by natural elements of rainfall, tides, geology, topography, rivers and streams and man made interventions such as flood defences, roads, buildings, sewers and other infrastructure. As was seen in the summer 2007 floods, flooding can cause massive disruption to communities, damage to property and possessions and even loss of life. The risk of flooding from rivers, surface water, sewers, groundwater, canals and reservoirs has been explored for Manchester, Salford and Trafford as part of this SFRA.

The SFRA has focussed on existing and proposed development areas and is not a comprehensive assessment of all flooding within Manchester, Salford and Trafford. Some areas which are at risk of flooding have not yet been allocated for development and therefore have not been discussed in detail within the SFRA.

There is an intricate and well connected network of rivers, streams, sewers and canals within Greater Manchester. Flooding does not respect administrative boundaries and actions to manage flood risk and water from new development need to be carefully considered so that they do not increase risk downstream. Manchester City, Salford City and Trafford Councils and the Environment Agency should work together on flooding problems, particularly where actions could exacerbate flooding in downstream communities; other stakeholders should also be involved where relevant.

It is important to try to avoid developing in flood risk areas in the first instance. Where this is not possible development should be directed to areas with the lowest possible level of flood risk. Having exhausted all opportunities to direct development away from areas of flood risk then the allocation of land for development must consider the vulnerability of the proposed land use to flooding and take measures to minimise flood risk to people, property and the environment. This is the thrust of the risk based sequential approach to managing flood risk and it is the backbone of PPS25.

Current Government policy requires local authorities to demonstrate that due regard has been given to the issue of flood risk as part of the planning process. It also requires that flood risk is managed in an effective and sustainable manner and where new development is, as an exception, necessary in flood risk areas, the policy aim is to make it safe without increasing flood risk elsewhere and wherever possible reduce flood risk overall.

[1] AGMA (2008) Greater Manchester Sub-Regional SFRA
[2] Communities and Local Government (2006) Planning Policy Statement 25: Development and Flood Risk. The March 2010 revision to PPS25 has also been considered and there are no significant issues in terms of the content of this SFRA.
[3] Communities and Local Government (2009) Planning Policy Statement 25: Development and Flood Risk – Practice Guide

The SFRA fits into a hierarchy of Flood Risk Assessments, each at an increasing level of detail that are designed to inform different stages within the planning system, from Regional Spatial Strategies to site specific Planning Applications; the different tiers should be consistent with each other and reflect relevant guidance.

1.1.2 The Planning Framework

The land use planning process is driven by a whole host of policy guidance on a national, regional and local level. Local Development Frameworks, and Core Strategies in particular, are required to generally accord with national Planning Policy Statements (PPSs) and the Regional Spatial Strategy (RSS), including in terms of housing and employment land allocations and their spatial focus within the Region; the RSS having been informed by the Regional Flood Risk Appraisal. Whilst the majority of these policies are not aimed at mitigating flood risk, there are key links at strategic, tactical and operational levels between land use and spatial planning (Regional and Local Government), and Flood Risk Management (FRM) planning (Environment Agency), which should be considered as part of a planned and integrated approach to delivering sustainable development. Links to planning information are provided in Appendix A.

1.2 Development of the SFRA

A Steering Group was set up for the SFRA, comprising spatial planning officers from Manchester, Salford and Trafford Councils and from AGMA, together with officers from the Environment Agency (EA). British Waterways, the Manchester Ship Canal Company and United Utilities were consulted on specific elements of the SFRA, during its development, and drainage engineers and civil contingency officers within the three authorities and AGMA have also been engaged.

The Manchester, Salford and Trafford Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) is presented across four separate report volumes:

- Level 1 SFRA
- Level 2 SFRA
- Maps
- User Guide

1.2.1 SFRA User Guide

This volume has been developed to provide guidance on the use of the SFRA for Local Authority officers.

The guidance within this document does not supersede or replace relevant national or regional policy or guidance, or policies contained within local development documents, but is intended to provide tailored and supplementary information to help Local Authorities to use the SFRA effectively, picking up on hydraulic and other relevant linkages and setting out how these could be effectively addressed. Developers may also find some elements of the guidance useful in interpreting the other SFRA documents.

It is recognised that this Hybrid Level 2 SFRA has functional hydraulic and other links to the other Hybrid SFRAs in other parts of Greater Manchester, and beyond in the wider catchments, and that it is important that users also consider these wider links.

It is also recognised that flood risk is one of a number of key issues that Local Authorities will need to consider in exercising their statutory functions, consistent with relevant legislation.

1.2.2 Level 1 SFRA

The Level 1 SFRA has used existing data to make an assessment of flood risk from all sources now and in the future and builds on the Association of Greater Manchester Authorities (AGMA) Sub-Regional SFRA. It provides the evidence for LPA officers to apply the Sequential Test and identifies the need to pass the Exception Test where required. Both of these tests are a fundamental part of PPS25.

The main tasks for the Level 1 SFRA include:

- Stakeholder consultation, data collection and review
- Assessment of current flood risk
- Delineation of PPS25 Flood Zones including the Functional Floodplain and the impact of climate change
- Assessing flood risk from 'other' sources including surface water, groundwater, sewers, reservoirs and canals
- Considering the impact of climate change
- Assessing potential development sites
- Producing a range of strategic flood risk maps
- SFRA recommendations

1.2.3 Level 2 SFRA

The Level 2 SFRA provides evidence for key communities where the Exception Test may need to be applied. It considers the detailed nature of flood hazard taking account of the presence of flood risk management measures such as flood defences. The additional detail can also inform a sequential approach to development allocation within flood risk areas and mitigation options where appropriate.

The main tasks for the Level 2 SFRA included:

- Development of detailed 1D-2D linked hydraulic river models along the River Irwell, Irk, Medlock, Mersey and Manchester Ship Canal at strategic development locations
- Production of fluvial depth and hazard maps for a range of scenarios including breaching, overtopping and the impacts of climate change
- Assessment and modelling of residual risks associated with canals
- Detailed surface water flooding maps, delineation of Critical Drainage Areas and recommendations for SWMPs
- Assessment of the consequences of upstream development
- Assessment of the hydraulic interactions between different sources of flood risk
- Development strategy
- Recommendations for future work

1.3 Maps Volume

This volume collates the map outputs for the SFRA and provides a Maps Index. It provides information on how the maps should be used and data sources.

1.4 SFRA Monitoring

Whilst this SFRA has been produced using the most up-to-date national guidance and flood risk data, it is recommended that the SFRA should be updated on a regular basis. The Environment Agency has suggested that this be every 3 to 4 years, unless there is a significant flood affecting the area, giving rise to new information or areas at flood risk. A review of the SFRA should also be undertaken if there are any major national policy changes.

There are a number of key outputs from possible future studies and datasets which are known to be regularly updated. These should be incorporated in any updates to the SFRA. Table 1-1 shows the triggers for revising the SFRA.

Table 1-1: SFRA Review Triggers

Trigger	Sources	Possible Timescale
Irwell or Upper Mersey CFMP	Environment Agency	Updated every 5 years
Flood Zones	Environment Agency	Updated quarterly
NFCDD	Environment Agency	Ongoing
Updated modelling of the Manchester Ship Canal and/ or Grey Irwell	Environment Agency	Unknown
Possible Flood Event	All	Unknown
Greater Manchester Multi-Agency Flood Plan	GM Resilience	Ongoing
Planning Policy	Communities & Local Government	Unknown
Surface Water Management Plans	Greater Manchester	Unknown

2 Guidance for Policy Planners

The aim of this section is to provide guidance on the use of the SFRA in Planning Policy Development. Planners should also refer to the guidance on SFRA maps provided in the Maps Index and other sources of relevant information, the links to which are in Appendix A.

Policy Planners should use the guidance *in this SFRA User Guide, and where relevant PPS25 and its Practice Guide to:*

- ***Help scope the Sustainability Appraisal of the Core Strategy***
    - *Screen development options*
    - *Produce appropriate flood risk indicators*
- *Avoid allocating strategic sites at* ***high risk of flooding where no other planning objectives outweigh flood risk***
    - *Using Sustainability Appraisal and Sequential Test Spreadsheet and other relevant information*
- ***Carry out the Sequential Test on all proposed development sites***
    - *Using information provided in the MST Level 1 SFRA and Sequential Test Spreadsheet to avoid sites at high risk*
- ***Identify those sites where a greater understanding of flood risk is required, and what the risks are***
    - *These should include key development sites at high risk of flooding*
- ***Help to identify the likelihood of sites passing the Exception Test***
    - *Using the Sustainability Appraisal to assess development sites with regards to other planning objectives and assign weight given to flood risk as an environmental constraint*
    - *Using information provided in the* MST *Level 2 SFRA, and other relevant information to assess level of risk to each site*
- ***Help to allocate appropriate sites for development, informed by the Sustainability Appraisal***
    - *Produce evidence that both tests have been applied by noting the outcome and decisions made to avoid, substitute or allocate the site*
- ***Inform the drafting of flood risk and other relevant policies and develop guidance on site allocations, informed by the Sustainability Appraisal***
    - *Guidance should include the need for site-specific FRAs to pass Part C) of the Exception Test*

2.1 Introduction

PPS25 provides the basis for the sequential approach, in which its policies require that the LPA consider flood risk, its mechanisms, spatial distributions and development vulnerability in all stages of the development planning process.

PPS25 promotes positive planning to deliver strategic opportunities to reduce flood risk to communities and apply the Government's policy on flood risk management. The Practice Guide also provides further advice on how flood risk should be taken into account in the LDF (See Section 2.20-2.24 of PPS25 PG).

Throughout the risk based sequential approach, management actions to avoid, substitute, control and mitigate flood risk should always be kept in mind and opportunities taken to minimise flood risk at every stage of the planning process. The principal aim of these actions is to ensure that flood risk to people, their property and the environment is reduced to acceptable levels.

The hierarchy of management decisions and actions include:

- **Avoidance** by locating new development outside areas at risk of flooding;
- **Substitution** by changing from a more to a less vulnerable land use; and
- **Control & Mitigation** of the risks by implementing flood risk management measures through a variety of techniques to reduce the impact and mitigate residual risks.

The sequential approach is achieved through the **successive** application of the Sequential Test and Exception Test. Both the Level 1 and Level 2 SFRAs provide the evidence base for this decision making process and should form part of the baseline information for the Sustainability Appraisal of LDDs for the scoping and evaluation stages.

The SFRA provides the relevant information on flood risk to allow the LPA to:

- Produce appropriate policies for the allocation of sites and for Development Control which reduces and where possible avoids flood risk to people and property,
- Produce appropriate flood risk indicators to inform the Sustainability Appraisal,
- Undertake the Sequential Test and Exception Test, and
- Allocate appropriate land use.

Within the context set by the RSS in terms of the scale and spatial distribution of development, the Level 2 SFRA also provides information to allow planners to make strategic decisions that identify the amount and type of development that may be suitable in particular areas and the likelihood of this development remaining safe from flooding if allocated. It also, therefore, identifies potential strategic and local mitigation strategies and measures that may be required for development to be feasible in these areas.

2.2 Applying the Sequential Test and assessing the likelihood of passing the Exception Test

This section provides the following guidance on how Policy Planners may apply the Sequential and Exception Test within the Sustainability Appraisal of LDDs.

When allocating land for development in flood risk areas, those responsible for making decisions are expected to demonstrate that there are no suitable alternative development sites (of the type and nature proposed by the Core Strategy) located in lower flood risk areas.

If the Sequential Test has been applied, and the LPA cannot allocate planned development in lower flood risk areas, the Exception Test should be undertaken. **At the Policy Planning stage, only the likelihood of passing the Exception Test can be assessed, as actually passing the test will require the completion of a site specific FRA to determine if the development site and its occupiers will be safe during times of flood.**

PPS25 does not provide step-by-step guidance on how to apply each Test rather the broad approach which should be followed.

What the guidance below will do, if followed appropriately, is produce clear and transparent evidence that both the Sequential and Exception Tests have been applied which can then feed into the Sustainability Appraisal process of LDDs. This can either be reported within the Sustainability Appraisal itself or a supporting stand alone document which then feeds into the Sustainability Appraisal.

The guidance provided in this Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide does not supersede PPS25 or other plans and policies, but should be seen as a practicable approach in how the LPA could apply the Sequential and Exception Tests within the preparation of the LDF.

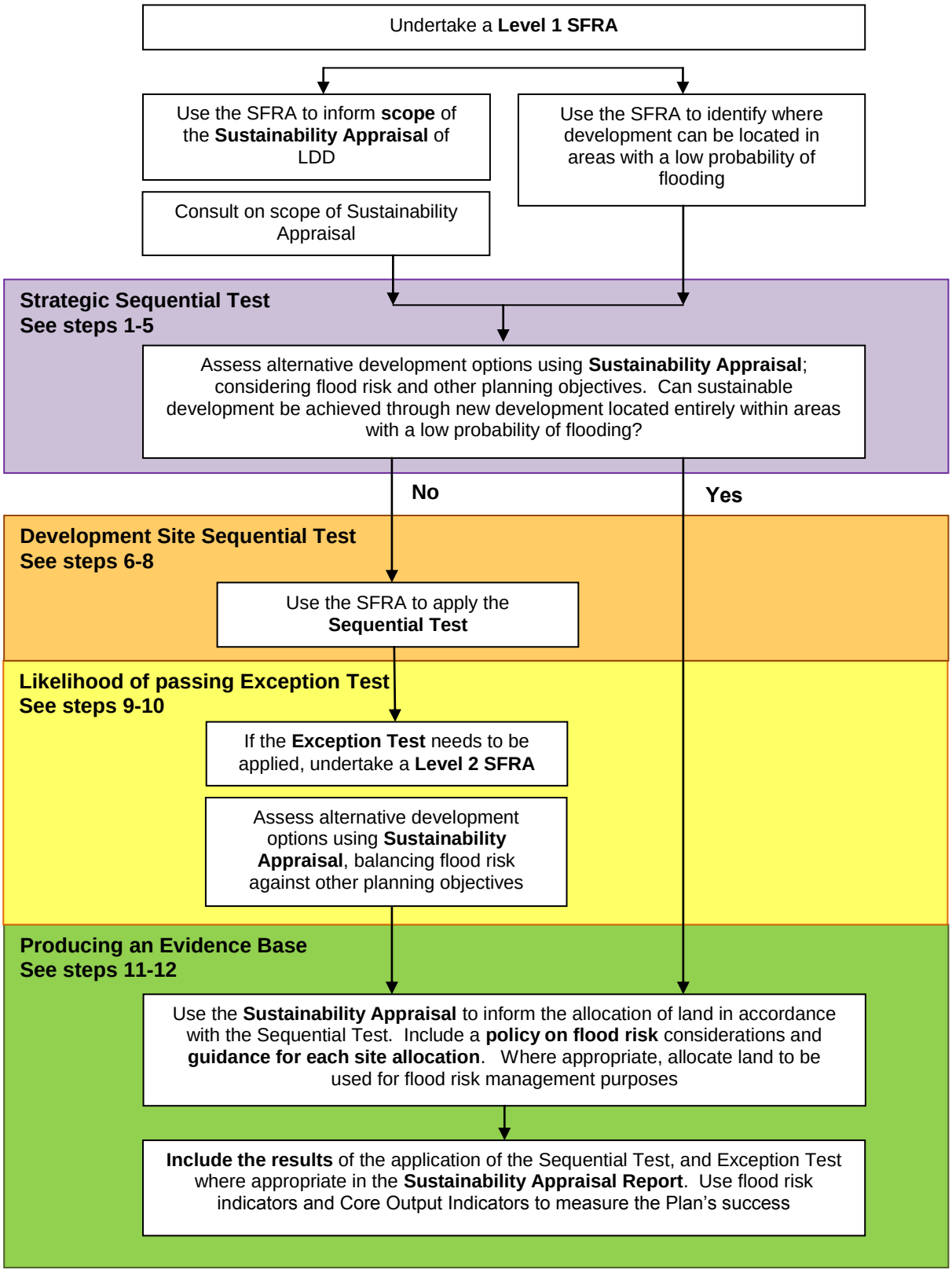
2.2.1 Spatial Planning Flow Diagrams and Tables

Figure 2-1 illustrates the process of taking account of flood risk within LDDs and the use of SFRAs. The flow diagram has been adapted from PPS25 Practice Guide (Figure 2.4 p.18) to link in with guidance provided within this User Guide.

Each colour represents a key stage in the sequential approach process. Identical colours are used throughout this Chapter to make it easier to identify what guidance relates to individual steps within the sequential approach sequence.

Figure 2-1 is a generic flow diagram, and each LPA may have produced a Core Strategy (and other LDDs) prior to undertaking the Sequential Test with the benefit of the data in this SFRA. Therefore the generic flow diagram in this User Guide should be used in this context and should take account of steps which may have previously been taken within the first pass of the Sustainability Appraisal stage.

Figure 2-1: Taking flood risk into account in LDDs



The steps in this Figure relate to those in Figure 2-2 and Table 2-1

The following flow diagrams and table provide a recommended approach for Policy Planners in applying the two Tests keeping in mind the flood risk management hierarchy of avoid, substitute, control and mitigate, whilst identifying and allocating sustainable development sites.

Colours have again been used to represent key stages in the sequential approach process as identified in Figure 2-1. The same colours are used in the flow diagrams and tables below, the aim of which is to make it easier to identify what guidance relates to individual steps within the sequential approach sequence.

Consultation should take place with the Environment Agency Development and Flood Risk Team (where required) to obtain further guidance, and for hydraulically linked sites a broadly consistent approach to this across the three authorities would be beneficial, although recognising that in terms of site allocations the three authorities are distinct.

During this process there is a need to identify which sites should be avoided, substituted, those which can go forward, or once the Sequential Test has been applied how to assess if the site will remain safe during the Exception Test. This is a step wise process and must be documented, but a challenging one as a number of the criteria used are qualitative and based on experienced judgement.

Figure 2-2: Sequential Test and Exception Test Flow Diagram

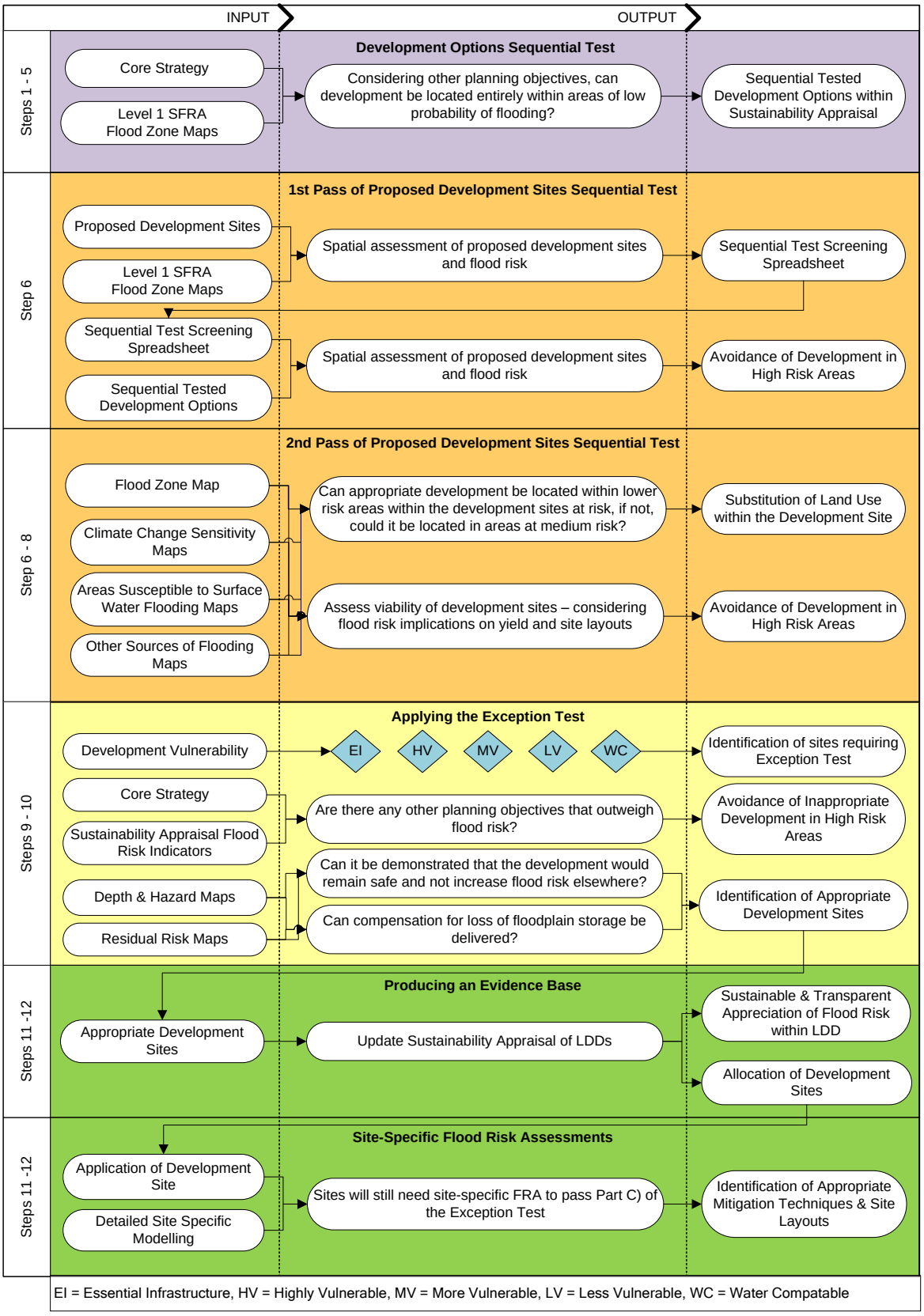


Table 2-1: Sequential & Exception Test Key Steps

Applying the Sequential Test during the SA of Development Options

Step 1 - State the **geographical area** over which the Sequential Test is to be applied. Whilst PPS25 recognises that the Sequential Test should be applied to a whole LPA area, it is recognised that Local Authority Core Strategies seek to allocate development in communities and a pragmatic approach to undertaking the Sequential Test should be agreed with the LPA and the EA regarding the area of search.

Step 2 - Identify reasonably available areas of strategic growth

Step 3 - Identify the presence of **all sources of risk** using the evidence provided in this SFRA

Step 4 - **Screen available land** for development in ascending order from Flood Risk Zone 1 to 3, including the subdivisions of Flood Risk Zone 3

*This can be achieved using the information provided in the **Sequential Test Spreadsheet** (See Level 1 SFRA section 4). The screening spreadsheet provides a spatial assessment of each proposed development site provided by the LPA against Flood Zones and SFRA surface water susceptibility zones*

Step 5 - Could all development be located in lower risk areas? If not, move onto the next Steps

1st and 2nd Pass of the Proposed Development Sites Sequential Test

Follow Figure 2-3 using the Sequential Test Spreadsheet to:

Step 6 - Identify those sites which should be **avoided** where risk is considered too great and there is no strategic planning objectives identified in Core Strategy

Step 7 - Identify those sites in which the consequence of flooding can be reduced through **substitution** within the site boundary

Step 8 - Assess yield and layout issues for remaining high risk sites to check whether development is viable

Identify the Likelihood of passing the Exception Test

Follow Key Questions imbedded within Figure 2-4 and SFRA evidence to identify the likelihood of those sites remaining at risk passing the Exception Test. The Strategic Location summary tables and Flood Risk Balance Sheets produced in the Level 2 SFRA sections 8 and 9 can aid this process

Step 9 - Assess the compatibility of the **development vulnerability** using Table D.2 of PPS25 and identify the requirement of passing the **Exception Test** using Table D.3 of PPS25

Step 10 - Use the SA to assess alternative development options by balancing flood risk against other planning constraints. **Proposed sites should be avoided and removed if it is unlikely to pass the Exception Test i.e. if**:

- Key Questions in Figure 2-4 attributes a significant negative response
- Where development will require significant mitigation measures to make the site safe and to reduce impacts downstream
- Where the requirement of loss of floodplain compensation cannot be delivered

Producing an Evidence Base

The following steps should be used within the SA to produce the evidence that all tests have been applied:

Step 11 - **Produce a supporting stand alone document** recording all decisions made during Steps 1 to 10. Each proposed development site should be referenced and the decisions made to avoid, substitute, or allocate the site and the evidence used. This can be incorporated within the appendix of the SA

Step 12 - **Allocate development allocations within the SA**, including appropriate flood risk policies and development guidance on each allocated site. Guidance should include the need for appropriate site-specific FRAs.

*The Environment Agency and other relevant stakeholders (such as United Utilities or British Waterways) should be **consulted** on any policies drafted that inform the application of the Exception Test and the production of FRAs within the LPA area*

Figure 2-3: First and Second Pass of Proposed Development Sites Sequential Test

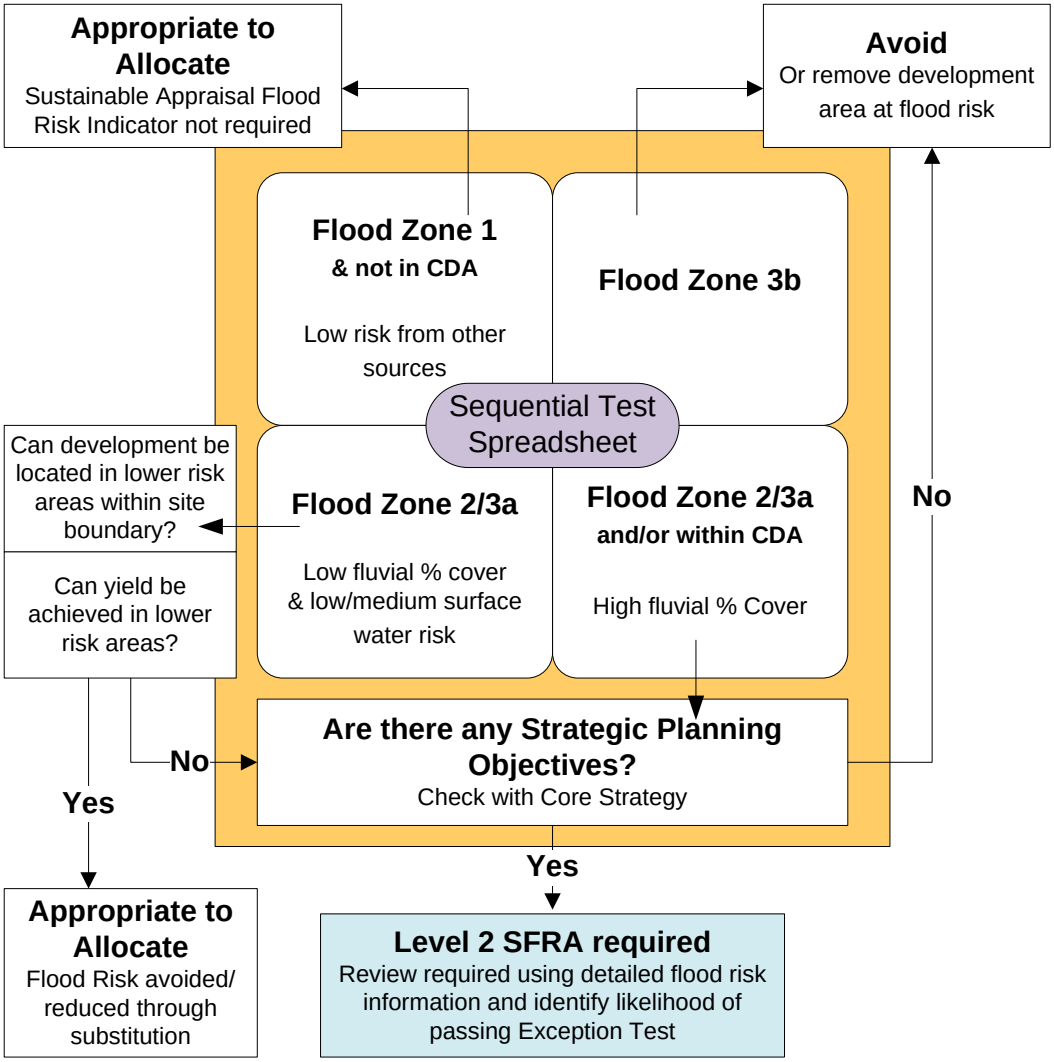
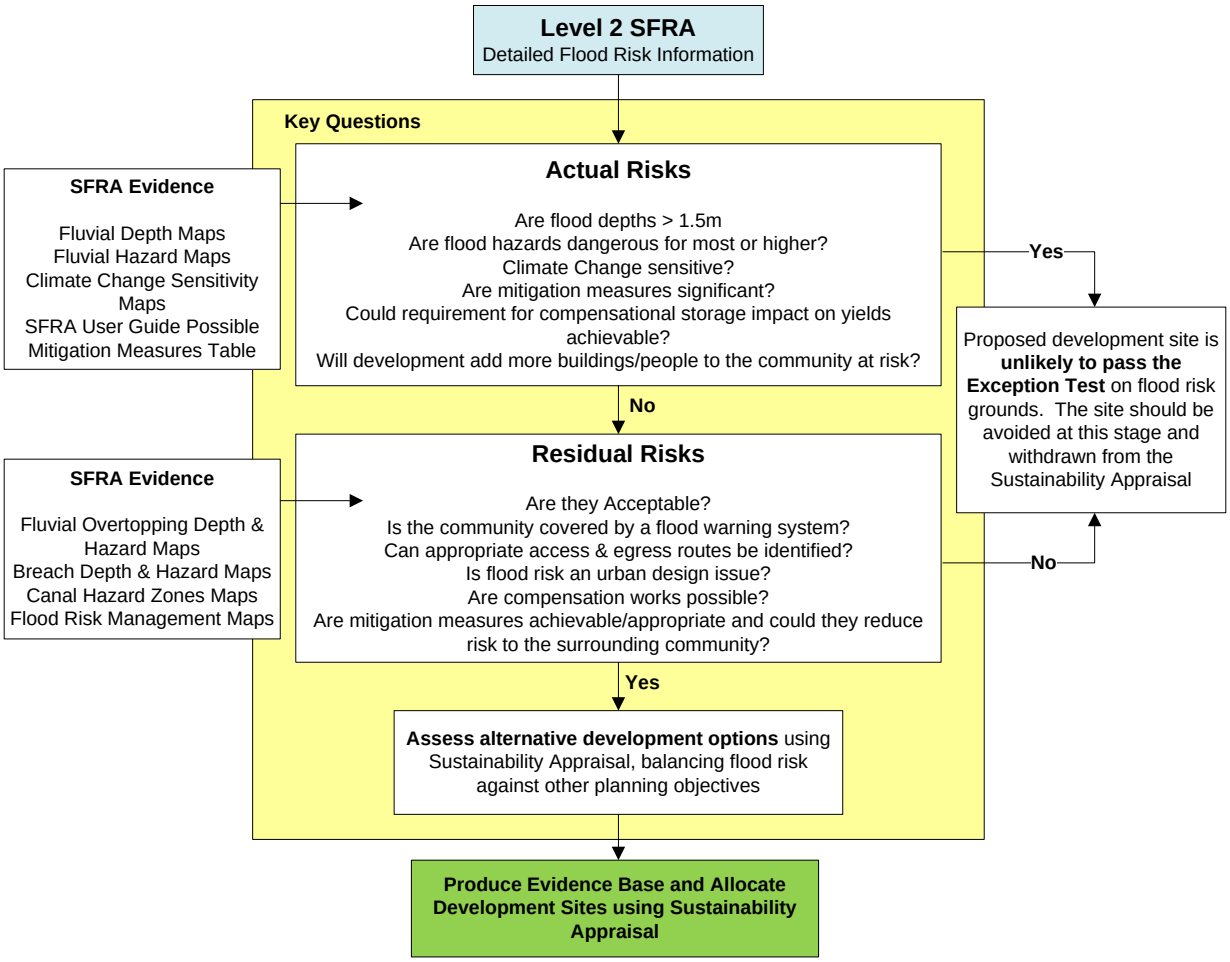


Figure 2-4: Identifying the Likelihood of Passing the Exception Test



2.3 Flood Risk and Green Infrastructure

The Green Infrastructure (GI) of Manchester, Salford and Trafford is part of the districts' life support system. It is a planned and managed network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and rural fringe consisting of:

- Open Spaces – parks, woodlands, nature reserves, lakes
- Linkages – River corridors and canals, pathways and cycle routes and greenways
- Networks of "urban green" – private gardens, street trees, verges and green roofs

With regards to flood risk, green spaces can be used to manage storm flows and free up water storage capacity in existing infrastructure to reduce risk of damage to urban property, particularly in city centres and vulnerable urban regeneration areas. GI can also improve accessibility to waterways and improve water quality, supporting regeneration and improving opportunity for leisure, economic activity and biodiversity.

Towards a Green Infrastructure Framework for Greater Manchester (September 2008) was published by TEP for AGMA and Natural England on the feasibility of a GI framework for Greater Manchester. Figure 2-5 is an extract of the Summary Report illustrating the broad GI network in Greater Manchester. Figure 2-6 shows the GI in relation to flood risk areas.

GI should be incorporated into master planning and individual sites where practicable, directed by the need to retain exceedance flood paths and natural attenuation of flood flows.

The evidence provided in the MST Level 1 and Level 2 SFRA should be used to enhance Towards a Green Infrastructure Framework for Greater Manchester by identifying opportunities for delivering FRM measures through GI. River corridors identified as functional floodplain are an excellent linkage of GI and can provide storage during a flood event. Areas that either suffer from, or contribute to, critical surface water flooding problems should be incorporated into council GI strategies. Opening up land to create flow paths or flood storage areas can help protect current and future developments.

Figure 2-5: Green Infrastructure and District Places – Key Diagram

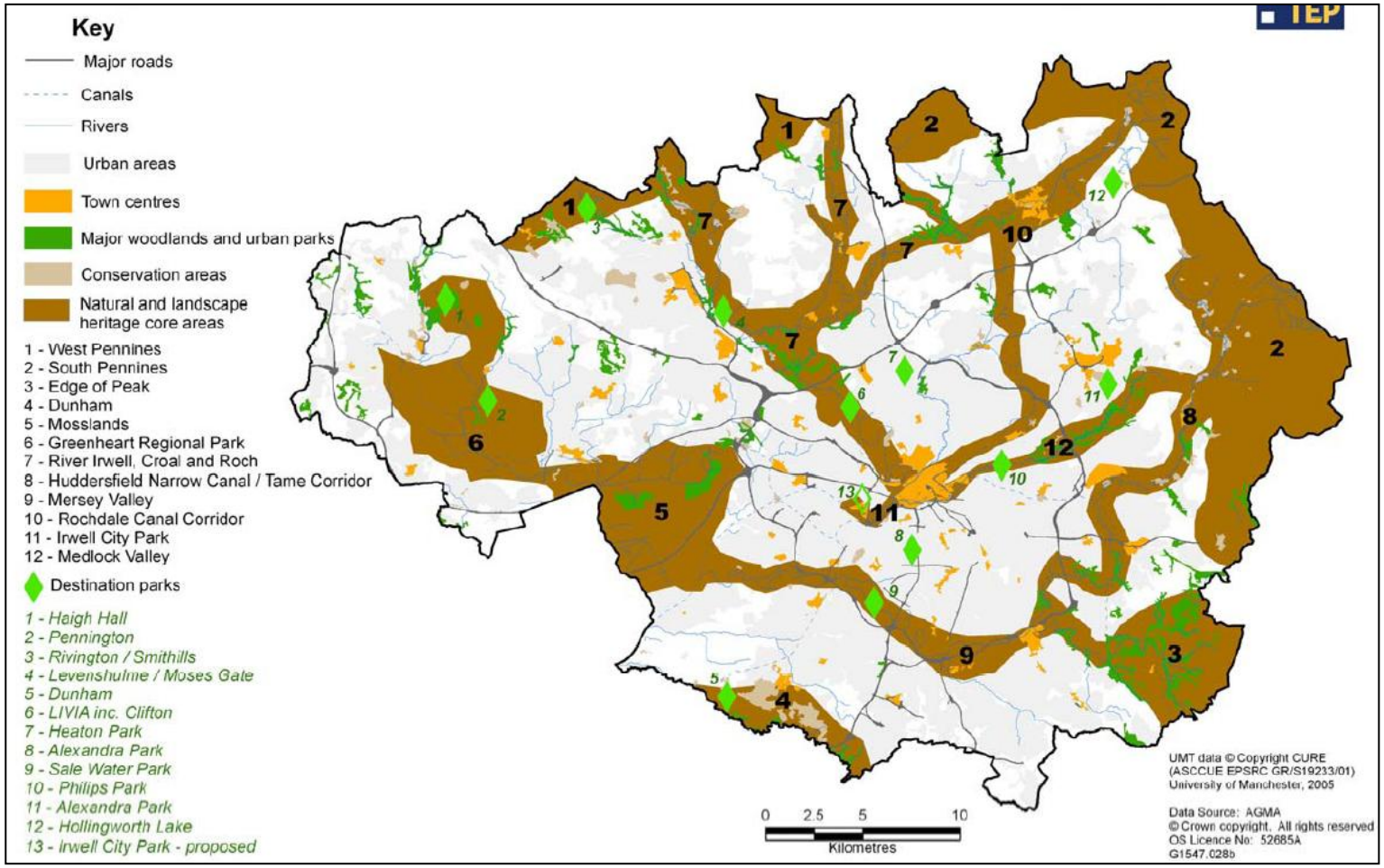
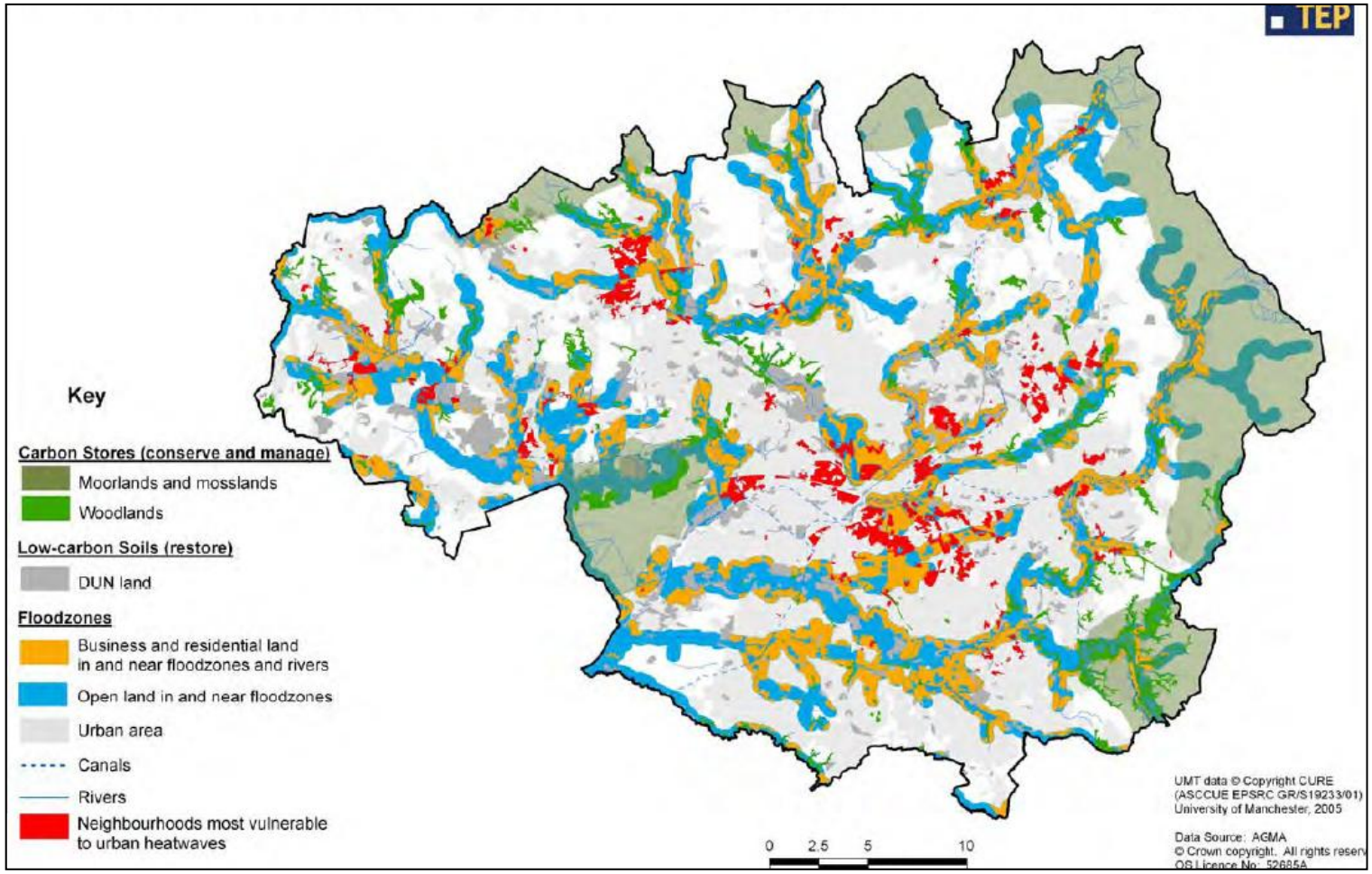


Figure 2-6: Green Infrastructure in a changing climate



2.4 Liaison between services

Given the cross cutting nature of flooding, it is essential that effective communication protocols and working arrangements at both a District and at a GM level are developed and maintained. The linkages between Policy Planning and Development Control are well established, but between Policy Planning, Emergency Planning and Drainage Engineering they are less so. Engagement with external stakeholders such as the Environment Agency, United Utilities, British Waterways and the Manchester Ship Canal Company, as well as the emergency services, should also be included as appropriate.

Planning policy should have regard to flood warning and evacuation plans prepared by Emergency Planners at different spatial levels.

It may be useful to consider how key parts of agreed flood evacuation plans could be incorporated within LDFs, including in terms of protecting evacuation routes and assembly areas from inappropriate development.

3 Guidance for Development Control

The aim of this section is to provide guidance on the use of the SFRA by Development Control officers. When it comes to individual planning applications, Planners should use the guidance in this SFRA User Guide, PPS25 and its Practice Guide to:

- ***Check whether the Sequential Test and/or the Exception Test have already been applied***
    - *Refer developer to LDD and supporting evidence to identify if the Sequential Test has been applied and development is likely to pass the Exception Test – site may have already been assessed*
    - *If evidence is available, the Sequential Test and likelihood of passing the Exception Test have been assessed. If no evidence is available, developers must apply the Sequential and Exception Tests – move on to the next stage*
- ***Refer developer to the following in order for them to apply the Sequential for all sites and Exception Tests where necessary***
    - *Manchester City, Salford City and Trafford Councils Level 1 SFRA to inform Sequential Test*
    - *Sequential Test Spreadsheet to compare similar sites assessed*
    - *Manchester City, Salford City and Trafford Councils Level 2 SFRA to inform* the likelihood of passing the *Exception Test*
    - *Manchester City, Salford City and Trafford Councils SFRA maps to review scale and nature of flood risk*
    - *Manchester City, Salford City and Trafford Councils SFRA maps to identify residual risks*
- ***Consult with Environment Agency and other relevant stakeholders to***
    - *Assess flood risk constraints identified on site using the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA*
- ***Scope an appropriate FRA***
    - *What is the scale and nature of risk from all sources?*
    - *Is there coherence in terms of assumptions / scenarios - conflict must be avoided*
    - *Does the site lie within a CDA identified in the Level 2 SFRA Section* 5*?*
    - *Refer developers to Section 3, 4 and 5 of this SFRA User Guide*
- ***Consult with Environment Agency over FRA acceptance/approval***

3.1 Introduction

The LPA are the principal decision-makers on applications for new development. This is carried out through Development Control. Whilst it is the overall responsibility of the developer to carefully consider flood risk issues regarding their proposed development site, the LPA should be involved at the earliest possible stage during pre-application discussions. For all planning applications, Development Control planners should consult appropriate drainage colleagues to assess whether there are flooding problems in addition to those picked up by the Environment Agency, United Utilities or the SFRA. Discussions with Planning Policy colleagues should also take place.

Development proposals should be supported by a coherent FRA which meets the requirements of PPS25, and has full regard to the hybrid Level 2 SFRA. Consistent assumptions and modelled scenarios for hydraulically linked watercourses in all FRAs will be necessary to develop a robust and coherent approach across the three authorities; cumulative impacts should also be considered. The three Local Authorities and the Environment Agency should be mindful of a developer (or different developers) seeking to use certain assumptions/ scenarios for one location, and different scenarios and assumptions for another location, to support development proposals. The potential for conflict between assumptions/ scenarios for different locations should be recognised and the implications of different assumptions/ scenarios for not only the development location, but also elsewhere along the watercourse.

Development Control officers must always consider development from a strategic view point and the cumulative effect of all proposed development taking place, even though applications for developments are submitted at a site level. It should not be presumed that flood risk has been fully addressed at a strategic high level - site specific Flood Risk Assessments will be required, in line with national policy, and applications should be considered within the context of a wider flood risk management strategy for an area.

3.2 The Sequential Test and Exception Test

Development proposals for allocated sites will have been sequentially appraised. However, developers should apply the sequential approach to site layout when matching land use vulnerability to flood risk areas within allocated sites, as described in PPS25. The LPA will then consider whether this passes the Exception Test.

However, where a site has not been identified within a Sequentially Tested LDD, the Sequential Test will need to be applied i.e. the developer will need to provide evidence to the LPA that there are no other reasonable available sites where the development could be located. The LPA will then use this information to apply the Sequential Test. This particularly applies to Windfall Sites that have not been allocated in the LDF.

Development Control officers should refer to Section 2 of this report for guidance on applying the Sequential and Exception Tests. Developers will need to provide evidence that the Exception Test can be passed where relevant. This will be needed for allocated and windfall sites, if required according to the vulnerability of the proposed land use, and the risk of flooding. Development Control officers will then need review the evidence provided and decide whether a site passes the Exception Test.

Some locations may require a strategic approach when it comes to planning development, due to the possibility of large off site impacts caused by piecemeal development. This is one of the reasons why clear and robust cross-boundary working arrangements are needed to effectively manage risk.

PPS25 Practice Guide Section 4.23 to 4.45 provides more detail and a recommended approach on how to apply the Sequential Test and Exception Test to individual planning applications, windfall sites, existing and single properties and changes of use and must be referred to.

Table 3-1: Development types and application of Sequential and Exception Tests

Development	Sequential Test Required	Who Applies the Sequential Test?	Exception Test Required?	Who Applies the Exception Test?
Allocated Sites	No	LPA should have already carried out the test during the allocation of development sites within their LDD	Dependent on land use vulnerability	LPA to advise on the likelihood of test being passed. But the developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Windfall Sites	Yes	Developer provides evidence that the test can be passed to the LPA. An area of search to be agreed within the local authority area[4].	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Regeneration Sites Identified Within LDD	No	-	Dependent on land use vulnerability	LPA to advise on the likelihood of test being passed. But the developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Renewable Energy Projects	No	PPS22 Renewable Energy advises the LPA not to use a sequential approach in the consideration of such proposals	Dependent on land use vulnerability.	LPA to advise on the likelihood of passing test. But the developer must provide evidence that the Test can be passed by providing planning justification and producing a detailed FRA.

[4] Whilst PPS25 recognises that the Sequential Test should be applied to a whole LPA area, it is recognised that Local Authority Core Strategies seek to allocate development in communities and a pragmatic approach to undertaking the Sequential Test should be agreed with the LPA and the EA regarding the area of search. This may be restricted to communities or wards if justified.

Development	Sequential Test Required	Who Applies the Sequential Test?	Exception Test Required?	Who Applies the Exception Test?
				Part B of the Exception Test may not apply in accordance with PPS22.
Redevelopment of Existing Single Properties	No	-	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Changes of Use	No	-	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA

3.3 Supporting the FRA Process

Certain types of development and development in certain areas must be supported by an appropriate site-specific FRA in accordance with the guidance provided in PPS25 Practice Guide Section 3.80 to 3.90.

Site specific Flood Risk Assessments (FRAs) are prepared by those proposing development. The principal aims of a FRA are to determine the acceptable management of flood risk to the development proposal itself and any impacts elsewhere, and to ensure that the development and its users/occupants remain safe in times of flood. The Developer should consult the LPA and the Environment Agency (and other relevant flood risk consultees, such as United Utilities, the Manchester Ship Canal Company or British Waterways), to identify known flood-related site constraints and agree the scope of an appropriate FRA.

This should meet the requirements of PPS25, and have full regard to the hybrid Level 2 SFRA, particularly in terms of hydraulically linked watercourses and the scope for cumulative impacts across the three authorities and beyond. The three Local Authorities and the Environment Agency should be mindful of a developer (or different developers) seeking to use certain assumptions/ scenarios for one location, and different scenarios and assumptions for another location, to support development proposals. The potential for conflict between assumptions/ scenarios for different locations should be recognised and the implications of different assumptions/ scenarios for not only the development location, but also elsewhere along hydraulically linked watercourses, considered.

There are three levels of FRA:

- **Level 1-** *Screening study, to identify whether there are any flooding or surface water management issues that need to be considered further*

- **Level 2-** *Scoping study, to be undertaken if the Level 1 FRA indicates that there are flood risk issues needing further consideration and these risk can be readily quantified*
- **Level 3-** *Detailed study, where further quantitative analysis is required to appropriately assess flood related issues and determine any effective mitigation measures needed to be put in place*

It should be recognised that the SFRA has assessed flood risk at a strategic level, which can be used to provide evidence for a Level 1 and Level 2 FRA. However, where a more detailed FRA is required the developer should undertake a detailed assessment of the flood risk to the site, using the SFRA to scope out flood risk issues and referring to the guidance in the SFRA User Guide, PPS25, its Practice Guide and CIRIA Report Development and Flood Risk. Developers should satisfy themselves that the data provided in this SFRA is up-to-date and accurate for their development.

The production of a site-specific FRA can be seen as an iterative process with those carrying out a Level 1 FRA before moving on to a Level 2 and finally a Level 3. It is appropriate to review the level of risk present to assess whether development is appropriate and achievable before moving onto the next stage.

A larger number of iterations and/or consultations on the FRA maybe needed if significant mitigation measures are proposed and compensational storage is required to assure the LPA and Environment Agency that the development can remain safe and meets all requirements. At some locations there may be hydraulic interactions between different sources of flooding. Where this is the case the FRA should look at the possible interactions in greater detail.

No development should have an adverse impact on flood risk elsewhere and advice and guidance on this may be obtained from the Local Authority. Development Control officers may be able to suggest an appropriate contact with drainage knowledge and experience who may be consulted in the first instance before discussion with the Environment Agency and where applicable United Utilities. The Development Control Planning Officer should ensure that any drainage requirements are covered in Planning Conditions on the Planning Consent.

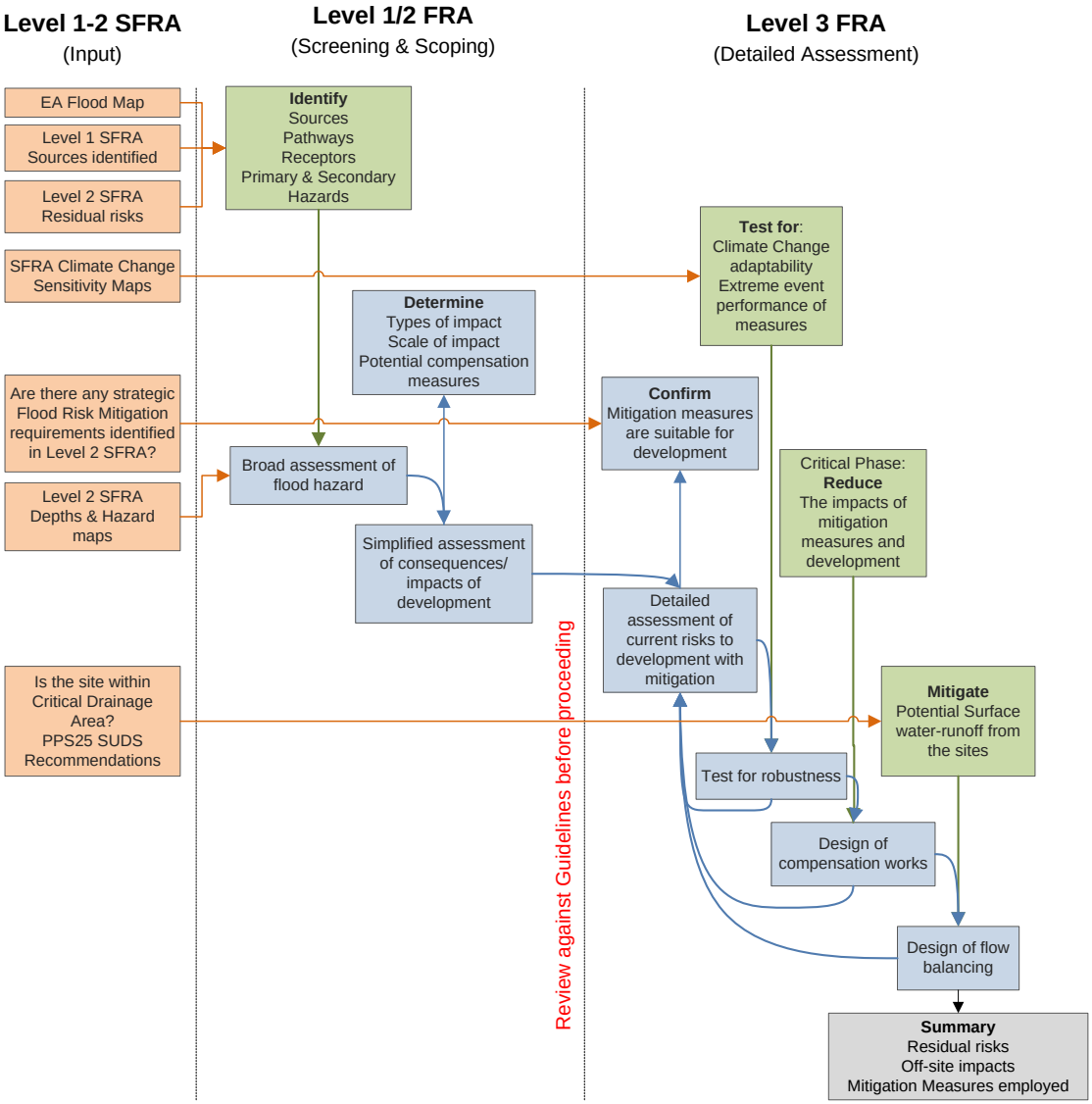
The Environment Agency Standing Advice should be used at this stage. This can be accessed online (http://www.environment-agency.gov.uk/research/planning/82584.aspx).

The Environment Agency is a statutory consultee for specific categories of development where flood risk is an issue.

Table 3-2: FRA Considerations and supporting evidence

Considerations	Supporting evidence in the SFRA
The development other than minor development is situated in Flood Zone 2 and 3	Level 1 SFRA Flood Zone Maps or Flood Zones on Environment Agency website if updated. See PPS25 Practice Guide section 2.46 for definition of major developments Consult hydraulically linked Local Planning Authorities
The development is >0.5 hectares situated in Flood Zone 1, but there are critical drainage problems (i.e. the development lies within a Critical Drainage Area) or the site has been identified as being at risk of flooding from other sources	Level 2 SFRA Critical Drainage Area Maps Consult hydraulically linked Local Planning Authorities
The development could be affected by other sources of flooding	Level 2 SFRA Canal Hazard and refined Surface Water maps Consult hydraulically linked Local Planning Authorities
The development is situated behind flood defences (possibility of overtopping during extreme flood event or breach)	Level 1 SFRA Flood Risk Management Maps Level 2 SFRA depth and hazard maps for both the 1 in 100 year and 1 in 1000 year flood events, including the consideration of climate change Fluvial breach maps Consult hydraulically linked Local Planning Authorities
The development exceeds 1ha in size	Consult Environment Agency Consult hydraulically linked Local Planning Authorities
The development is within 20m of the bank top of a Main River – the Environment Agency will have to consent to any work within 8m of a Main River and are likely to 'object in principle' to any development within these areas	Consult Environment Agency Consult hydraulically linked Local Planning Authorities
Any culverting operation or development which controls the flow of any river or stream	Consult Environment Agency Consult hydraulically linked Local Planning Authorities

Figure 3-1: FRA Preparation



3.3.1 Broad Canals

The SFRA has identified that the residual risk associated with overtopping and breaching from broad canals is a particularly important issue within the three local authority boundaries. Whilst generally a low probability occurrence, the consequences are such that this source should be considered within a flood risk assessment that accompanies a development application.

The Level 2 SFRA has identified indicative canal hazard zones that will aid in scoping where a FRA will be required and what level of detail is appropriate. Flooding from canals may not overlap with fluvial Flood Zones or it may add another source of flooding that must be considered.

3.3.2 Considering the general risk of canal flooding

Developers should be aware that any site that is at or below the top of a canal bank level may potentially be subject to canal flooding. The possible flood mechanisms include:

- Canal bank overtopping

- Canal embankment breach

Severe cases of canal bank overtopping may lead to breach failure depending on the geometry and characteristics of the canal at that location. Flood volumes and flood hazard caused by canal bank overtopping are usually much lower than those arising from a breach of a canal embankment.

Indicative canal flood hazard zones

Two "Canal Hazard Zones" have been created for the Bridgewater, Ashton and Rochdale Canals to show areas that could potentially be affected by flooding in the event of:

- overtopping of canal embankments and
- full breach of raised canal embankments. The potential breach locations/ areas have been sub-divided into:

  Probable. A walkover survey of key sections of the canal was undertaken to identify the embankments more likely to breach, based on their height and width. This zone shows those areas that would be affected by a breach of one of these embankments. Sites within this Canal Hazard Zone must appraise the actual risk of flooding to the site due to breaching of the canal in a FRA, starting at Stage 3. Detailed Assessment.

  Possible. Less likely breach locations, such as at wide or low embankments, were identified by a walkover survey of the canal. Sites within this Canal Hazard Zone must appraise the actual risk of flooding to the site due to breaching of the canal in a FRA, starting at Stage 2. Scoping.

In addition to this, an indication of areas that may be affected by canal flooding in Manchester following a breach from the Rochdale Canal in Oldham Council area has been included in the mapping for this SFRA. This again highlights the importance of considering flood risk on a cross-boundary basis. Sites within this Canal Hazard Zone must appraise the actual risk of flooding to the site due breaching of the canal in a FRA, starting at Stage 2. Scoping.

The Canal Hazard Zones are based on broad scale modelling techniques and should only be taken as an indication of areas that might be affected by canal flooding. These zones are there to trigger the scoping stage of a flood risk assessment, and should not be considered as comprehensive. It is the developer's responsibility to ensure that where a site is below canal level and within 1km that the screening exercise is undertaken and reported on in the FRA.

The SFRA has highlighted that there is a higher probability of the Bridgewater Canal overtopping than the other broad canals in the study area, since it has the potential to receive significant inflows from the River Medlock. The upstream part of the canal is likely to be the most heavily affected by the River Medlock; after the canal splits at Stretford the impact will be rapidly reduced as the flood wave dissipates. For extreme events water levels in the Manchester Ship Canal may also have some impact on the Bridgewater Canal.

Within the SFRA canal hazard zones a FRA must appraise the actual risk of flooding to the site due to overtopping and/or breaching of the canal. Guidance on this is provided below.

Developing in the Canal Hazard Zones

If a proposed development site is located within a SFRA canal hazard zone then a three stage approach is proposed which may include some or all of site screening, scoping and a detailed assessment.

Stage 1. Site screening

The FRA should address the following questions for overtopping and breach as a first stage:

- Is the site within the SFRA canal hazard zone?
- Is the proposed finished level of any part of the site lower than the canal bank level and within 1km of the canal?

- Is the canal embanked above the site?
- Have there been past incidences of canal breach which may show that the location of the development site is vulnerable to canal breach?

If the response to any of these questions is yes, canal overtopping and breach flood risk should be considered in a Scoping Stage.

Stage 2. Scoping

Overtopping

If the screening identifies a second stage for canal overtopping risk is required the following questions should be addressed:

- **If high water levels occur in the canal close to the site, based on an assessment of both bank levels, is it possible that canal spill is likely to be towards, as opposed to away from, the site?** If the opposite bank to that of the proposed site is lower it is likely that any spill will occur from this canal bank and not from the canal bank adjacent to the site.
- **Have there been past incidences of canal overtopping which may show that the location of the development site is vulnerable to canal overtopping?** The canal pound is the body of water contained between the lock gates. The canal pound length is the distance between the lock gates for the body of water. The canal pound length adjacent to the site may receive water from an upper pound and may discharge water to a lower pound in storm conditions. The size of the bywashes control the water level rise and in some cases may not have capacity to deal with an extreme event. There may be additional lateral spillways for the control of water level rise within the pound length. Lower canal freeboard may increase the likelihood of canal overtopping in that location. Acts of vandalism may have caused overtopping in the past. Advice on any locations of historic overtopping is generally available from British Waterways and The Manchester Ship Canal Company.
- **Is the nature of the topography surrounding the canal pound length such that the canal is likely to intercept significant slope rainfall-runoff in the 1 in 100 year storm conditions with climate change?** A canal in cutting may intercept rainfall-runoff from both banks causing water level rise in the pound length. A significant volume of rainfall-runoff in the 1 in 100 year event with climate change could cause overtopping within the pound length if the bywashes and spill structures are of insufficient capacity to control water level rise for that event and if there are raised embankments within the same pound length. The catchment for the canal pound is the area receiving runoff in a storm event which will include the canal water area, the towpath and may include areas beyond the canal on one or both banks as stated above. A canal pound with adequate bywashes and spill structure capacities that does not have a receiving catchment significantly larger than the width of the canal and its towpath is unlikely to have an overtopping problem unless historic events suggest otherwise.
- **Is the site close to the Bridgewater Canal between the inflow from the River Medlock (in the Deansgate/ Giants Basin area) and the split of the Bridgewater Canal at Stretford?** If so there is a higher likelihood of overtopping due to inflows from the River Medlock.

If the response to any of these questions is yes, canal overtopping flood risk should be carried forward into Stage 3 and would also prompt a review of breach potential.

Breach

If screening suggests a second stage for canal breach risk is required the following questions should be addressed to scope the appropriate form of a canal breach and hence the flood risk to the development site. This may require expert advice from an engineering consultant:

- **Could overtopping cause a breach of the canal?** Canal bank overtopping could lead to canal embankment failure depending on the nature of the bank material, the surface covering, overtopping flows and bank geometry. Small overtopping flows would be unlikely to lead to breach formation. The erosion potential of canal embankments should be quantified.
- **Is a breach possible from the bank geometry?** A breach is only likely to occur if the canal top of bank levels are sufficiently high above surrounding ground levels to form a raised embankment with a slope sufficiently steep to be susceptible to breach failure. British Waterways record particularly high embankments as principal embankments and they hold a record of the locations. The Manchester Ship Canal Company are likely to hold similar records. Preliminary cross sections of the embankment and its constituent materials should be assessed to determine an appropriate breach mechanism.
- **Have there been past incidences of canal breach which may show that the location of the development site is vulnerable to canal breach?** Past breach failures may have been caused by overtopping of the canal bank or failure of the canal lining. Advice on locations of historic breaches is generally available from British Waterways and The Manchester Ship Canal Company
- **Are any structures such as aqueducts in poor condition?** Aqueducts in poor condition will have a higher propensity to fail, and may have to be considered specifically.
- **Are there any local culverts underneath the canal that may have insufficient capacity?** The most serious breach in the past on the Rochdale Canal (north of the study area) has been caused by culvert blockage and floodwater damming behind the canal which led to a breach of the canal.

If the response to any of these questions is yes, canal breach flood risk should be carried forward into Stage 3. If a canal breach is considered unlikely but the site is immediately below a canal then the FRA should consider what, if any, residual risk could be associated with the canal. Mitigation measures could include incorporating flood resilience measures into low level properties and raising ground levels.

Stage 3. Detailed Assessment

Overtopping

If a third stage for canal overtopping risk is required the following should be addressed:

- **Construct a hydraulic model**. A hydraulic model should be constructed in order to understand the inflows and outflows to the canal during a 1 in 100 year flood event, considering climate change. Inflows should consider runoff from towpaths and embankments and/or slopes (if applicable), culverts, and upstream inflows through bywashes (around locks) and lock gates. For the Bridgewater Canal this must include interactions with the River Medlock and the Manchester Ship Canal. Environment Agency owned models exist for both these watercourses and they should be consulted at this stage.
- **Identify overland flow paths**. If significant overtopping is identified by the inflow/outflow model, then a model should be constructed in order to understand overland flow paths from the canal in the event of overtopping (at the location(s) from which the site could be affected) and the potential depth and hazard associated with canal flooding to the development site. Any uncertainties and assumptions related to this model should be clearly stated. The Level 2 SFRA surface water flooding maps provided in the SFRA and discussions with the Environment Agency will help to identify critical overland flow paths for further detailed modelling.
- **Assess the freeboard required**. Proposed finished floor levels should be assessed in relation to the risk of canal flooding. Risks associated with canal overtopping could be taken into account by raising floor levels (increasing the designed freeboard levels to take account of the risk) as the depths and flows will be generally low. Typically this approach is taken in the design of road and

finished floor levels, where a 300mm freeboard is provided to ensure that the primary route for exceedence flows from either the surface water system or the canal is along the road network and away from property. It is the developer's responsibility to assess whether this freeboard is adequate, and the master plan for the site reflects the need to retain and guide overtopping flows to a safe area. Within areas of fluvial or surface water flood risk FRAs will need to consider this along with the measures taken to manage these other sources. Typically a freeboard value is added to the 1% plus climate change flood level to take into account uncertainty and operational issues. Traditionally a value of 600mm is taken. Where a FRA is being undertaken in the canal hazard zone then the freeboard should be assessed from first principles taking into account flood risk from the canal as another source of uncertainty. A lower or higher freeboard allowance may be required as a result.

- **Assess any residual risks and decide how they should be managed**. Flood warning and resilience measures may be appropriate. The developer should liaise with the LPA, The Manchester Ship Canal Company (for the Bridgewater Canal) and British Waterways (for the Manchester, Bury and Bolton Canal, Ashton Canal and Rochdale Canal) to determine suitable emergency planning arrangements.

Breach

If a third stage for canal breach risk is required the following should be addressed:

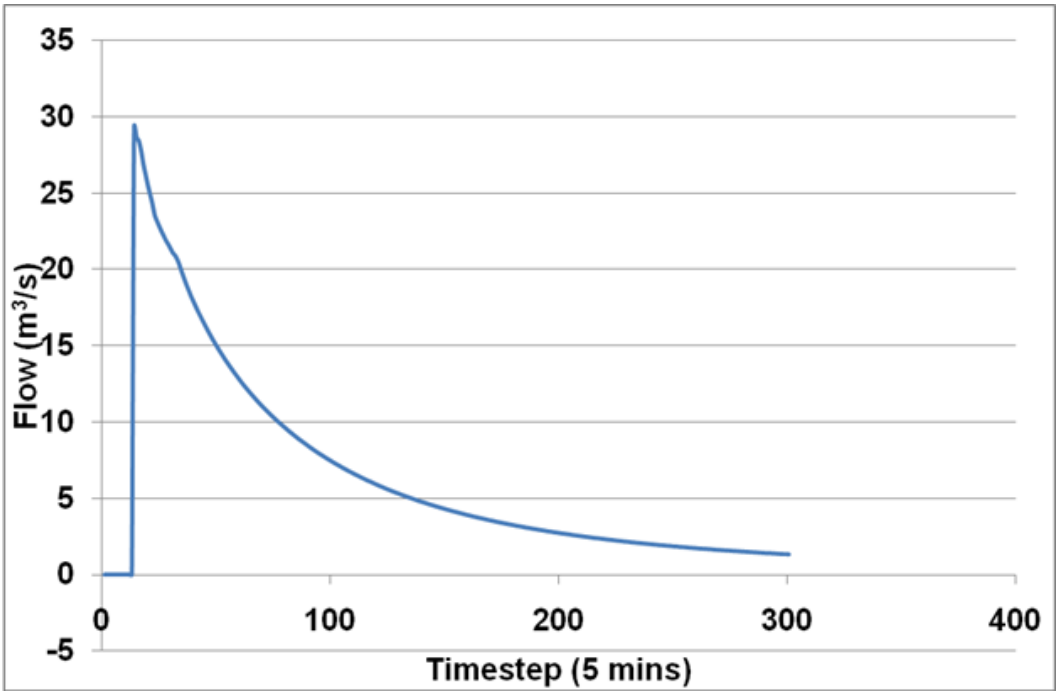
- **Assess materials used for the construction of the embankment**. Granular materials are likely to be more susceptible to failure than cohesive materials, and will have a different breach mechanism.
- **The structural/geotechnical condition of the canal embankment**. Raised embankments in poor condition, now or in the future, for example with animal burrows, are more likely to fail in breach. Are these principal embankments? This will affect the final breach mechanism adopted.
- **The condition and capacity of any culverts underneath the canal**.
- **The condition of any structures such as aqueducts**.
- **An assessment of the likely mechanisms of canal breach and consequence at the location(s) from which the site could be affected**. A hydraulic model should be constructed in order to understand peak flow, volumes and overland flow paths in the event of a breach and the potential depth and hazard to the development site associated with canal flooding. The canal should be assumed to be at maximum capacity at the time of breach. Any uncertainties and assumptions related to this model should be clearly stated. Additional guidance on the consideration of canal breach mechanisms should be referred to where necessary[5] [6] [7]. A description of typical breach mechanisms is provided below.
- **Proposed finished floor levels in relation to the risk of canal flooding**. Risks associated with canal breach should be taken into account by raising habitable floor levels (increasing the designed freeboard levels to take account of the risk), but FRAs will need to consider this along with the measures taken to manage other sources of flood risk.
- **Residual risks and how they should be managed**. Flood warning and resilience measures may be appropriate. It is acknowledged that depending on the likelihood of canal failure and its consequence that the management of this risk should be balanced between resistance and resilience measures (see PPS25 Practice Guide). The developer should liaise with the LPA, The Manchester Ship Canal Company (for the Bridgewater Canal) and British Waterways (for the Manchester, Bury and Bolton Canal, Ashton Canal and Rochdale Canal) to determine suitable emergency planning arrangements. It is for the FRA to

[5] British Waterways (2008) *British Standards: Hydraulic Design of Canal Works Good Practice Guide*
[6] Dun, R. W. (2006) *Reducing uncertainty in the hydraulic analysis of canals, Proceedings of the Institution of Civil Engineers, Water Management 159, pages 211-224*
[7] Dun, R. W. (2007) *An improved understanding of canal hydraulics and flood risk from breach failures. Water and Environment Journal 21 9-18.*

conclude on that balance and demonstrate that the risk can be managed through design and appropriate awareness, land raising and flood warnings.

In those circumstances when no data is available a simplistic but conservative approach can be adopted. The key parameters to replicate are an appropriate peak flow and correct total outflow volume. An example breach hydrograph used in the SFRA is as follows. It is the responsibility of the developer within the FRA to establish whether this sample hydrograph is appropriate to the site.

Figure 3-2: Example breach hydrograph



3.3.3 Manchester Ship Canal

Although technically a canal, the Manchester Ship Canal is a canalised watercourse and hence its flooding mechanisms have more in common with a watercourse than a typical canal. The Manchester Ship Canal consists of the lower reaches of the River Irwell and Mersey and receives natural inflows from these catchments. **The risk of flooding from the Manchester Ship Canal should therefore be considered as fluvial flood risk.** The Sequential Test and Exception Test apply as set out in PPS25. A FRA should consider the actual risk of flooding and the residual risk of flooding in the event of operational failure of water control structures on the canal. Consistent assumptions and modelled scenarios for hydraulically linked watercourses, such as the MSC/ Grey Irwell and tributaries in all FRAs will be necessary to develop a robust and coherent approach across the three authorities. The three Local Authorities should be mindful of a developer or different developers seeking to use certain assumptions/ scenarios for one location and different scenarios and assumptions for another location, to support development proposals. Development Control officers should consider what the implications of different scenarios assumptions would be not only for the development location, but also elsewhere along the hydraulically linked watercourse.

The Level 2 SFRA explores a range of flood risk scenarios for the Manchester Ship Canal and the SFRA mapping presents an adopted residual risk scenario. This is considered to provide a reasonable representation of risk in the event of human or mechanical failure and reduced efficiency of the sluices. Taking account of the residual risk on the Manchester Ship Canal is critical and the Level 2 SFRA supports the use of setting finished floor levels based on the residual risk scenario to cover the uncertainties regarding the current estimates of water levels on the Manchester Ship Canal, rather than taking a traditional value of 600mm above the 1 in 100 year event, considering climate change.

The Environment Agency are producing guidance on flood risk for development adjacent to the Manchester Ship Canal. Please contact Planning Liaison at the Environment Agency for the most up to date copy of this guidance.

3.3.4 Reservoirs

As part of a FRA, developers should liaise with Local Authority Emergency Planners to identify potential evacuation measures that should be taken to protect against the unlikely event of a major reservoir breach.

Developers should undertake a zone of search in the vicinity of their site to identify smaller reservoirs such as fishing lodges or mill supply ponds. The FRA should determine the ownership and maintenance regime of the reservoir and undertake a more detailed investigation into the effects of the reservoir overtopping or failing. The developer should then liaise with the LPA and reservoir owner (which may be the Local Authority, United Utilities, Environment Agency (in the case of flood storage reservoirs), other operating bodies or private) to determine applicable emergency planning requirements or mitigation needs. Where there is significant flood hazard identified to the site from such failure, and especially from unmaintained reservoirs, the developer should liaise closely with the LPA about the suitability of the site for development.

3.3.5 Groundwater

Groundwater has been considered as a potential mechanism that could affect risk to a development site, as outlined in the Level 1 SFRA. If a risk of groundwater flooding is found, developers should consult with the LPA and Environment Agency at an early stage as to the next steps. The risk of groundwater flooding should be considered when assessing suitable SUDS techniques at a strategic level.

Groundwater flooding is expected to be a design issue. For example, basements should not be considered in areas at risk of flooding from groundwater rebound or in the floodplain of watercourses where there might be alluvial groundwater flooding.

3.3.6 Sewers

Where the SFRA has identified that there is a risk from surface water flooding, any water that surcharges the sewer system would be expected to follow similar flow paths and pond in similar low spots, although the volume of water that emerges from the system will be entirely dependent on the reason for the network surcharging (which could be due to rainfall beyond the design level of the sewer system, sewer capacity issues or blockage or failure).

Developers should take account of the guidance in section 3.4 and liaise closely with the appropriate Local Authority drainage contact, and in conjunction with United Utilities over any localised sewer flooding problems that could affect the site. Any known sewer flooding locations are prioritised for investment by United Utilities and may be the subject of future investment by the water company.

Future development should be designed so that it does not contribute to existing sewer flooding problems.

3.3.7 Surface Water

Underground drainage systems have a finite capacity and regard should always be given to larger events when the capacity of the network will be exceeded. Hence there is a need to design for exceedance. This should be considered alongside any surface water flows likely to enter a development site from the surrounding area.

Master planning should ensure that existing overland flow paths are retained within the development. As a minimum the developer should investigate, as part of a FRA, the likely depths and extents of surface water flooding on a development site when the surface water mapping produced for the Level 2 SFRA indicates that there is a risk of surface water flooding. This is a precautionary, but an appropriate approach to reduce the risk of flooding to new developments. Green infrastructure should be used wherever possible to

accommodate such flow paths. Floor levels should always be set a minimum of 300mm above adjacent roads to reduce the consequences of any localised flooding.

3.4 Drainage for new developments

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and a consequent potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure. It should be borne in mind that the sewer network in places across the Greater Manchester area was designed to drain less development than exists today. Development (both planned for and urban creep such as windfall development and paving over gardens) has increased the coverage of impermeable surfaces and added flow over time and the network is known to be at capacity in many places. The frequent localised flooding experienced in many parts of Greater Manchester, and Salford in particular in this study area, is testament to this problem.

Managing surface water discharges from new development is therefore crucial in managing and reducing flood risk to new and existing development downstream. Carefully planned development can also play a role in reducing the amount of properties that are directly at risk from surface water flooding. The Planning System has a key role to play in settings standards for sustainable drainage from new developments and ensuring that developments are designed to take account of the risk from surface water flooding. Sustainable drainage plays an important part in reducing flows in the sewer network and in meeting environmental targets, alongside investment in maintenance and new capacity by United Utilities. United Utilities plan their investment on a five year rolling cycle, in consultation with key partners, including the Environment Agency.

Sustainable drainage and the use of Sustainable Drainage Systems (SUDS) is supported by the policy direction in Future Water[8], Making Space for Water[9], the Pitt Review[10] and the Flood and Water Management Act[11] that provides for more sustainable management of the water cycle, working in partnership across different agencies and new responsibilities for local flood risk management. In particular, the Flood and Water Management Act requires developers to include sustainable drainage in new developments. As part of their new responsibility for local flood risk management, local authorities will be responsible for approving SUDS for new developments and adopting and maintaining them.

Recognising the above, **the following order of preference is recommended for drainage from new developments :**

- Infiltration
- Discharge to a watercourse
- Discharge to a public sewer

The choice of system will be determined by local ground conditions (including groundwater levels). Whilst infiltration SUDS may be the most suitable for new development, developers must consider the risk of contamination to underlying aquifers.

The guidance below should be used in addition to the Environment Agency Standing Advice[12].

3.4.1 Critical Drainage Areas

[8] Defra (2008) *Future Water*
[9] Defra, Department for Transport, HM Treasury and Office of the Deputy Prime Minister (2005) *Making Space for water: Taking forward a new Government strategy for flood and coastal erosion risk management in England; First Government response to the autumn 2004 Making space for water consultation exercise*
[10] The Pitt Review (2008) *Learning lessons from the 2007 floods*
[11] Her Majesty's Stationery Office and Queen's Printer of Acts of Parliament (2010) *Flood and Water Management Act* © Crown Copyright
[12] Environment Agency. *Flood Risk Standing Advice for England - PPS25 National Version 2.0. Can be accessed online at http://www.environment-agency.gov.uk/research/planning/82584.aspx*

Certain locations are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. This can be for a number of reasons, including known local flooding problems associated with these areas. These areas have been defined as Critical Drainage Areas (CDAs) in the SFRA. Specific drainage approaches are recommended in these areas to help reduce local flood risk. The SFRA has designated CDAs as high flood risk areas.

The CDAs provided in the SFRA should be refined over time as more detailed information on flood risk and local flood management assets, including sewered catchments, becomes available.

In these areas, a detailed FRA is advised for all developments over 0.5 hectares, regardless of which Flood Zone the site falls within. This should demonstrate that new development is not at risk from flooding from existing drainage systems or potential overland flow routes. It should also demonstrate that the development will not adversely affect existing flooding conditions by the use of appropriate mitigation measures. The FRA should define and address the constraints that will govern the design of the drainage system and layout of the development site.

The Environment Agency Standing Advice allows developers to screen online for the level of flood risk assessment that is appropriate for a development with regard to the PPS25 Flood Zones. This highlights the need for a FRA in Flood Zones 2 and 3 and in Flood Zone 1 where there are critical drainage problems. The Standing Advice notes that for developments in Flood Zone 1 FRA Guidance Note 1[13] should be followed *'In areas where the Local Planning Authority has identified drainage problems through a Strategic Flood Risk Assessment or Surface Water Management Plan and they have indicated that a formal flood risk assessment is required'. FRA Guidance Note 1 requires FRAs to provide 'Proposals for surface water management that aims to not increase, and where practicable reduce the rate of runoff from the site as a result of the development (in accordance with sustainable drainage principles, and the Local Planning Authority's published SFRA).'* It is recommended that proposals for development in Critical Drainage Areas, as defined by this SFRA, follow the guidance set out below

Recommended allowable discharge rates for CDAs and other areas

All development should seek to reduce existing local flooding problems and not add to them. The AGMA authorities are currently developing drainage standards for developments within Critical Drainage Areas and for all other areas. Over time, it is envisaged that local authorities will commission drainage strategies (see below) to determine in more detail, and establish the evidence base for, set reductions in surface water runoff from development sites. These will be used to inform the incorporation of targets and standards in Development Plan Documents, supported by Supplementary Planning Documents, as appropriate.

With regard to this, the developer should liaise closely with the Environment Agency, United Utilities and the LPA as soon as possible to determine an appropriate reduction in runoff rate and volume with reference to discharge limits as laid down by any completed SWMP, drainage strategy or local development document for that area. Minimising surface water run off rates within catchments should be the starting point for negotiations with Developers.

In the interim, and based on the technical work undertaken for the SFRA, the following guidance is provided:

- Development should aim to deliver Greenfield runoff on Greenfield sites up to a 1 in 100 year storm event, considering climate change
- Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, considering climate change

[13] Environment Agency. Flood Risk Assessment (FRA) Guidance Note 1, Development Greater Than 1 Hectare (ha) in Flood Zone 1 (and Critical Drainage areas less than 1ha) Can be accessed online at http://www.environment-agency.gov.uk/static/documents/Research/FRAGuidanceNote1.pdf

- Development should be designed so that there is no flooding to the development in a 1 in 30 year event and so that there is no property flooding in a 1 in 100 year plus climate change event

Wherever possible, this should be achieved through the implementation of SUDS. Source control should be considered first. There may be opportunities to deliver SUDS though integrated solutions for collections of strategic sites. The future ownership and maintenance of SUDS systems should be discussed at the planning application stage with the relevant sections of the LPA (including Highways and Drainage), United Utilities and the Environment Agency. This approach should be taken unless the developer can demonstrate that this is not feasible and that there will be no adverse impact caused by the development elsewhere.

This is supported by Category 4 of the Code for Sustainable Homes, which requires developers to ensure that peak run-off rates and run-off volumes will be no greater than the pre-development conditions as a minimum. However, the code recommends that attenuation of the additional flows caused by development should be related to the degree of flood risk in an area. In 'high flooding risk areas', 100% of the additional volume should be attenuated.[14] Planning Policy Statement 1[15] allows local planning authorities to stipulate high levels of the code where there are local circumstances that allow and warrant it. **The SFRA has designated CDAs as high flood risk areas.**

The effectiveness of a flow management scheme within a single site is heavily limited by site constraints including (but not limited to) topography, geology (soil permeability), development density, existing drainage networks within the site and surrounding area, adoption issues and available area. The design, construction and ongoing maintenance regime of such a scheme must be carefully defined at an early stage and a clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential.

3.4.2 Integrated drainage

There is the potential for groups of development sites coming forward to share a central and integrated solution for managing surface water runoff. This is best investigated further through a SWMP or a Drainage Strategy, which may or may not be undertaken at the same time as a SWMP. A Drainage Strategy can be used to assess:

- A strategy to manage surface runoff from the development sites to control flood risk to drainage or river systems downstream.
- A strategy to manage surface runoff within development sites to manage flood risk within the development site.
- A strategy to manage flood risk in the development site from surface water runoff entering from outside the development site.

A Drainage Strategy undertaken as part of SWMP has the advantages that it is developed in partnership with others, with access to key datasets and knowledge and the opportunity to agree drainage standards, a programme for delivering any infrastructure required and long term maintenance responsibilities. New development can provide a key opportunity to reduce flood risk to existing communities and a SWMP provides the opportunity to take an overview of all local flood risk management issues in an area and plan for a mix of new drainage and retrofit measures[16].

A Drainage Strategy will be required to be prepared by the developer(s) where an integrated solution is necessary, due to issues of land constraints, geology, connection to public sewers and watercourses.

Integrated solutions can provide great benefits besides water management, including providing Green Infrastructure enhancements, recreational facilities, improving biodiversity and making communities a better place to live. Where there are several sites that would

[14] CLG (2006) Code for Sustainable Homes
[15] CLG (2007) Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1
[16] Defra (2010) Surface Water Management Plan Technical Guidance

share a communal facility, such sites may be funded through developer Section 106 or Community Infrastructure Levy payments. Early discussions with the LA and UU are essential.

Drainage Strategies can be particularly useful for considering, recommending the implementation of and long term management arrangements for SUDS and setting appropriate runoff rates from new development. They can be used to support a DPD or SPD as discussed above. A Drainage Strategy would include the timescales for delivering integrated solutions in line with the requirements of PPS12, having considered the delivery programmes of different operating authorities, such as United Utilities and the Environment Agency.

Drainage Strategies should be used to set surface water runoff standards for all developments within a defined drainage catchment, including considering surface water runoff from windfall sites that may come forward.

Recommendations for SWMPs and Drainage Strategies have been made in the Level 2 SFRA.

Consultation with other service areas

Given the cross cutting nature of flooding, it is essential that effective communication protocols and working arrangements at both a District and at a Greater Manchester level are developed and maintained. The linkages between Policy Planning and Development Control are well established, but between Development Control, Emergency Planning and Drainage Engineering they are less so. Engagement with external stakeholders such as the Environment Agency, United Utilities, British Waterways and the Manchester Ship Canal Company, as well as the emergency services, should also be included as appropriate.

It may be useful to consider whether as a condition of planning approval flood evacuation plans should be provided by the developer which aim to safely evacuate people out of flood risk areas, using as few emergency service resources as possible. These plans should detail any prearranged emergency arrangements including dry evacuation routes, flood warning and safe assembly points. It is recommended that any flood evacuation plan written is forwarded onto the Emergency Planning teams within Manchester City, Salford City and Trafford Councils (and where relevant other authorities) as appropriate and the Environment Agency for review. The plan owner must put in place the plan if the development goes ahead, and liaise with the council regarding maintenance and updating of the plan. The Plan should accord with relevant higher level policy and plans, such as national guidance, or any agreed sub-regional or district evacuation plans.

4 Flood Risk Management

4.1 Introduction

Throughout the risk based approach, the need to take a sequential approach when allocating land for development should always be kept in mind and opportunities taken to minimise flood risk at every stage of the planning process. Therefore **mitigation measures should be seen as a last resort to address flood risk issues.**

Mitigation measures must be designed to provide an appropriate level of protection to a site for the lifetime of the development. At many sites it may be technically feasible to mitigate or manage flood risk. **However**, the potential impacts of mitigation measures on flood risk to the surrounding community must always be considered and where the depth of flooding is substantial, these mitigation measures may result in practical constraints to development with significant financial implications.

It may be technically possible to engineer the way out of a flood risk situation but this could increase flood risk elsewhere and/ or have significant negative outcomes for local place-making. The SFRA proves evidence to facilitate the right development in the right place – this means that there are some areas of significant risk where it may not be possible to prove that residential development can be made safe from flooding and where lower vulnerability land uses will need to be considered.

Placemaking needs to be carefully considered when designing development in flood risk areas and the design of buildings should take a risk-based approach i.e. risk does not need to be double-counted for where there is low residual risk. Where there is significant residual risk, residential accommodation (if appropriate) may need to be provided on a first floor basis.

The minimum acceptable standard of protection against flooding for new property within flood risk areas is the 1 in 100 year flood event for fluvial flooding, with an allowance for climate change over the lifetime of the development.

Mitigation measures should be considered on a strategic basis that avoids a piecemeal approach and advocates partnership between the LPA and the Environment Agency and integration with wider Environment Agency flood risk management works and strategies (e.g. River Irwell CFMP, Upper Mersey CFMP and the forthcoming Manchester Strategies).

The hydraulic linkages between the three authorities mean that development or defence works in one authority could have consequences in another authority. This applies not only to Manchester, Salford and Trafford but also in relation to other GM Districts and other neighbouring districts. Work to develop appropriate consultation and operational protocols between local authorities, and potentially between local authorities, the Environment Agency and other stakeholders for such development and works is needed to ensure effective flood risk management and sustainable development.

The SFRA has identified the need for a strategic vision when it comes to managing flood risk to new development in the majority of cases due to the cross boundary nature of flood risk issues with regards to both the site boundaries themselves and on a larger scale the boundaries of each local authority and the Greater Manchester sub-region.

As a summary, taking a strategic approach requires all that are involved in flood risk management to consider:

- Avoidance of development in flood risk areas;
- The sequential approach to site layout, substituting higher vulnerability development in lower flood risk areas and considering flooding from all sources;
- Wherever possible, using open land or green infrastructure to reduce risk, provide compensatory flood storage or serve a sustainable drainage function;

- **Adopting mitigation solutions that fit with the wider vision of the community in managing flood risk. In significant flood risk areas, developers should aim to reduce risk to the wider community;**
- Adopting SUDS;
- Preparing emergency flood plans.

The Level 2 SFRA Section describes the range of planning considerations and mitigation options available and summarises their suitability for the Strategic Locations in the SFRA

Table 4-1 provides links to the evidence in the Level 1 and Level 2 SFRAs, to identify what development could be seen as appropriate with a certain flood risk area and what mitigation measures could potentially be adopted to reduce the level of risk. As above, all mitigation measures should fit in with the wider strategic approach advocated for Strategic Locations, as set out in the Level 2 SFRA and ensure that there is no increase in flood risk elsewhere. A developer should liaise closely the Environment Agency and Local Planning Authority as to what mitigation measures may be suitable.

Table 4-1: Possible Mitigation Measures

SFRA Data Source	Risk Indicators[17]	Appropriate Development	Comments	Possible Local Mitigation (local community, site and plot level)	Possible Strategic Mitigation
Fluvial flooding					
SFRA map series FL For other sources, series GW, MM and SS_4.1 and SS_4.2	Flood Zone 1	EI, WC, HV, MV & LV	All development is permitted within Flood Zone 1; however other sources of flooding should be investigated.	None required for fluvial but may be for other sources	A strategic approach to SUDS where large scale development can reduce flood risk downstream, catchment storage and other sources of flooding as appropriate
	Flood Zone 2 <0.3m depths	EI, WC, HV, MV & LV	Low depth and hazards can be manageable with minor mitigation required	Sequential approach to site layout. Flood resilient design.	Catchment storage
	Flood Zone 3 <0.3m depths	EI, WC, MV & LV	Low depth and hazards can be manageable with minor mitigation required	Sequential approach to site layout. Flood resilient design.	Catchment storage
	Flood Zone 2 >0.3 depths	EI, WC, MV & LV	All development should be designed to remain safe up to the 1 in 100 year event, considering climate change factors; however residual risks (e.g. breach) should be considered where development is afforded protection by flood risk management assets. Development should provide for the	Sequential approach to site layout. Raising floor levels may be a possibility. Compensatory storage should be provided (considering actual risk) where raised defences or land raising remove storage from the floodplain, especially where this would have an adverse effect elsewhere.	Catchment storage

[17] Whilst depth is used here as an indicator of possible mitigation measures, where hazard data exists it should be used in addition when considering appropriate uses and mitigation measures.

SFRA Data Source	Risk Indicators[17]	Appropriate Development	Comments	Possible Local Mitigation (local community, site and plot level)	Possible Strategic Mitigation
			safety of occupants in an extreme event, which may typically be the 1 in 1000 year event.	Resilient design and emergency planning should account for residual risk.	
	Flood Zone 3 0.3–1m depths	EI, WC, MV & LV	Sustainable mitigation and flood risk management may be feasible for both housing and employment purposes. There is a greater likelihood of passing the Exception Test. All development should be designed to remain safe up to the 1 in 100 year event, considering climate change factors; however residual risks (e.g. breach) should be considered where development is afforded protection by flood risk management assets. Development should provide for the safety of occupants in an extreme event, which may typically be the 1 in 1000 year event.	Sequential approach to site layout. A risk based approach should be taken to the setting of Finished Floor Levels as set out in Section 9 of the Level 2 SFRA and in approved SPDs. Compensatory storage should be provided (considering actual risk) where raised defences or land raising remove storage from the floodplain ,especially where this would have an adverse effect elsewhere. Resilient design and emergency planning should account for residual risk. When needed new development should seek to enhance effectiveness of flow routes and allow permeability to the through flow of water (e.g. Salford Overall Growth Point Lower Broughton). This can help enhance Green Infrastructure links.	Catchment storage
	Flood Zone 3 1–1.5m depths	EI, WC & LV	Mitigation is likely to be costly and may not be economically justifiable for low value land uses. Housing allocations are not normally suitable. The likelihood of passing the Exception Test is lower. All development should be designed to remain safe up to the 1 in 100 year event, considering climate change factors; however residual risks (e.g.	Floor level raising for employment purposes is unlikely to be economically viable and employment allocations should be reconsidered in favour of alternative lower risk sites. Compensatory storage should be provided (considering actual risk) where raised defences or land raising remove storage from the floodplain, especially	Catchment storage

SFRA Data Source	Risk Indicators[17]	Appropriate Development	Comments	Possible Local Mitigation (local community, site and plot level)	Possible Strategic Mitigation
			breach) should be considered where development is afforded protection by flood risk management assets. Development should provide for the safety of occupants in an extreme event, which may typically be the 1 in 1000 year event.	where this would have an adverse effect elsewhere. Resilient design and emergency planning should account for residual risk. Opportunities for floodplain and river restoration and/or buffer strips should be investigated.	
	Flood Zone 3 >1.5m depths	None	Flood risk mitigation measures are unlikely to be economically justifiable. Development is unlikely to be sustainable and the likelihood of passing the Exception Test is low.	Comprehensive mitigation schemes would be required including raised defences. Compensatory storage should be provided (considering actual risk) where raised defences or land raising remove storage from the floodplain, especially where this would have an adverse effect elsewhere. Resilient design and emergency planning should account for residual risk. Opportunities for floodplain and river restoration and/or buffer strips should be investigated.	Catchment storage, comprehensive flood mitigation schemes
Surface water flooding					
SFRA map series SS	Surface water susceptibility (high, intermediate and low) Critical Drainage Areas	EI, WC, HV, MV & LV	Although surface water flooding is not likely to directly impact on the spatial allocation of development, it should be considered within site layout. Surface water will also need to be controlled on site.	Opportunities should be sought to open up land were surface water is expected to flow or pool. SUDS should also be adopted to reduce risk on site and to the surrounding community by storing water and managing run-off rates. The additional guidance for developing in CDAs should be considered if appropriate.	A strategic approach to Green Infrastructure and SUDS

SFRA Data Source	Risk Indicators[17]	Appropriate Development	Comments	Possible Local Mitigation (local community, site and plot level)	Possible Strategic Mitigation
Canal flooding					
SFRA map MM_3.2	Overtopping and breach	EI, WC, HV, MV & LV	Flood risk from broad canals is residual, with the exception of the Bridgewater Canal that receives flow from the River Medlock. The upstream part of the canal is likely to be the most heavily affected by the River Medlock; after the canal splits at Stretford the impact will be rapidly reduced as the flood wave dissipates. Although this is not likely to directly impact on the spatial planning of development in the majority of cases, it should influence building design and Finished Floor Levels.	The risk of canal flooding should be part of a FRA with liaison with LPA, EA and British Waterways or The Manchester Ship Canal Company. The risk could be mitigated through increasing the freeboard of proposed development Finished Floor Levels, flood warning and resilience. Raising the awareness of the risk is critical.	Storage/ balancing of flows on the River Medlock to reduce flows passing into the Bridgewater Canal
Reservoir flooding					
SFRA map MM_3.1	Location only	EI, WC, HV, MV & LV	Flood risk from reservoirs is residual. Although this will not directly impact on the spatial planning of development, it should influence site emergency planning. Smaller reservoirs could potentially pose the greatest risk.	The risk of flooding should be assessed as part of the FRA as set out in this User Guide. Smaller reservoirs should be assessed to identify the risk and appropriate mitigation put in place.	Inspection and maintenance of reservoirs (note those over 10,000m^2 are covered by the Flood and Water Management Act, 2010)

SFRA Data Source	Risk Indicators[17]	Appropriate Development	Comments	Possible Local Mitigation (local community, site and plot level)	Possible Strategic Mitigation
Groundwater flooding					
SFRA map series GW	Groundwater flooding mechanism	EI, WC, HV, MV & LV	Groundwater flooding should be treated as a design issue.	It may influence suitable mitigation and sustainable drainage measures.	
EI = Essential Infrastructure, WC = Water Compatible, HV = Highly Vulnerable, MV = More Vulnerable, LV = Less Vulnerable Check with Table D.3 of PPS25 to see if Exception Test is required.					

5 Guidance for Emergency Planners

The aim of this section is to provide guidance on the use of the SFRA by Emergency Planners.

Emergency Planners should use the guidance in this SFRA User Guide, PPS25 and its Practice Guide to:

- ***Update Multi-agency Flood Plans***
  - *Using the overall assessment of flood risk provided in the Level 1 SFRA*
  - *Using the assessment of residual risk in the Level 2 SFRA*
- ***Provide advice on developer Flood Plans for new development***
  - *Using outputs from the Level 1 and Level 2 SFRAs*
- ***Raise awareness of flood risk from all sources***
  - *Using outputs from the Level 1 and Level 2 SFRAs*

5.1 Introduction

This section provides guidance on how Local Authority Emergency Planners can use the outputs of the SFRA to update Multi-agency Flood Plans and provide advice on Flood Plans written by developers for new development.

5.2 Emergency planning overview

Under the Civil Contingencies Act (2004) local authorities are classified as category 1 responders. During an emergency such as a flood event, coordination with other responders (including the emergency services and the Environment Agency) is essential to guarantee the safety of residents. Under the Civil Contingencies Act, the Local Authority holds a statutory duty to provide civil protection to their communities, to ensure human welfare; environmental stability and UK security are not affected. Under the Act, risk assessments and planning are coordinated through Local Resilience Forums (LRF). Greater Manchester's local authorities are represented on the Greater Manchester Resilience Forum (GMRF) by the Chief Executive with lead responsibility in AGMA for civil contingencies, together with the chair of the Local Authority Chief Officers' Civil Contingencies Group.

http://www.agma.gov.uk/greater_manchester_resilience_web/index.html

GMRF's overall purpose is to ensure that there is an appropriate level of preparedness to enable an effective multi-agency response to emergency incidents that may have a significant impact on the communities of Greater Manchester. Strategic decision-making and resource allocation are determined by reference to the Greater Manchester Community Risk Register (CRR), which considers the likelihood and consequences of the most significant risks facing Greater Manchester and the Forum's work is coordinated through an annual strategy and work programme.

The aim of the SFRA so far has been to try to avoid development in flood risk areas in the first instance. However, it has also been accepted that there is current development in flood risk areas and there will need to be a level of continued regeneration. Minimising

flood risk to people, property and the environment should be considered. Flood defences go some way in reducing the current flood risk by providing a standard of protection, however there is still residual risk associated with them as they can be overtopped or be breached. Flood Warnings are an integral part of flood risk management, for which the Environment Agency is the lead authority responsible for warning the public, local authorities and emergency services.

Along with the Environment Agency Flood Warning systems, there are a range of Flood Plans at a sub-regional and local level, outlining the major risk of flooding and the strategic and tactical response framework for key responders. In a major flood requiring strategic coordination these plans would operate under the command and control framework described in the Greater Manchester Generic Response Plan, supported by the Greater Manchester Strategic Multi-Agency Flood Plan.

This SFRA contains useful data to allow emergency planning processes to be tailored to the needs of the area and be specific to the flood risks faced. The detailed maps and GIS layers provided should be made available for consultation by emergency planners during an event and in the planning process.

5.3 Flood Plan Recommendations

The Level 1 and 2 SFRAs provide a number of flood risk data sources that should be used when producing or updating flood plans.

Plans currently in place or under preparation which impact on Manchester, Salford and Trafford include:

- Greater Manchester Multi-Agency Generic Response Plan (2009)
- Environment Agency Flood Warning Plan
- Greater Manchester Strategic Multi-Agency Flood Plan (2009)
- Manchester Multi-Agency Flood Response Plan (2007)[18]
- Salford City Council Multi-Agency Flood Response Plan (not yet finalised), which incorporates Broughton, Lower Kersal and Charlestown Flood Response Plan (2007) [19]
- Trafford Multi-Agency Council Flood Response Plan (DRAFT) [20]
- Multi-Agency Flood Plans (MAFPs) are all produced in line with DEFRA guidance on developing MAFPs.

The data in the SFRA can be used to update these Flood Plans if appropriate and Emergency Planners may wish to use the assessment to help them in considering and understanding the possibility, likelihood and spatial distribution of all sources of flooding, including fluvial, surface water and sewer, man-made bodies of water including canals and reservoirs and groundwater flooding, as discussed in the Level 1 SFRA and associated mapping for the report (Emergency Planners may however have access to more detailed information, such as for Reservoirs, than is contained within the SFRA). This information may support emergency responders in planning for and delivering a proportionate, scalable and flexible response to the level of risk. Relevant sections and maps include:

- Understanding the risk from different sources of flooding (Level 1 SFRA Section 2)
- Flood zone maps - Map FL_1.2
- Flood extent maps including Climate Change - Map FL_1.3 & FL_1.4
- Flood depth maps – Map FL_1.5, FL_1.7, FL_1.8 and FL_1.9
- Flood hazard maps – Map FL_1.6 and FL_1.10

[18] Borough Multi Agency Flood Plans are currently undergoing a Greater Manchester peer review process to ensure they are appropriately aligned with the Greater Manchester Strategic Multi Agency Flood Plan.
[19] Borough Multi Agency Flood Plans are currently undergoing a Greater Manchester peer review process to ensure they are appropriately aligned with the Greater Manchester Strategic Multi Agency Flood Plan.
[20] Borough Multi Agency Flood Plans are currently undergoing a Greater Manchester peer review process to ensure they are appropriately aligned with the Greater Manchester Strategic Multi Agency Flood Plan.

- Consider and understand the residual risk associated with flood risk management infrastructure, including canals, using the information provided in the Level 2 SFRA to develop plans proportionate to the risk posed. Relevant sections and maps include:
- The overtopping or breaching of flood defences - Level 2 SFRA Section 2 and 3, Maps FL_1.1 & FL_1.3 to FL_1.12.
- The overtopping or breaching of Canals – Level 2 SFRA Section 3, Map MM_3.2
- Surface water flooding issues – Level 2 SFRA Section 5, Maps SS_4.1 to SS_4.4

Use the data in the Level 1 and 2 SFRAs to:

- Review the Greater Manchester Community Risk Register (CRR)
- Update Multi-Agency Flood Plans to reflect the above findings and, if appropriate, provide data to support the updating of the Greater Manchester Strategic Multi Agency Flood Plan.
- Consider the need for evacuation plans for existing vulnerable institutions and people in the floodplain and other areas at high flood risk
- Develop appropriate warning and informing strategies
- Consider reviewing and updating safe evacuation routes and access routes for emergency services from any existing area of flood risk to rest centres, avoiding routes that may be flooded

5.4 Planning Approvals – Flood Plans including flood warning

Given the cross cutting nature of flooding, it is essential that effective communication protocols and working arrangements at both a District and at a GM level are developed and maintained between Emergency Planners and Policy Planners/ Development Control officers and Drainage Engineers; external stakeholders such as the emergency services, the Environment Agency, United Utilities, British Waterways and the Manchester Ship Canal Company.

It may be useful to consider whether as a condition of planning approval flood evacuation plans should be provided by the developer which aim to safely evacuate people out of flood risk areas, using as few emergency service resources as possible. These plans should detail any prearranged emergency arrangements including dry evacuation routes, flood warning and safe assembly points. The application of such a condition is likely to require Planning Policy support in LDDs, and discussions with the GMRF are essential to establish the feasibility/ effectiveness of such an approach, prior to it being progressed. It may also be useful to consider how key parts of agreed flood evacuation plans could be incorporated within LDFs, including in terms of protecting evacuation routes and assembly areas from inappropriate development.

It is recommended that any flood evacuation plan written is forwarded onto Manchester City, Salford City and Trafford Councils (and where relevant other authorities) as appropriate and the Environment Agency for review. Planning policy should have regard to flood warning and evacuation plans prepared by Emergency Planners, including the Greater Manchester Strategic Evacuation and Shelter Guidance (DRAFT); district Flood Evacuation Plans should be shared appropriately within Districts and where appropriate with partners. The plan owner must put in place the plan if the development goes ahead, and liaise with the council regarding maintenance and updating of the plan.

According to the PPS25 Practice Guide, flood warning and evacuation plans should include the information highlighted in Table 5-1. The table also provides links to data provided in the Level 1 and 2 SFRAs which should be used to inform their preparation. More detailed analysis should be done within a site-specific FRA that should inform these plans.

Table 5-1: Flood Warning, Evacuation Plans and SFRA Evidence

	SFRA Evidence
How flood warning is to be provided	
Availability of existing flood warning system	SFRA Map FL_1.1
Rate of onset of flooding	Level 2 SFRA animations
How flood warning is given	-
What will be done to protect the development and contents	
How easily damaged items will be relocated	-
The availability of staff/occupants/users to respond to a flood warning	-
The time taken to respond to a flood warning	-
Ensuring Safe occupancy and access to and from the development	
Occupants awareness of the likely frequency and duration of flood events	SFRA Map FL_1.2
Designing and locating safe access routes	SFRA mapping, series FL, MM and SS
Preparing evacuation routes	SFRA mapping, series FL, MM and SS
Identify safe locations for evacuees	SFRA mapping, series FL, MM and SS
Vulnerability of occupants	See PPS25, Table D.2
Expected time taken to re-establish normal use following an event	-

5.5 Flood Awareness

Emergency Planners should also use the outputs from the Level 1 and 2 SFRAs to raise awareness within local communities. This should include raising awareness of measures that people can take to make their homes more resilient to flooding from all sources and encouraging all those at fluvial flood risk to sign up to the Environment Agency's Floodline Warnings Direct service.

Appendix A: Links to relevant data sources

Association of Greater Manchester Authorities AGMA (inc Greater Manchester SFRA)	**www.agma.gov.uk**
British Waterways	**www.britishwaterways.co.uk**
Catchment Flood Management Plans for the NW	**www.environment-agency.gov.uk/research/planning/114513.aspx**
Construction Industry Research and Information Association (CIRIA)	**www.ciria.org**
Climate Change Action Plan for the North West	**www.climatechangenorthwest.co.uk**
Defra	**www.defra.gov.uk**
Department of Communities and Local Government: Planning Policy	**www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/**
Environment Agency	**www.environment-agency.gov.uk**
EU Floods Directive	**http://ec.europa.eu/environment/water/flood_risk/index.htm**
Flood and Water Management Act	**http://www.opsi.gov.uk/acts/acts2010/pdf/ukpga_20100029_en.pdf**
Flood Risk Regs	**www.opsi.gov.uk/si/si2009/uksi_20093042_en_1**
Flood Risk Standing Advice	**www.environment-agency.gov.uk/research/planning/33098.aspx**
Future Water	**www.defra.gov.uk/environment/quality/water/strategy/index.htm**
Green Infrastructure North West	**www.greeninfrastructurenw.co.uk**
Greater Manchester Resilience Forum	**www.agma.gov.uk/greater_manchester_resilience_web/index.html**
Improving Surface Water Drainage	**www.defra.gov.uk/environment/flooding/manage/surfacewater/index.htm**
Making Space for Water	**http://www.defra.gov.uk/environment/flooding/policy/strategy/index.htm**
Manchester City Council	**www.manchester.gov.uk**
Manchester Ship Canal Company	**www.shipcanal.co.uk/**
North West of England Plan Regional Spatial Strategy to 2021	**www.4nw.org.uk**

North West River Basin Plan	**http://wfdconsultation.environment-agency.gov.uk/wfdcms/en/northwest/Intro.aspx**
Planning Policy Statement 25	**www.communities.gov.uk/publications/planningandbuilding/pps25floodrisk**
Regional Flood Risk Appraisal – 4 North West	**www.4nw.org.uk/whatwedo/issues/environment/?page_id=485**
RIBA: Designing for Flood Risk	**www.architecture.com/FindOutAbout/SustainabilityandclimatechangeFlooding/DesignGuide.aspx**
Salford City Council	**www.salford.gov.uk**
The Government Response to the Pitt Review	**www.defra.gov.uk/environment/flooding/documents/risk/govtresptopitt.pdf**
The Pitt Review	**http://archive.cabinetoffice.gov.uk/pittreview/thepittreview.html**
Trafford Council	**www.trafford.gov.uk**
United Utilities	**www.unitedutilities.com/**
Water Framework Directive	**http://ec.europa.eu/environment/water/water-framework/index_en.html**