

## Development in Rotherham Regeneration Area

### Flood Risk Toolkit

#### FLOOD RISK TOOLKIT

Introduction

How to Use Guide

Level 2 Strategic Flood Risk Assessment

Sequential Approach Guide

Design Guidance

Large Scale Plans

April 2011

## Development in Rotherham Regeneration Area

### Flood Risk Toolkit

#### Introduction

## FLOOD RISK TOOLKIT

Introduction

How to Use Guide

Level 2 Strategic Flood Risk Assessment

Sequential Approach Guide

Design Guidance

Large Scale Plans

April 2011



## Contents

<b>1</b>	<b>Introduction</b>	<b>1 - 1</b>
1.1	Development and Flood Risk in Rotherham	1 - 1
1.2	The Flood Risk Toolkit	1 - 2
1.3	Structure of the Flood Risk Toolkit	1 - 3
<b>2</b>	<b>Background</b>	<b>1 - 5</b>
2.1	Flooding History	1 - 5
2.2	Flood Studies	1 - 5
2.3	Surface Water Flooding	1 - 5
<b>3</b>	<b>Rotherham Renaissance Flood Alleviation Scheme</b>	<b>1 - 6</b>
3.1	Objective	1 - 6
3.2	Stand Alone	1 - 6
3.3	Phasing	1 - 6
3.4	Works completed to date	1 - 6
3.5	Next works to be implemented	1 - 7
3.6	Overall Effects of RRFAS on Flood Levels	1 - 7
3.7	Future Development	1 - 7
<b>4</b>	<b>The Flood Risk Toolkit</b>	<b>1 - 8</b>
4.1	Objectives for Flood Risk Toolkit	1 - 8
4.2	Application of the Flood Risk Toolkit	1 - 8

## Table of Figures

Figure 1	– Rotherham Regeneration Area.	1 - 1
Figure 2	– Flood Risk Management Hierarchy. (PPS 25, 2010)	1 - 2
Figure 3	– Content of the Flood Risk Toolkit	1 - 3

**This page is intentionally left blank.**

# 1 Introduction

## 1.1 Development and Flood Risk in Rotherham

Rotherham Metropolitan Borough Council (RMBC) in partnership with the Environment Agency, have made considerable progress in adopting their risk based approach to flood risk management, in parallel with establishing its regeneration plans, for riverside areas in Rotherham. They have defined the Rotherham Regeneration and Flood Alleviation Area which is referred to as the 'Rotherham Regeneration Area' throughout. The extent of this area is shown in Figure 1.

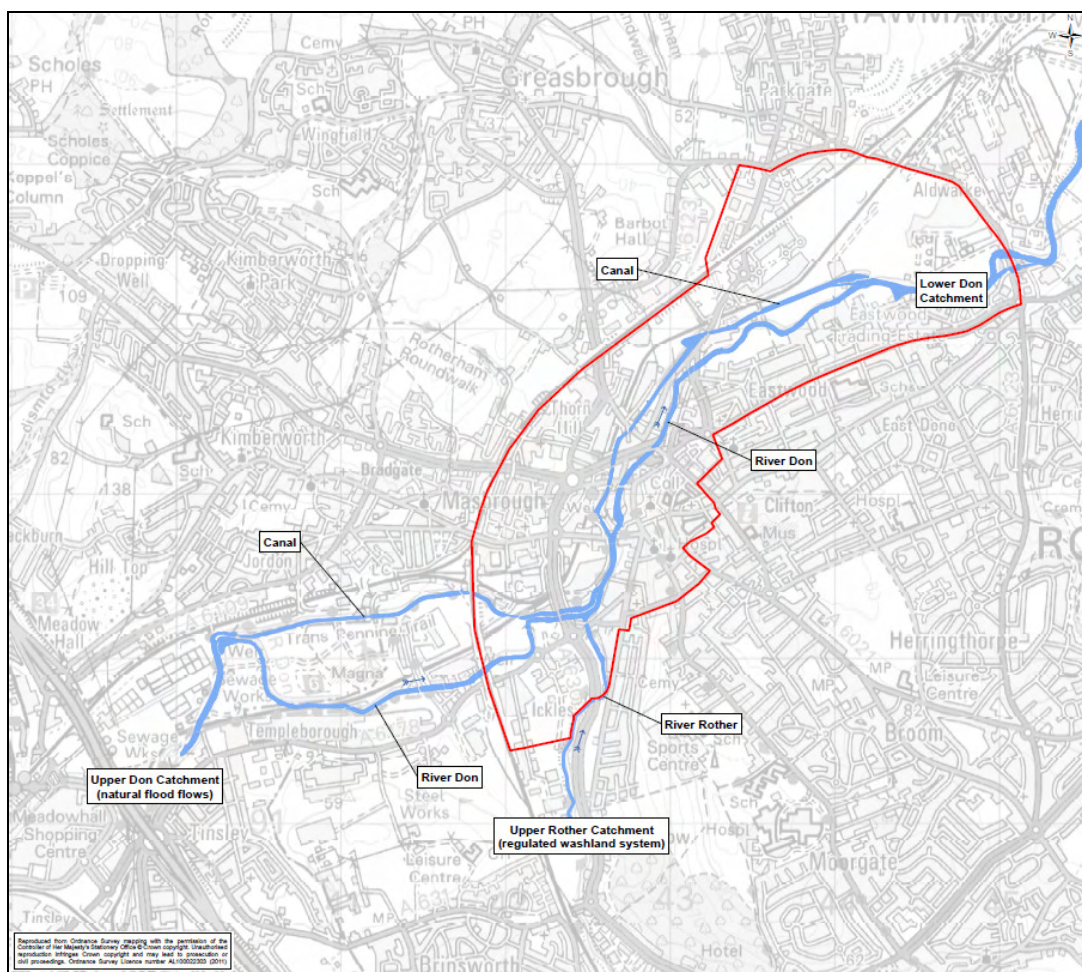


Figure 1 – Rotherham Regeneration Area. (Extract from Section 6: Large Scale Plans)

The policy approach to delivering appropriate sustainable development, taking account of flood risk, is set out in Planning Policy Statement 25: Development and Flood Risk<sup>1</sup> (PPS 25).

<sup>1</sup> Planning Policy Statement 25: Development and Flood Risk. Communities and Local Government, March 2010

The aim of these policies is to manage flood risk through the planning system by avoiding inappropriate development in flood risk areas. The approach adopted requires flood risk to be taken into account, in accordance with the flood risk management hierarchy.

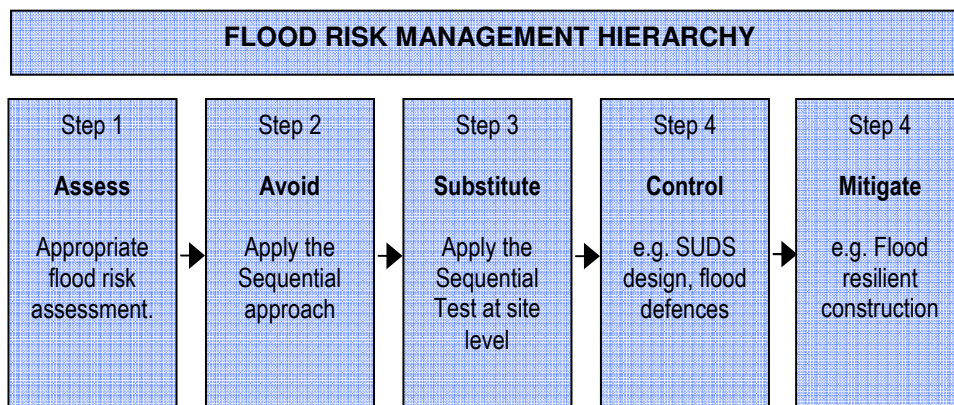


Figure 2 – Flood Risk Management Hierarchy<sup>2</sup>. (PPS 25, 2010)

With reference to Figure 2, the documents within the Flood Risk Toolkit will show the existing flood risk has been assessed (Step 1); that a sequential approach for the Rotherham Regeneration Area has been developed (Step 2); and that a community wide flood alleviation scheme developed (Step 4).

This does not mean that any development in the Rotherham Regeneration Area can proceed. Each development within the area will be subject to a site specific Sequential Test (Step 3) and need to demonstrate how the flood risks associated with the site have been mitigated in the design (Step 5).

## 1.2 The Flood Risk Toolkit

The primary objective of the documents within the Flood Risk Toolkit is to assist in the production and assessment of planning applications within the Rotherham Regeneration Area.

This Flood Risk Toolkit has been compiled to justify the approach by communicating the significant amount of study that has been done; record significant decisions that have been made; and share the knowledge that has been gained with others. Its production has come about through RMBC and the Environment Agency working together in partnership.

<sup>2</sup> Planning Policy Statement 25: Development and Flood Risk. Communities and Local Government, March 2010

### 1.3 Structure of the Flood Risk Toolkit

The Flood Risk Toolkit brings together a series of individual documents that are relevant to development planning in the Rotherham Regeneration Area as shown in Figure 3.

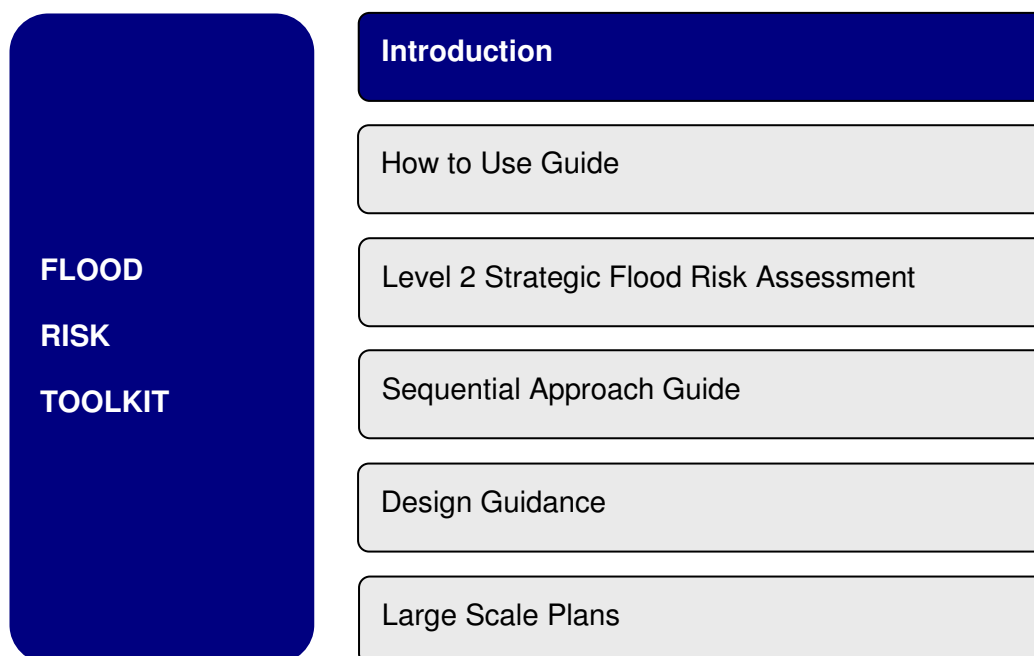


Figure 3 – Content of the Flood Risk Toolkit

*Section 1* introduces the Flood Risk Toolkit and sets out the background about how it came to be and where it should be used. It conveys the historical context and shows how management of flood risk has developed in Rotherham.

*Section 2* includes instructions on how to use the Flood Risk Toolkit and directs the reader to key information contained in various sections of the Flood Risk Toolkit. It includes a checklist to compile the relevant information about a development site. This helps developers collate the information needed to complete a Flood Risk Assessment to support a planning application.

RMBC have undertaken a Level 2 Strategic Flood Risk Assessment (SFRA2). This is included in *Section 3*. This assessment has provided information about the probability of flooding, depth, velocity and onset of flooding. It has enabled identification of flood risks, the causes of flooding and mitigation measures for areas within the Rotherham Regeneration Area. It provides the information required to allow the PPS25 Sequential and Exception Tests to be applied and completed.

*Section 4* contains the Sequential Approach guide. The sequential approach requires Local Planning Authorities (LPA's) to demonstrate that there are no reasonably available sites in areas of low flood probability that would be appropriate to the type of development for the land use proposed. This section shows how land use allocations have been made to meet wider development drivers. This means that developments in Flood Zones 2 and 3 have passed the Strategic Sequential Approach. It explains how the Sequential Test needs to be completed for each site to demonstrate that there is no alternative site at lower flood risk within the Rotherham Regeneration Area.



Design Guidance for new developments and flood defence works in the Rotherham Regeneration Area is presented in *Section 5*. This defines technical requirements for flood defence structures, methods for dealing with surface water, advice on riverside access and river edge treatments, information about climate change adaptations and flood resilience measures.

A series of plans and maps are included in subsequent sections of the Flood Risk Toolkit to enable reproduction for inclusion in Flood Risk Assessments in the Rotherham Regeneration Area. The following Large Scale Plans listed below are also included in Section 6 for reference:

Figure Reference	Title	What the Figure Shows
Figure 4	Rotherham Regeneration Area	This plan shows the boundary of the study area and the 9 Character Areas and some of the key development areas.
Figure 5	Topography of the Study Area	This shows the topography of the study area.
Figure 6	Fluvial Flood Risk Zones for Rotherham Town Centre Character Areas	This shows the current level of flood risk across the study area, based on PPS 25 flood risk zones.
Figure 7	Modelled Flood Zone 3 Areas - Flood Depths	This shows the depth of river flooding which would occur during a 1% AEP (1 in 100 annual chance) flood event.
Figure 8	Modelled Flood Zone 3 - Fluvial Flood Risk Hazard	This shows the level of hazard that flooding from rivers would cause in the study area.
Figure 9	Rotherham Town Centre Surface Water Flood Risk By Character Area	This shows the level of surface water flood risk.
Figure 10	Surface Water Flood Depths in High Risk Flood Zones	This shows the depth of surface water flooding which would occur during a 1% AEP (1 in 100 annual chance) flood event.
Figure 11	Surface Water Flood Risk Hazard in High Risk Flood Zones	This shows the level of hazard that flooding from surface water would cause in the study area.
Figure 13	Modelled Reduction in Flood Risk with the Rotherham Renaissance Flood Alleviation Scheme in Place	This shows the level of flood risk with the RRFAS constructed based on the PPS 25 Flood Risk Zones.
Figure 14	Fluvial Breach Hazard of RRFAS – 1% Annual Probability	This models the impact if a breach in flood defences occurred once they are completed.
Figure 15	Flood Depth to Defence Breaching – 1% Annual Probability	This shows the depth of flood water if a breach occurred.

## 2 Background

### 2.1 Flooding History

Flood events in November 2000 and June 2007 demonstrated the scale of flood risk in Rotherham and the consequences of flooding in the Town Centre and the surrounding neighbourhoods. The 2007 event was the more severe event and affected key transport infrastructure; emergency control centres; civic and community facilities; key utility infrastructure; and more than one hundred commercial, industrial and retail properties.

Rotherham has development goals for the town that are centred around the rivers. Their vision is to transform the image of the town to prosperity by stimulating activity and increasing the sense of security through regeneration. The floods affected key locations targeted for redevelopment and regeneration to provide business and economic opportunities that are fundamental to the function of the whole Borough.

**Flooding threatens both the existing economy and the future potential for regeneration to improve the economy of Rotherham. It is essential that flood risk management is incorporated into any regeneration plans for Rotherham.**

### 2.2 Flood Studies

Since November 2000, RMBC, in partnership with Environment Agency, have undertaken studies to define flood risk and identify flood risk management solutions for Rotherham. This included detailed hydrological and hydraulic modelling to fully identify the flood risk, followed by technical, environmental and economic appraisal of alternative options to manage flood risk.

**These studies concluded that a community wide Rotherham Renaissance Flood Alleviation Scheme (RRFAS) is required to reduce the risk of flooding from the rivers in Rotherham to an appropriate level.**

### 2.3 Surface Water Flooding

Having established the flood risk from the rivers, the risk associated with surface water flooding has been evaluated. This has shown that surface water flooding is also a significant issue in Rotherham.

**Both fluvial (river) flooding and surface water flooding are significant issues in Rotherham that need to be taken into account when planning and permitting development.**

## 3 Rotherham Renaissance Flood Alleviation Scheme

### 3.1 Objective

The objectives of the Rotherham Renaissance Flood Alleviation Scheme (RRFAS) are to:

- *Protect existing infrastructure and businesses;*
- *Protect proposed new development;*
- *Improve access to riverside areas;*
- *Provide a consistent standard of protection in the town; and*
- *Take climate change into account in the design.*

The extent of RRFAS is shown in Figure 4 of the Design Guidance (Section 5 of the Flood Risk Toolkit).

**Once fully completed, the RRFAS will protect from river flooding up to a 1% Annual Exceedance Probability (AEP) event, (1 in 100 annual chance) by providing continuous protection from Magna in Templeborough to Frank Price Lock (near Parkside Retail Park).**

### 3.2 Stand Alone

Given the partnership approach (between RMBC and Environment Agency) and the detailed extent of studies carried out, it has been agreed that RRFAS is delivered as a 'stand alone' project to mitigate flood risk in Rotherham. RRFAS needs to be implemented to achieve regeneration and it is compatible with the Environment Agency's catchment wide flood risk management plans.

**As a 'stand alone' scheme the RRFAS can be implemented in advance of emerging catchment wide studies being undertaken by the Environment Agency.**

### 3.3 Phasing

The interrelationship between the RRFAS and development has meant that funding and implementation can only be achieved through a multi-agency, phased approach. Private investment will be needed to complete development of defences at key riverside sites. It has been acknowledged and accepted that RRFAS cannot provide its full benefits until all phases are complete.

**Works will be implemented in phases as funds become available. The RRFAS cannot provide its full benefits until all phases are complete.**

### 3.4 Works completed to date

Phase 1 of the RRFAS was completed in 2008. It provides protection from river flooding up to a 1% AEP (1 in 100 annual chance) event from Magna to Centenary Way in Templeborough. These works were funded by RMBC, Yorkshire Forward and European Union (Objective 1). Phase 1 delivered 2.3km of new defences; created compensatory floodplain and urban wetland; improved river flow during flood events, though raising and removal of bridges; improved access to the riverside; and flood proofed a railway bridge.

In 2010, funding from RMBC and the Yorkshire Regional Flood Defence Committee (YRFDC) facilitated the removal of Don Bridge. This redundant bridge presented a major obstruction to flood flows and its removal reduced flood levels (from the 2005 baseline) by 600mm immediately upstream of Don Bridge, by 0.3m to 0.6m at Rotherham Lock and by up to 0.3m at the former Guest and Chrimes site.

### 3.5 Next works to be implemented

A short isolated section of the scheme between the Tesco footbridge and the bus station on the south side of the River Don has received planning permission. Construction is planned during 2011. When complete, this will protect a busy part of the town centre and a key emergency escape route to high ground.

### 3.6 Overall Effects of RRFAS on Flood Levels

Modelling has shown that the provision of compensatory floodplain and removal of bridge obstructions has significantly reduced flood levels below the pre-scheme baseline (i.e. 2005). Implementation of subsequent work phases will incrementally increase flood levels, however, modelling also shows that when the RRFAS is fully complete, these levels will not exceed the 2005 baseline levels.

**The overall effect of RRFAS is to create a net reduction in flood levels and hence reduce the overall flood risk in Rotherham.**

### 3.7 Future Development

The RRFAS has addressed the consequences of containing the river within defences and loss of floodplain for the whole RRFAS. It has been agreed for developments within Rotherham Regeneration Area that no further compensatory floodplain is required, provided the development is compatible with the technical requirements of RRFAS. How this can be achieved is defined in greater detail in the Design Guidance (Section 5 of the Flood Risk Toolkit).

**Any further development works in the Rotherham Regeneration Area, or any further flood alleviation scheme phases, will not need to provide any compensatory floodplain, provided that they are compliant with the technical requirements of RRFAS set out in the Design Guidance.**

The long term nature of the RRFAS and development plans has required that certain policies and practices be established to ensure that neither are undermined. This has been done by developing this Flood Risk Toolkit. In time this will be incorporated in the emerging LDF as Supplementary Planning Documents (SPD) and will be supported by relevant policies in the emerging Core Strategy.

**In the interim, the Flood Risk Toolkit will be a best practice approach until it is formally adopted as SPD.**

The aims of this Flood Risk Toolkit for Rotherham will ensure that:

- *Flood risk is not increased by future development;*
- *New developments are consistent with the technical requirements of RRFAS;*
- *Site specific Flood Risk Assessments are produced using a uniform approach;*
- *Developers provide appropriate information in planning applications; and*
- *Regeneration efforts can precede giving Rotherham a new lease of life.*

#### 4.1 Objectives for Flood Risk Toolkit

The Flood Risk Toolkit:

- *Is a package of information to use in preparing a Flood Risk Assessment to support a planning application for sites in the Rotherham Regeneration Area;*
- *Includes data that allows the flood risk of individual sites in the Rotherham Regeneration Area to be consistently assessed;*
- *Provides all the reference documentation to use to demonstrate that flood risk has been taken into account for planned development;*
- *Provides a means by which regeneration can progress alongside implementation of flood risk management measures in the town;*
- *Is a means to ensure new developments are safe, from the impacts of flooding in terms of resilience, access and egress;*
- *Enables development to proceed without increasing flood risk in adjacent areas;*
- *Enables flood risk assessment for each development site to mitigate the risks within the site; and*
- *Is a vehicle by which RMBC can control and manage development in the Rotherham Regeneration Area to prevent the principles of RRFAS from being undermined.*

#### 4.2 Application of the Flood Risk Toolkit

The Flood Risk Toolkit has been developed for use in assessing the risk of flooding from rivers and surface water for sites within the Rotherham Regeneration Area. It is intended to assist developers in demonstrating flood risk has been taken into account at each development site.

Failure to use the Flood Risk Toolkit may result in delay or refusal of planning consent.

**It is expected that planning applications for sites within the Rotherham Regeneration Area are supported by a Flood Risk Assessment that has been prepared with reference to the Flood Risk Toolkit.**

## Development in Rotherham Regeneration Area

### Flood Risk Toolkit

#### How to Use Guide

# FLOOD RISK TOOLKIT

Introduction

**How to Use Guide**

Level 2 Strategic Flood Risk Assessment

Sequential Approach Guide

Design Guidance

Large Scale Plans

April 2011



## Contents

<b>1</b>	<b>How to Use Guide</b>	<b>2 - 1</b>
1.1	Purpose of the How to Use Guide	2 - 1
1.2	Application of Planning Policy Statement 25: Development and Flood Risk.	2 - 1
1.3	Rotherham Regeneration Area Flood Risk Checklist	2 - 2
<b>2</b>	<b>Step by Step Approach</b>	<b>2 - 3</b>

**Appendix A Rotherham Regeneration Area Flood Risk Checklist Appendix A**

### Table of Figures

Figure 1 – Content of the Flood Risk Toolkit	2 - 1
Figure 2 – Flood Risk Management Hierarchy	2 - 2



**This page is intentionally left blank.**

# 1 How to Use Guide

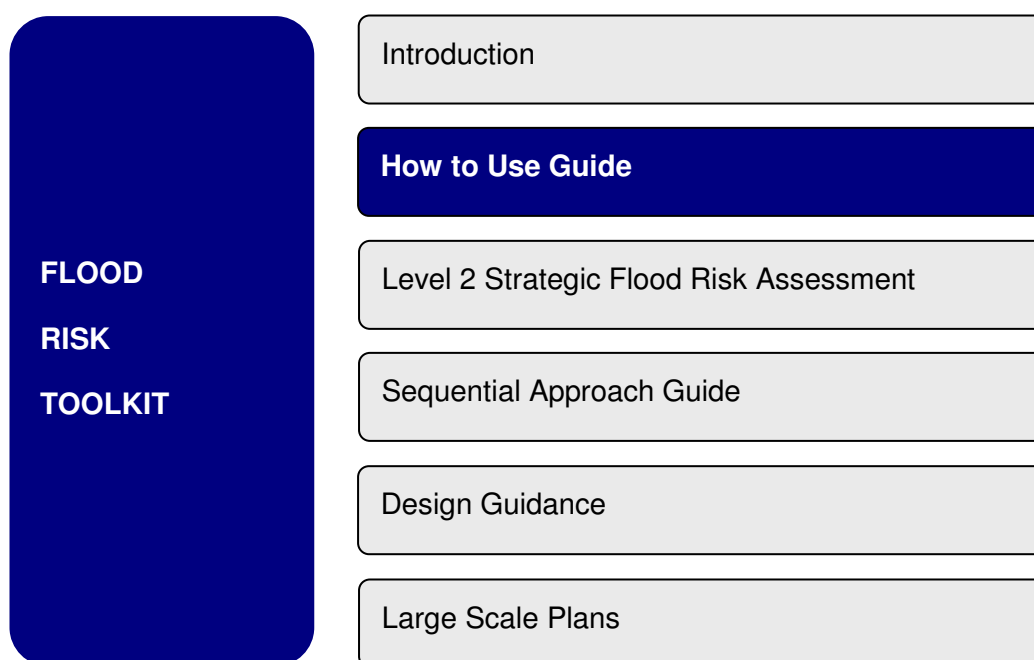
## 1.1 Purpose of the How to Use Guide

The How to Use Guide is part of the Flood Risk Toolkit, as shown in Figure 1. It explains how it is to be used to assess flood risk for proposed development sites within the Rotherham Regeneration Area.

It aims to guide the user through the process of Flood Risk Assessment and identify the relevant information in the Flood Risk Toolkit. It can be used by developers, their consultants, the Local Planning Authority (LPA) and the Environment Agency in assessing and determining the applications for planned development.

## 1.2 Application of Planning Policy Statement 25: Development and Flood Risk.

The Flood Risk Toolkit approach refers to Planning Policy Statement 25 (PPS 25)<sup>1</sup>. It sets out how PPS 25 is applied to the Rotherham Regeneration Area. The benefit is that all developers can use the data in the Toolkit consistently to produce a PPS 25 compliant Flood Risk Assessment (FRA).



**Figure 1 - Content of the Flood Risk Toolkit**

Firstly, the How to Use Guide will confirm whether the Flood Risk Toolkit applies to the proposed development site. If the Flood Risk Toolkit does apply, the “How to Use Guide” will set out the steps in the Flood Risk Management Hierarchy, as shown in Figure 2.

<sup>1</sup> Planning Policy Statement 25: Development and Flood Risk. Communities and Local Government. March 2010:

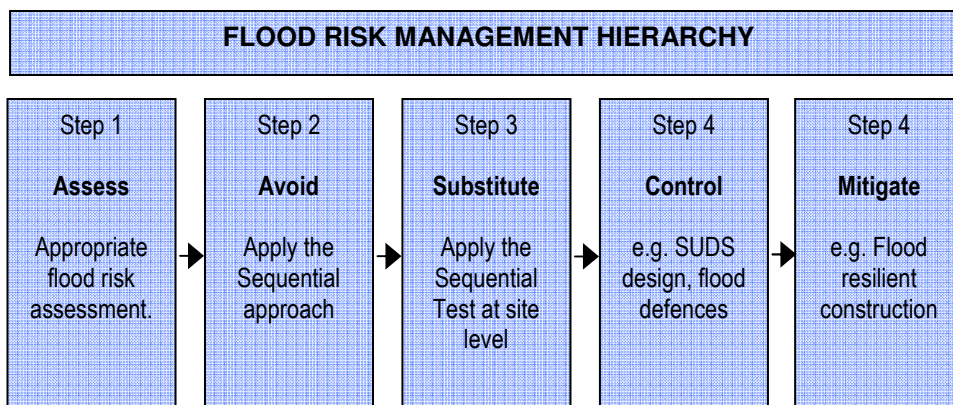


Figure 2 – Flood Risk Management Hierarchy

### 1.3 Rotherham Regeneration Area Flood Risk Checklist

A checklist is provided to compile the relevant information about each development site. This checklist is appended to the How to Use Guide. Including this checklist as supporting documentation to an FRA will help the LPA to review the submission.

By using the Flood Risk Toolkit and the checklist in this guide you will:

- *Be directed to the relevant information for the site;*
- *Be able to demonstrate the compatibility of the development with the flood risk;*
- *Demonstrate there are no reasonably available alternative sites with lower flood risk for the proposed development;*
- *Show how the layout and nature of the development has been influenced by flood risk;*
- *Determine the design standards to be adopted to control flood risk;*
- *Identify any measures needed to mitigate flood risk; and*
- *Explain and confirm how flood risk is not increased elsewhere.*

The checklist is a useful means of compiling the relevant information about the development site and record how flood risk has been taken into account. The checklist directs you to the relevant information within the Flood Risk Toolkit. The following chapter sets out a series of steps to take to complete the form.

## 2 Step by Step Approach

**To Start: Take a copy of the blank Checklist.**

**Part 1** of the checklist relates to the Flood Risk at the site and whether the Toolkit is applicable.

- Step 1:** Complete the site details; including the site name, the area of the site in hectares and a brief description of the proposed development. It will also be helpful to attach a location plan of the site.
- Step 2:** Refer to Figure 4 of the Level 2 Strategic Flood Risk Assessment (SFRA 2) (Section 3 of the Flood Risk Toolkit) to determine the Character Area the site is situated. If the site lies in one of the Character Areas, then it will pass the Strategic Sequential Approach.
- If the site does not lie in one of these character areas then this Toolkit does **not** apply.
- If the Toolkit does **not** apply, please refer to PPS 25 and liaise with the LPA officer to confirm whether a planning application and a FRA are required for the proposed development.
- Step 3:** Refer to Figure 6 of SFRA2 to identify the Flood Risk Zone in which the site is located. If the site has more than one Flood Zone, please state what percentage of the site lies in each zone.
- If the development is located in Flood Zone 1 and its area does not exceed one hectare, then a FRA is **not** required and the Flood Risk Toolkit does not apply (end of assessment). Liaise with the LPA officer to confirm what information the need to provide along with a planning application.
- Step 4:** Refer to Figure 9 of SFRA2 to determine the level of surface water flood risk at the site. If the site has more than one risk category, please state what percentage of the site lies in each category.
- Step 5:** Refer to Table 1 of the Sequential Approach Guide (Section 4 of the Flood Risk Toolkit) to determine the vulnerability classification of the proposed development. Please describe how the development fits the selected classification.
- Step 6:** Refer to Annex C of PPS 25 to see a list of different types of flooding. It will be necessary to check if other types of flooding are present at the site using other information sources. The SFRA2 has only focused on flooding from rivers and surface water, so further searches and enquiries will be required to identify these.
- Step 7:** Based on the information found, describe how flooding will occur at the site. For example, where will it come from and what will cause it.

**Step 8:** Describe the existing surface water and drainage arrangements at the site. Refer to an existing plan and append this to the Flood Risk Toolkit checklist.

**Step 9:** Summarise the flood risk, in terms of severity, at the site. This should be based on information in the SFRA2 and the assessments done in the previous steps.

**Part 2** of the checklist determines whether the development needs to follow the Sequential Approach, if it passes a site specific Sequential Test and the extent of information required in the FRA.

**Step 10:** Indicate whether the development is an extension or refurbishment of an existing business or industrial development within the existing site boundary.

If so, then the sequential approach is **not** required. An FRA **will** still need to be completed if the development lies in Flood Zone 2 or 3, or if it exceeds one hectare in Flood Zone 1.

**Step 11:** Having established at Step 2 and Step 10 that the Toolkit **applies** to the site and that it has passed the **strategic sequential approach**. Now it is necessary to assess whether the development can pass a **site specific Sequential Test**.

Refer to Chapter 2 and Appendix A of the Sequential Approach Guide (Section 4 of the Flood Risk Toolkit) to assess if there are any alternative sites. Record what considerations have been made to locate the development in another part of the Rotherham Regeneration Area that has a lower flood risk. Each of the character areas has been assessed for suitability based on land use, flood risk and future development plans.

Explain and justify demonstrate why the development needs to be in the proposed location to pass the Sequential Test.

**Step 12:** Find out whether the vulnerability classification of the development (see Step 5) and the Flood Risk Zone (see Step 3) indicate whether the development can be permitted in terms of river flooding.

(Table D.3 from Annex D of PPS 25 is reproduced on the checklist. Please circle the result for the development.)

**Step 13:** Find out whether the vulnerability classification of the development (see Step 5) and the surface water flood risk (see Step 4) indicate whether the development can be permitted.

(Table 4 from the Sequential Approach Guide is reproduced on the checklist.) Please circle the result for the development.

**Step 14:** The previous two steps define flood risk issues at the proposed development site within the Rotherham Regeneration Area. Tick the appropriate box to show whether development can be permitted or not (in terms of flood risk), or whether it will be necessary to pass an Exception Test.

This will also show which aspect of flooding is most significant to the development and consider whether to pursue the initial proposals or whether to make changes to the layout and design of the site in order to control and mitigate flood risk to the satisfaction of the LPA.

Having got to this stage it is advisable to undertake further liaison with the LPA to confirm correct interpretation the data and reached appropriate conclusions.

**Part 3** of the Checklist is concerned whether the site control mitigates flood risk, and demonstrates that flood risk is not increased.

- Step 15:** Please state how the layout and siting of the development takes account of flood risk issues at the site. Please attach the proposed layout plan. For example, landscaping or car parking in high risk areas and allowing evacuation routes in medium/low risk areas.
- Step 16:** How does the development meet the technical requirements of the Design Guidance (Section 5 of the Flood Risk Toolkit). Confirm that:
- a) The alignment of any flood risk management infrastructure or raised land is no nearer the river than shown in Figure 4 of the Design Guidance in Section 5 of the Flood Risk Toolkit, and,
  - b) It will not prevent the future implementation of the Rotherham Renaissance Flood Alleviation Scheme.
- Step 17:** What flood risk mitigation measures have been incorporated into the proposed development? Describe how the location, height, level and type of these measures have been determined.
- Step 18:** How have buildings and access routes been designed to make them safe when flooding occurs?
- Step 19:** Please provide details of the data, calculations and assumptions that were used and any further analysis undertaken in assessment of flood risk.
- Step 20:** Please state how run off from the development is to be dealt with. Please confirm that Sustainable Drainage Systems (SUDs) have been considered and describe their application in this development.
- Step 21:** Describe the flood related risks that will remain after implementation of the measures to protect the site from flooding.
- Step 22:** Describe how, and by whom, these residual risks will be managed over the lifetime of the development
- Step 23:** If an Exception Test was required for this development, describe how this has been achieved. The criteria are set out in PPS 25 Annex D, paragraph 9.

**This page is intentionally left blank.**

**Appendix A Rotherham Regeneration Area Flood Risk Checklist**

--



**This page is intentionally left blank.**

**Rotherham Regeneration Area Flood Risk Toolkit  
FRA Checklist**

**Part 1 – Flood Risk**

**Step 1: Site Details**

Name/ Address		Area (ha)	
---------------	--	-----------	--

Development Description

.

*Please attach location plan of the site and a National Grid Reference for the centre of the site.*

**Step 2: Character Area**

Character Area (tick)	1		2		3		Other	
	4		5		6		The Flood Risk Toolkit <b>does not</b> apply	
	7		8		9			
<i>Refer to SFRA 2 Figure 4</i>	The site has <b>passed</b> the Strategic Sequential Approach							

**Step 3: Flood Risk from Rivers**

Zone	1	2	3
%			
	The site is at <b>LOW</b> risk of flooding	<b>Use the Flood Risk Toolkit to produce a FRA</b>	

*Refer to SFRA 2 Figure 6*

**Step 4: Flood Risk from Surface Water**

	High	Medium	Low
<i>Refer to SFRA 2 Figure 9</i>			

**Step 5: Vulnerability Classification**

Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable

*Refer to PPS 25, Annex D Table D.2*

**Step 6: Other sources of Flooding**

Groundwater	Sewers	Reservoirs	Canals	Other sources

*Refer to PPS 25 Annex C*

**Rotherham Regeneration Area Flood Risk Toolkit  
FRA Checklist**

**Step 7: Mechanism of Flooding**

With reference to the FRA describe how flooding will occur at the site

**Step 8: Existing Surface Water and Drainage arrangements at the Site**

Describe the existing surface water and drainage arrangements at the Site

**Step 9: Flood Risk Summary**

Describe the flood risk at the site based on information in the SFRA and other assessments of the site.

## Rotherham Regeneration Area Flood Risk Toolkit FRA Checklist

### Part 2 – Sequential Approach and Site Specific Sequential Test

#### Step 10: Sequential Approach

Is the proposal an extension or refurbishment of an existing business/ industrial development within the existing site boundary, which is not a change of use?	Yes	No
	Sequential Approach is <b>not Required</b>	Sequential Approach <b>Required</b>

#### Step 11: Site Specific Sequential Test

Are there any other sites, within the Regeneration Area, with lower flood risk that could accommodate this development?

Yes	No
-----	----

The Site Specific Sequential Test has **not** been passed and development will **not** be permitted

Please elaborate on the considerations and reasons why the Site Specific Sequential Test has been passed for the proposed development – see the Sequential Approach Guide (Section 4 of the Flood Risk Toolkit).

#### Step 12: Flood Risk Zone Vulnerability and Development Compatibility

<i>Please circle</i>		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
<b>Flood Zone</b>	<b>Zone 1</b>	Development Permitted	Development Permitted	Development Permitted	Development Permitted	Development Permitted
	<b>Zone 2</b>	Development Permitted	Development Permitted	Exception Test Required	Development Permitted	Development Permitted
	<b>Zone 3a</b>	Exception Test Required	Development Permitted	Development not Permitted	Exception Test Required	Development Permitted
	<b>Zone 3b</b>	Exception Test Required	Development Permitted	Development not Permitted	Development not Permitted	Development not Permitted

Refer to Table D.3 Annex D PPS 25

**Rotherham Regeneration Area Flood Risk Toolkit  
FRA Checklist**

**Step 13: Surface Water Flood Risk Vulnerability and Development Compatibility**

<i>Please circle</i>		<b>Essential Infrastructure</b>	<b>Water Compatible</b>	<b>Highly Vulnerable</b>	<b>More Vulnerable</b>	<b>Less Vulnerable</b>
<b>Flood Zone</b>	<b>Low</b>	Development Permitted	Development Permitted	Development Permitted	Development Permitted	Development Permitted
	<b>Medium</b>	Development Permitted	Development Permitted	Exception Test Required	Development Permitted	Development Permitted
	<b>High</b>	Exception Test Required	Development Permitted	Development not Permitted	Exception Test Required	Development Permitted

*Refer to Table 4 of The Sequential Approach Guide*

**Step 14: Going forward**

Is Development permitted in terms of flood risk vulnerability? (tick)	Yes		No		Exception Test Required	
---	-----	--	----	--	-------------------------	--

**Part 3 – Flood Risk Control and Mitigation Measures**

**Step 15: Development Layout**

Please state how the layout and siting of the development takes account of flood risk issues at the site.

*Please attach the proposed layout plan*

**Step 16: Application of the Design Guide**

How does the development meet the requirements of the Design Guide in terms of future implementation of the Rotherham Renaissance Flood Alleviation Scheme?

Please elaborate on how the development proposals ensure that:

- a) The alignment of any flood risk management infrastructure or raised land is no nearer the river than shown in Figure 4 of the Design Guidance in Section 5 of the Flood Risk Toolkit, and,
- b) It will not prevent the future implementation of the Rotherham Renaissance Flood Alleviation Scheme.

## Rotherham Regeneration Area Flood Risk Toolkit FRA Checklist

### **Step 17: Mitigation Measures**

What flood risk mitigation measures have been incorporated into the proposed development?

### **Step 18: Access and Evacuation Routes**

How have buildings and access routes been designed to make them safe when flooding occurs?

### **Step 19: Technical Assessments**

Please provide details of the modelling data, calculations and assumptions and any further analysis undertaken in the assessment of flood risk.

**Rotherham Regeneration Area Flood Risk Toolkit**  
**FRA Checklist**

**Step 17: Mitigation Measures**

Please state how runoff from the development is to be dealt with. Please confirm that Sustainable Drainage Systems (SUDs) have been considered and describe their application in this development.

**Step 21: Residual Risks**

Describe the flood related risks that will remain after implementation of the measures to protect the site from flooding.

**Step 22: Long-term Responsibility**

Describe how, and by whom, these residual risks be managed over the lifetime of the development

**Step 23: The Exception Test**

If an Exception Test was required for this development, describe how this has been achieved

*Refer to PPS 25 Annex D, Paragraph 9.*

## Development in Rotherham Regeneration Area

### Flood Risk Toolkit

#### Level 2 Strategic Flood Risk Assessment

#### FLOOD RISK TOOLKIT

Introduction

How to Use Guide

**Level 2 Strategic Flood Risk Assessment**

Sequential Approach Guide

Design Guidance

Large Scale Plans

April 2011





## Contents

<b>Non Technical Summary</b>	<b>3 – NTS1</b>
<b>1 Introduction</b>	<b>3 – 1</b>
1.1 Rotherham Regeneration Area	3 – 1
1.2 Strategic Flood Risk Assessments	3 – 1
1.3 Report Structure	3 – 1
1.4 Supporting Figures and What They Show	3 – 2
<b>2 National Planning Policy</b>	<b>3 – 3</b>
2.1 National Planning Policy	3 – 3
2.1.1 PPS 25: Development and Flood Risk	3 – 3
2.1.2 PPS 1A: Planning for Climate Change	3 – 4
2.1.3 PPS 4: Planning for Sustainable Economic Development	3 – 4
2.1.4 PPS 12: Local Spatial Planning	3 – 5
2.1.5 Flood Water Management Bill	3 – 5
<b>3 SFRA 2 Approach and Methodology</b>	<b>3 – 7</b>
3.1 SFRA 2 Methodology	3 – 7
<b>4 Baseline Position in the Town Centre</b>	<b>3 – 8</b>
4.1 Topography, Watercourses and Sewers	3 – 8
4.2 Previous Flood Events	3 – 9
4.3 Current Flood Risk in Rotherham Town Centre	3 – 9
4.3.1 Assessing Fluvial Flood Risk	3 – 10
4.3.2 Assessing Surface Water Flood Risk	3 – 14
4.3.3 Summary of Flood Risk	3 – 19
<b>5 Flood Risk with RRFAS in Place</b>	<b>3 – 20</b>
5.1 Rotherham Renaissance Flood Alleviation Scheme (RRFAS)	3 – 20
5.2 How the RRFAS Reduces Flood Risk	3 – 21
5.3 Phased Implementation of RRFAS Phase 2	3 – 22
<b>6 Residual Risks With RRFAS in Place</b>	<b>3 – 25</b>
6.1 Assessment of Residual Flood Risk	3 – 25
6.1.1 Overtopping of Defences	3 – 25
6.1.2 Assessment for Overtopping Scenarios	3 – 26
6.1.3 Breaching of Defences	3 – 26
6.1.4 Assessment for Breach Scenarios	3 – 27
6.2 Mitigating Residual Flood Risk	3 – 27
6.2.1 Flood Release Mechanisms	3 – 28
6.2.2 Resilience Advice	3 – 28
6.3 Climate Change Adaptation	3 – 29
<b>7 Conclusions</b>	<b>3 – 32</b>

## Table of Figures

- Figure 1 – Rotherham Regeneration Area
- Figure 2 – Content of the Flood Risk Toolkit
- Figure 3 – Flood Risk Management Hierarchy
- Figure 4 – Rotherham Regeneration Area
- Figure 5 – Topography of the Study Area
- Figure 6 – Fluvial Flood Risk Zones for Rotherham Town Centre Character Areas
- Figure 7 – Modelled Flood Zone 3 Areas
- Figure 8 – Modelled Flood Zone 3 - Fluvial Flood Risk Hazard
- Figure 9 – Rotherham Town Centre Surface Water Flood Risk By Character Area
- Figure 10 – Surface Water Flood Depths in High Risk Flood Zones
- Figure 11 – Surface Water Flood Risk Hazard in High Risk Flood Zones
- Figure 12 – Rotherham Renaissance Flood Alleviation Scheme
- Figure 13 – Modelled Reduction in Flood Risk with the Rotherham Renaissance Flood Alleviation Scheme in Place
- Figure 14 – Fluvial Breach Hazard of RRFAS – 1% Annual Probability
- Figure 15 – Flood Depth to Defence Breaching – 1% Annual Probability

## List of Tables

- Table 1 Non Technical Summary – Rotherham Character Areas
- Table 2 Non Technical Summary – Description of Each Character Area within the Rotherham Regeneration Area and Current Fluvial Flood Risk
- Table 3 Non Technical Summary – Description of Each Character Area within the Rotherham Regeneration Area and Current Surface Flood Risk
- Table 4 – Figures to support the assessment and what they show
- Table 5 – PPS 25 Key Principles
- Table 6 – Assessing Fluvial Flood Risk
- Table 7 – Assessing Surface Water Flood Risk
- Table 8 – Flood Risk in Each Character Area
- Table 9 – River Channelisation
- Table 10 – The Probability of Various Flood Events

# Non Technical Summary

## Introduction

This Level 2 Strategic Flood Risk Assessment (SFRA 2) is one of the documents making up the Flood Risk Toolkit for the Rotherham Regeneration Area, the extents of which are shown in Figure 1.

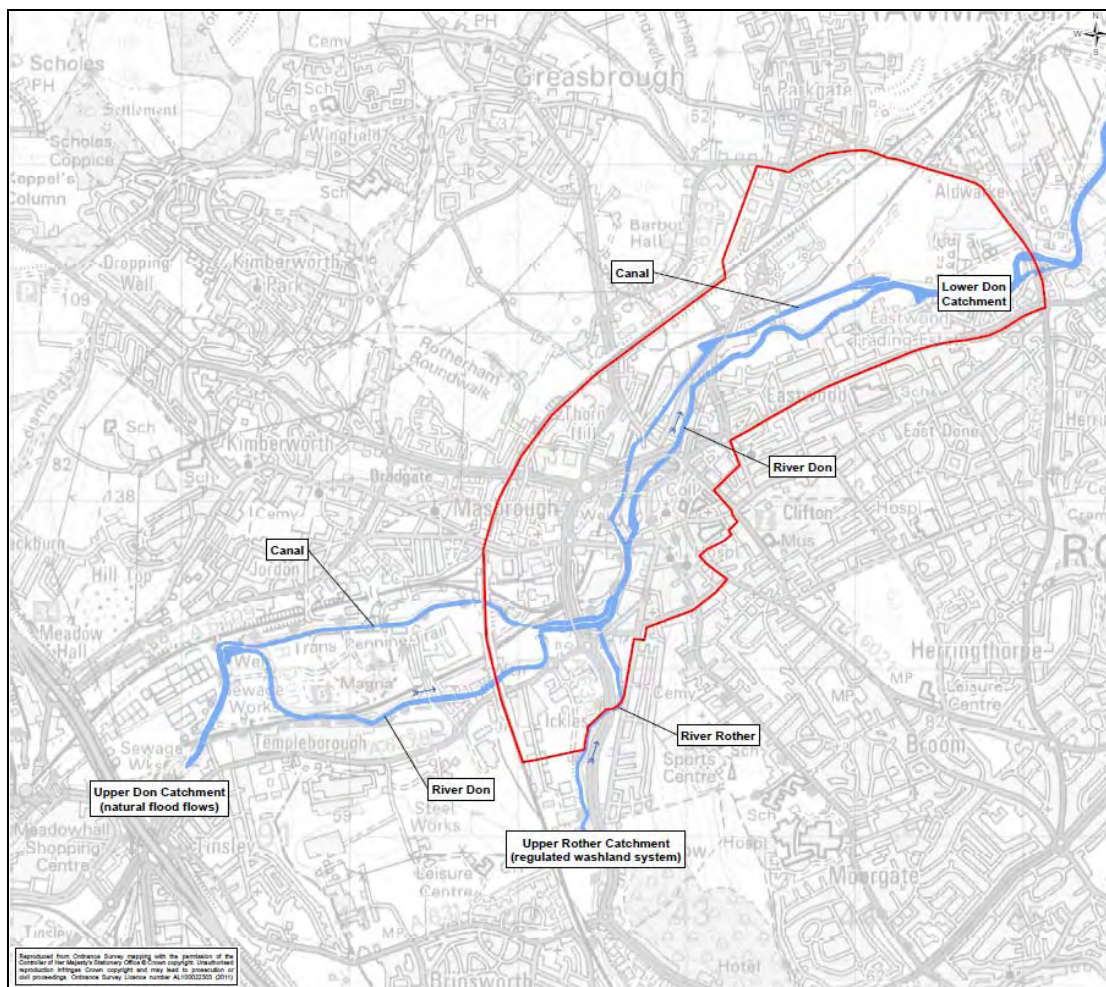


Figure 1 – Rotherham Regeneration Area

This SFRA 2 forms Section 3 of the Flood Risk Toolkit (Figure 2). The Flood Risk Toolkit refers to Planning Policy Statement 25 (PPS 25)<sup>1</sup>. It sets out how PPS 25 is applied to the Rotherham Regeneration Area. The benefit is that all developers can use the data in the Toolkit consistently to produce a PPS 25 compliant Flood Risk Assessment (FRA).

<sup>1</sup> Planning Policy Statement 25: Development and Flood Risk. Communities and Local Government. March 2010:

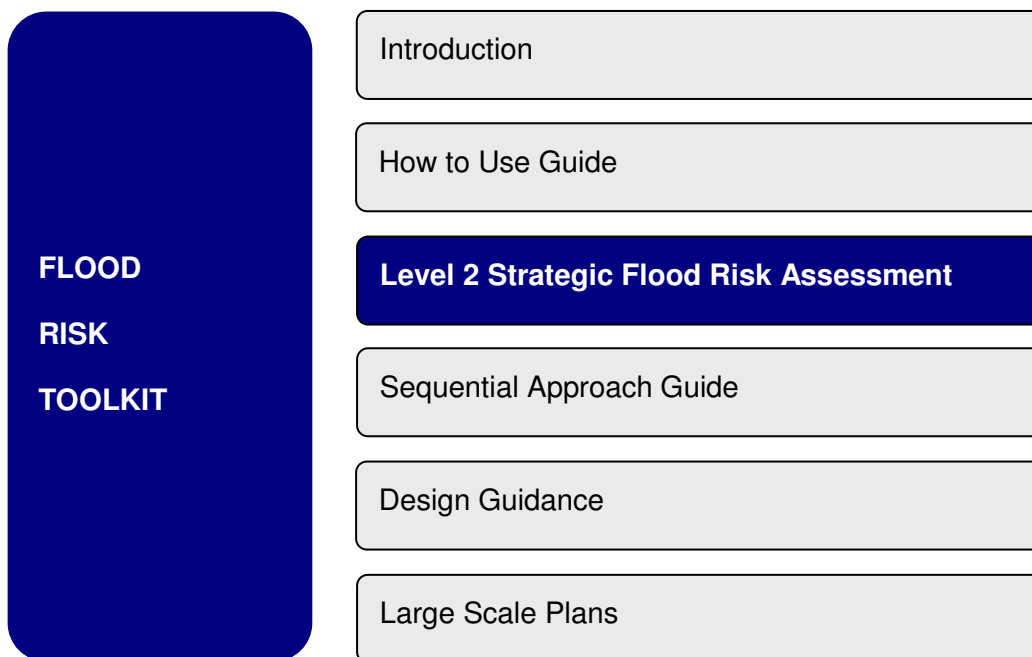


Figure 2 – Content of the Flood Risk Toolkit

The SFRA 2 provides information to complete Step 1 of the flood risk management hierarchy, as shown in Figure 3.

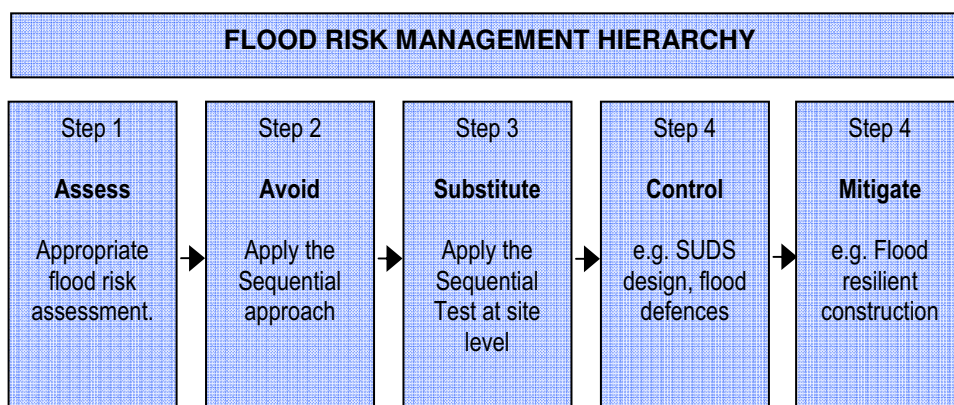


Figure 3 – Flood Risk Management Hierarchy<sup>2</sup>

### The Purpose of SFRA 2

National guidance in Planning Policy Statement 25: Development and Flood Risk (PPS 25)<sup>3</sup> is clear that Local Planning Authorities must take into account the potential for flood risk, and plan for the possible impacts of climate change, when making decisions. Strategic Flood Risk Assessment (SFRA) is the assessment mechanism to do this.

<sup>2</sup> Planning Policy Statement 25: Development and Flood Risk. Communities and Local Government. March 2010:

<sup>3</sup> Communities and Local Government, PPS 25 Development and Flood Risk, 29<sup>th</sup> March, 2010

The Level 1 Strategic Flood Risk Assessment (SFRA 1) already completed in 2008 provided a 'high level overview' of flood risk in Rotherham. This identified that parts of the Rotherham Regeneration Area are at a medium to high risk of river and surface water flooding.

The emerging LDF Core Strategy Vision for the Town Centre is to 'Transform the Town Centre'. The physical renaissance and development of the riverside is a critical aspect of this Vision, as well as achieving a greatly enhanced function for the Town Centre.

**Emerging Core Strategy Vision for Rotherham Town Centre – Transforming Rotherham Town Centre**

*An overview of the ten Renaissance Goals are:*

1. *Make the river and the canal a key part of the town's future;*
2. *Populate the town's centre by creating good quality living;*
3. *Place Rotherham within a sustainable landscape setting of the highest quality;*
4. *Put Rotherham at the centre of a public transport network;*
5. *Improve parts of major road infrastructure;*
6. *Make Forge Island a major new piece of the town centre;*
7. *Establish a new civic focus that not only promotes a more open and accessible type of governance but also embraces culture and the arts;*
8. *Demand the best in architecture, urban design and public spaces for Rotherham;*
9. *Improve community access to health, education and promote social well being;*
10. *Create a broadly based, dynamic local economy with a vibrant town centre as its focus.*











Given the importance of this area to the function and goals of the Borough, further assessment is required beyond SFRA 1 to identify, more specifically the cause, risk and measures to mitigate and reduce the risk from flooding. The subsequent assessment, SFRA 2 must be capable of providing information to allow the PPS 25 Sequential and Exceptions Tests to be completed and provide information on flood probability, depth, velocity and the onset of flooding.

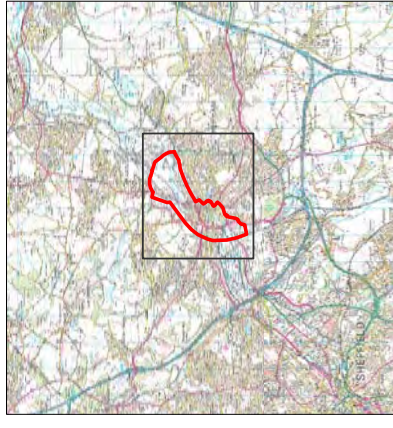
The focus on flood risk is particularly aligned to the regeneration aspirations of the Council, especially to reinvigorate the Town Centre economy which is integral to the future success of the whole Borough. The regeneration of the Town Centre is at the heart of the emerging Core Strategy to 'Transform the Town Centre'. A specific strategic objective is investing in the regeneration of former heavy industrialised land and other key development sites adjacent to the River Don.

The SFRA 2 has been undertaken for the Centre of Rotherham which will be defined as the Rotherham Regeneration Area in the emerging Core Strategy. It is proposed that this area will be divided into nine specific Character Areas; these are described in Table 1 and illustrated in Figure 4.

**FIGURE 4**

**Legend**

-  Rotherham Regeneration Area
-  Character Area Boundary
-  Developed Areas, Referred to in the Report, Affected by Flood Risk
-  Potential Development Sites
-  Railway Station
-  Bus Station
-  Railway
-  A Road
-  Main River
-  Canal



Rev	Date	Purpose of revision	AD	PG	MM	DD
0	JAPR 2011		Drawn	Checked	Revised	Approved

**JACOBS**  
 1 City Walk, Leeds, LS11 9QX, UK  
 Tel: +44(0)113 242 8771 Fax: +44(0)113 389 1389  
 www.jacobs.com

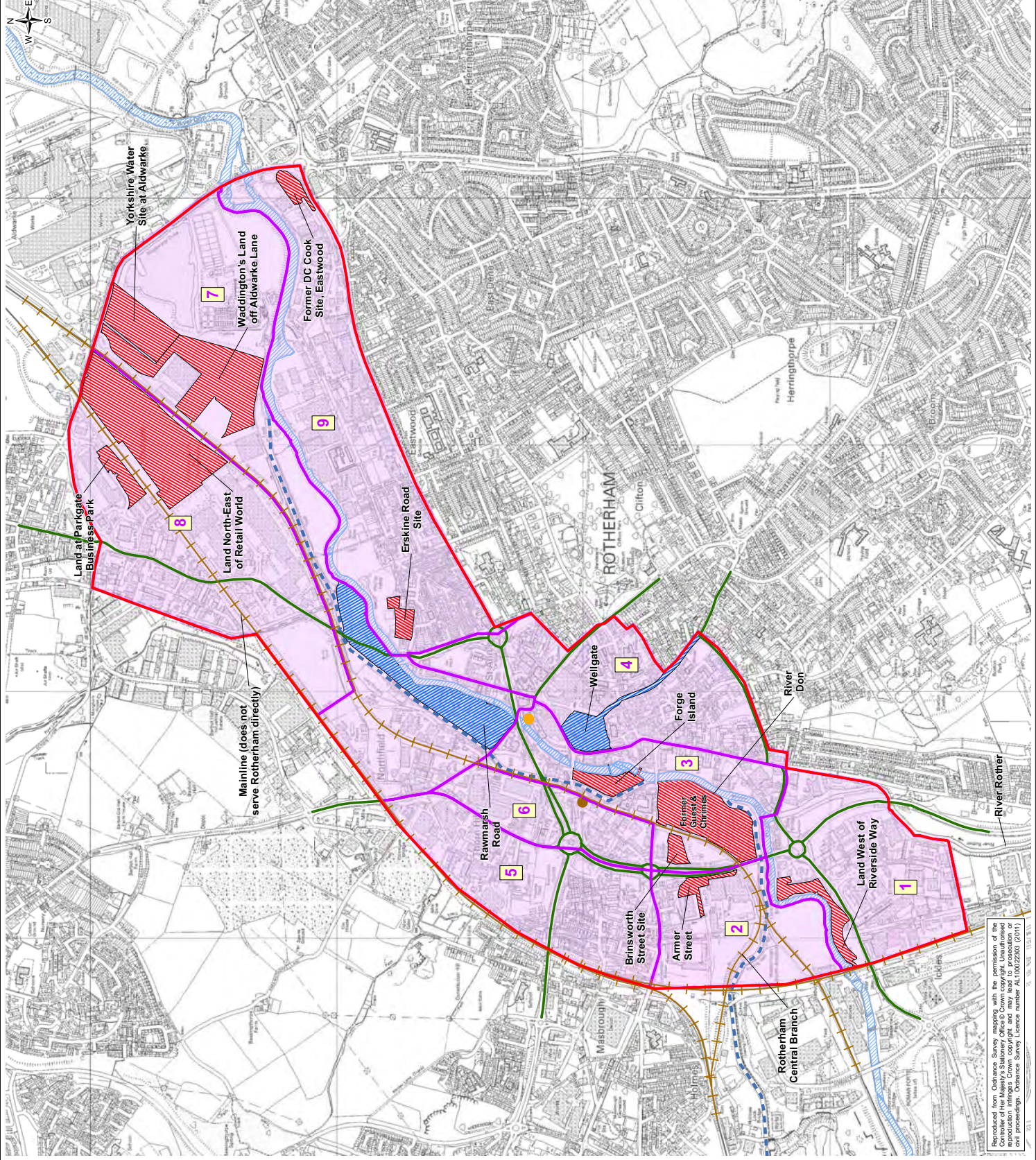
**MAR**  
 Client  
**Rotherham Metropolitan Borough Council**  
 Bakers House, Ravenshoe Road,  
 Rotherham, S60 1TD

Project  
**ROTHERHAM SFRA 2**

Drawing Title  
**ROTHERHAM TOWN CENTRE RENAISSANCE  
 BOUNDARY - CHARACTER AREAS AND KEY SITES**

Drawing Status	FINAL	DO NOT SCALE
Scale @A3	1:15,000	
Jacobs No.	B1486900	
Client No.		
Drawing No.	B1486900_SFRA_04.mxd	

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined in this drawing. Refer to the contract for full terms and conditions.  
 P:\B0000000\B0486900 - TRFAS Phase 2\GIS\Output\SFRA\B1486900\_SFRA\_04.mxd



Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL10002203 (2011)

	Description	Boundary	Current Land Uses
1	Bradmarsh and Templeborough	South of River Don and Rother Confluence/ Enterprise Park.	Office/ Industrial
2	Masborough West of Centenary Way	South of Masborough Street, north of Sheffield Road, west of Centenary Way.	Industrial
3	Central Riverside Area	West, North and East of the River Don, East of Centenary Way.	Vacant and degraded land/ Redevelopment Sites
4	Town Centre	Town Centre Core - East of Westgate, Corporation Street and Effingham Street.	Main Town Centre Uses (retail, Council offices)
5	Masborough – Thornhill	North of Masborough Street, West of Greasborough Street, South of Greasborough Road.	Industrial/ Housing
6	College Street	Area to the North of Main Street, West of the Railway Line, East of Centenary Way and Greasborough Street.	Industrial
7	Northfield	East of Greasbrough Road, West of Effingham Street, South and North of the Rotherham Canal as far as Blackwater Dyke, Aldwarke	Retail/ Industrial/ Offices/Development Sites
8	Parkgate Retail Park	Area around Northfield Road, north of Effingham Street and north of the River Rother including development land at Parkgate.	Retail/Development Sites
9	Eastwood	North of Erskine Road and Chesterton Road and South of the River Rother including Eastwood Trading Estate.	Offices/ Industrial/Housing

**Table 1 Non Technical Summary – Rotherham Character Areas**

The SFRA 2 provides the following information on flood risk for each Character Area:

- *The existing flood risk using the PPS 25 flood risk zones;*
- *Where the Town Centre is affected by surface water flood risk;*
- *Flood depths and the potential level of hazard flooding causes;*
- *How flood risk will be reduced as a result of the implementation Rotherham Renaissance Flood Alleviation Scheme (RRFAS);*
- *What the ‘residual’ flood risks are with river defences in place should for any reason these fail in the future; and*
- *A ‘level playing field’, as it is a consistent basis for developers and regulators to assess and determine flood risk from river and surface water flooding at a specific site.*



## **A Comprehensive Approach to Flood Risk in Rotherham**

Since the significant flood event in 2000, Rotherham Metropolitan Borough Council (RMBC) along with the Environment Agency, has been working on a coordinated response to flooding including:

- *Being a leading local authority in tackling flood risk as recognised in the PPS 25 Good Practice Guidance<sup>4</sup>;*
- *Completing a Borough wide Level 1 Strategic Flood Risk Assessment in 2008;*
- *Delivering an award winning £15 million first phase of the Rotherham Renaissance Flood Alleviation Scheme (RRFAS), which includes the installation of flood release mechanisms to release flood water should overtopping of the defences occur;*
- *Creating a new area of functional flood plain and urban wetland at Centenary Riverside; and*
- *Removing Don Bridge to prevent obstructions to flood flows and therefore reduce flood levels.*

Some of the key benefits of the above are:

- *The area upstream of Templeborough is protected and therefore flood risk is reduced. This has attracted new investment on a number of development sites in close proximity to the Town Centre. It also protects major infrastructure in this area, in particular transport access into the Town Centre;*
- *The combination of Centenary Riverside and the removal of Don Bridge compensates for any floodplain lost as a result of development in the Town Centre. The Environment Agency has agreed that if new development is designed to be fully compatible with RRFAS, then individual development sites in flood risk areas of the Rotherham Regeneration Area will not need to create their own on-site compensatory floodplain (thus maximising the developable area in each site);*
- *The works constructed set the requirements in terms of the levels of defences for the next phase of the scheme through the Town Centre. This will extend the scheme from Templeborough (near the Magna Centre), to Frank Price Lock just downstream of Parkgate Retail Park; and*
- *The fully completed scheme will provide protection from river flooding up to a 1% AEP (1 in 100 annual chance) event throughout this area.*

The next phase of the RRFAS will be delivered incrementally as development on sites occurs and funding from other sources becomes available. In some cases, the protection of specific sites by the RRFAS will give rise to a wider benefit in that it will then protect the whole flood cell (these are areas where the extent of flooding can be clearly defined). However, the full flood risk protection benefits of the scheme will only occur once it is fully completed.

The implementation of the complete RRFAS would mean the majority of the Rotherham Regeneration Area would effectively be reduced to the equivalent of Flood Zone 2 under the PPS 25 classifications. This shows how significant the scheme is to reducing overall flood risk.

<sup>4</sup> Department of Communities and Local Government, PPS 25 Development and Flood Risk Practice Guide, Updated December 2009

## Who Should Use This Document and Why

This document should be used by all agencies when planning for new development within the boundary of the Rotherham Regeneration Area (see Figure 1). The SFRA 2 should be used by developers to determine:

- *Whether the development they are proposing is affected by flood risk and the level of risk this poses (The SFRA 2 also enables a comparison to be made with the National Flood Risk Maps, produced by the Environment Agency);*
- *The type of flooding which could occur and the depth and level of hazard which this could cause;*
- *How flood risk would be reduced with the RRFAS in place;*
- *What the residual flood risk remain with RRFAS in place. This is because even with defences in place, flooding could still occur if overtopping or a breach of these defences occurred; and*
- *The level of flood risk and potential issues to take into account when making decisions on development proposals and options for development sites. In particular, where a site is within Flood Zone 2 or 3, the Sequential Approach Guidance and Design Guidance should be referred to evaluate how flood risk will need to be assessed and mitigated when proposing to develop a site.*

## Summary of the SFRA 2

The methodology is consistent with PPS 25 and also reflects the specific local objectives for the SFRA 2 set out above. The approach has been agreed internally within RMBC including the Planning Policy, Development Management, Regeneration and Drainage Teams. The document has been completed following discussions at the outset with the Environment Agency and further meetings during the assessment process to agree the approach to modelling flood risk.

The physical characteristics of the Rotherham Regeneration Area creates problems specific to the area, as both the South Yorkshire Navigation and the railway act as natural low lying flow routes. This means water can travel a considerable distance away from the original source of flooding. The SFRA 2 has modelled these characteristics as it is based on a specific flood risk model for the Town Centre undertaken to develop RRFAS in 2003. The exception to this is in Character Area 7, 8 and 9 as the model did not extend to this area. For these Character Areas, the National Flood Maps completed by the Environment Agency have been used. Additional locally specific flood risk modelling on Surface Water Flood Risk and Breach and Overtopping has been completed as part of the SFRA 2.

Bringing together the different types of flood modelling into one single document in the SFRA 2 should make it simpler for organisations to demonstrate and address key planning tests on flooding when submitting planning applications. The SFRA 2 provides a level playing field for baseline information on the current level of flood risk<sup>5</sup>.

<sup>5</sup> See Figure 2.5 of the PPS 25 Practice Guide. This is a flow chart of how flood risk should be taken into account when determining planning applications and the role of regulators.

In terms of modelling flood risk at specific development sites the following principles have been agreed with the Environment Agency:

- *The Environment Agency flood maps should be used as the starting point when considering flood risk. However, where the 2003 RRFAS model is available, this can be used as the basis for determining the current level of flood risk;*
- *Centenary Riverside provides compensatory flood plain for the Rotherham Regeneration Area and provides a widened river channel during times of flood;*
- *The completion of the removal of Don Bridge, combined with the Centenary Riverside works, are considered to be substantive enough to enable development of subsequent individual development sites in the river corridor to be undertaken without the need for their owners to create on-site compensatory floodplain;*
- *The protocol for maintaining RRFAS is set out in the Design Guidance; and*
- *The precise tie in points between different sections of Phase 2 of RRFAS will be decided on a case by case basis as the scheme progresses.*

When considering site specific Flood Risk Assessments, the baseline water levels in the river channel should be taken as prior to any construction works on RRFAS commencing i.e. the conditions that were present at the end of 2005.

### **Current Flood Risk**

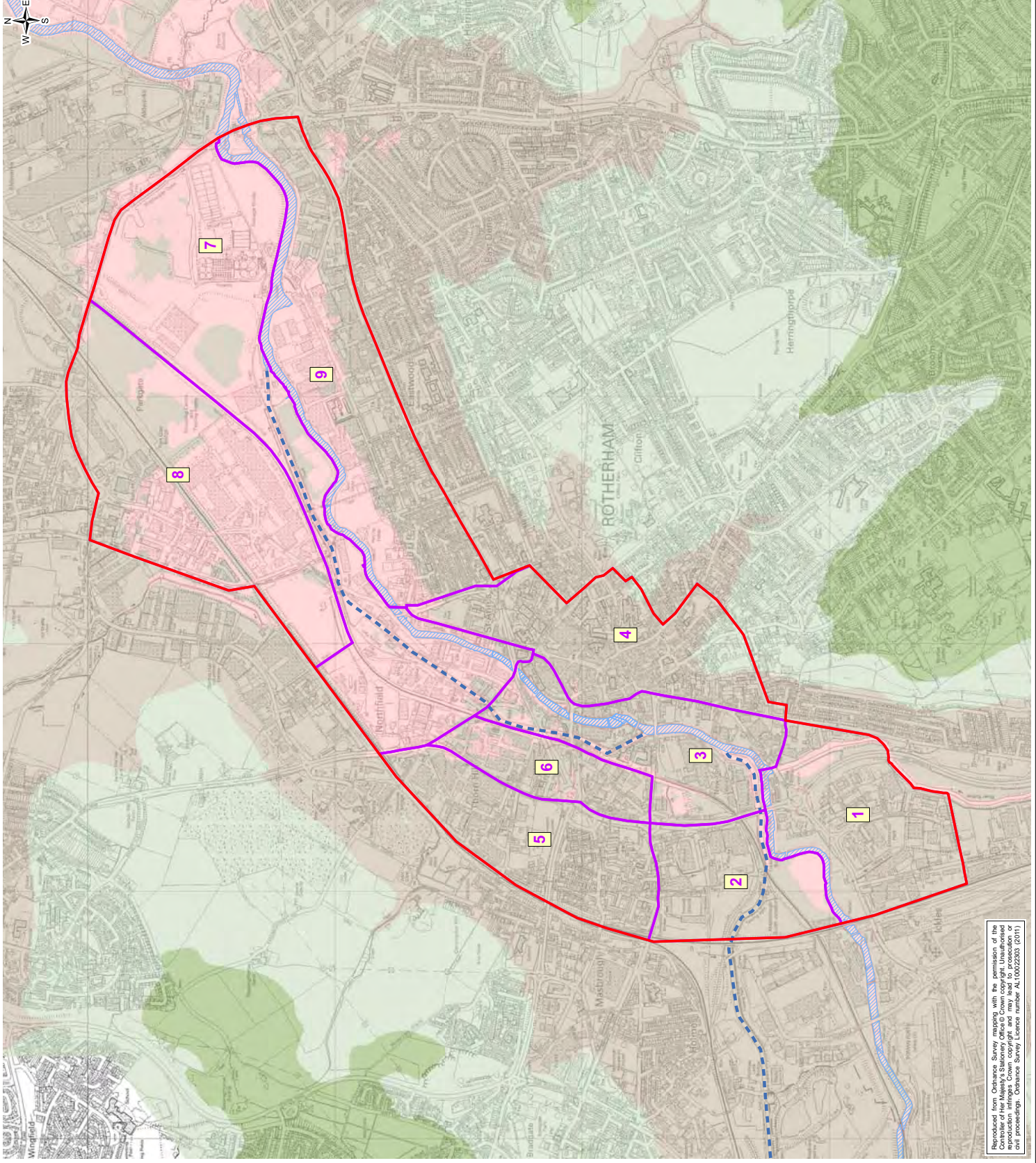
During the summer 2007 flood, key transport routes and interchanges (road and rail), emergency facilities and control centres, utility company facilities critical to the operation of the Town Centre, large numbers of commercial/industrial properties and a small number of residential properties, were all severely affected. This resulted in immediate safety and evacuation incidents during the actual flood event and significant disruption for a number of months following. In the Rotherham Regeneration Area, the railway and canal act as key flow paths channelling water to lower parts of the area, particularly the Central Riverside Area and Eastwood.

The Town Centre Character Area is lower lying than the surrounding topography which rises gently (see Figure 5). This means parts of the Town Centre Character Area are prone to surface water flooding as water flows overland, channelling along natural flow routes before ponding in the lowest lying areas (for example subways). Surface water flooding can occur very quickly so it is very difficult to provide warnings. In the Town Centre Character Area, surface water flooding occurs in places where the risk of river flooding is low, for example around Wellgate and St Ann's. It is therefore necessary to take into account both types of flooding when determining the risk of flooding.

**FIGURE 5**

**Legend**

- Rotherham Regeneration Area
- Character Areas
- Main River
- Canal
- Elevation**
- 15m - 25m
- 25m - 50m
- 50m - 80m
- 80m - 150m

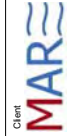


Reproduced from Ordnance Survey mapping with the permission of the Ordnance Survey. All rights reserved. Reproduction in any form without the permission of the Ordnance Survey is prohibited. Crown Copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL100022303 (2011)

Rev	Date	Initial Issue	AD	PG	MM	DD
0	1 APR 2011	Purpose of revision	Drawn	Checked	Revised	Approved



1 City Walk, Leeds, LS11 9DQ, UK  
Tel: +44(0)113 242 8771 Fax: +44(0)113 389 1389  
www.jacobs.com



**Client**  
Rotherham  
Metropolitan  
Borough Council  
Bakewell House, Rotherham Road,  
Rotherham, S60 1TD



Project

ROTHERHAM SFRA 2

Drawing Title

TOPOGRAPHY OF THE STUDY AREA

Drawing Status	FINAL
Scale @A3	1:15,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA_05.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.  
P:\B0000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA\B1486900\_SFRA\_05.mxd

DO NOT SCALE

The table below summarises the level of fluvial flood risk in each character based on the PPS 25 Flood Risk zones (see Figure 6).

- **Flood Zone 1** has the lowest probability of flooding. In these areas the risk is less than 0.1% annual exceedance probability (AEP) (less than 1 in 1000 annual chance) in any year meaning that a rainfall event of unprecedented magnitude would be required to cause flooding;
- **Flood Zone 2** has a medium probability of flooding. In these areas the risk is between 1% and 0.1% AEP (1 in 100 and 1 in 1000 annual chance). This means that although the probability of flooding is still infrequent, the risk is more serious and adequate precautions are required;
- **Flood Zone 3a** has a high probability of flooding. In these areas the risk is greater than 1% AEP (1 in 100 annual chance). This means flooding could occur at a greater frequency and therefore the risk is much higher; and
- **Flood Zone 3b** is Functional Floodplain in times of heavy rainfall and is at the highest risk of frequent flooding. In the Rotherham Regeneration Area, this Flood Zone is contained to the river channel itself and the Centenary Riverside compensatory floodplain area. The only development which should take place within this zone is flood defence works.

PPS 25 does not define risk from surface water in the same way as river flooding. The study has defined three flood risk zones which are high, medium and low. Areas with a medium and high risk may require specific mitigation, particularly where a clear flow path is apparent.

The table below sets out the main areas of surface water flooding within each Character Area:

Character Area	Level of Surface Water Flood Risk
Area 1 Bradmarsh and Templeborough	High in the area north of the Industrial Estate. Along Sheffield Road in Bradmarsh and Templeborough and into the Central Riverside Area.
Area 2 Masborough west of Centenary Way	High in places particularly around the former football ground and Almer Street.
Area 3 Central Riverside Area	Some localised areas of high risk, particularly to the east of the River Don around Sheffield Road and immediately south of the bus station.
Area 4 Town Centre	Some larger areas are severely affected by pluvial flood risk. This includes Wellgate, the top of Corporation Street, parts of the Civic Offices and Effingham Street.
Area 5 Masborough Thornhill	Very small and specific localised areas around Tenter Street and south of Primrose Hill.
Area 6 College Street	High in a few small specific locations around Thames Street/Glasshouse Street.
Area 7 Northfield	High in places around Northfield. The canal and railway is a flood flow pathway.
Area 8 Parkgate Retail Park	High in the area around the Rotherham Road roundabout. This character area is badly affected by surface water flooding overall.
Area 9 Eastwood	High in some very specific locations, particularly just north of the Eastwood Trading Estate.

**Table 2 Non Technical Summary - Description of Each Character Area within the Rotherham Regeneration Area and Current Surface Flood Risk.**

**FIGURE 6**

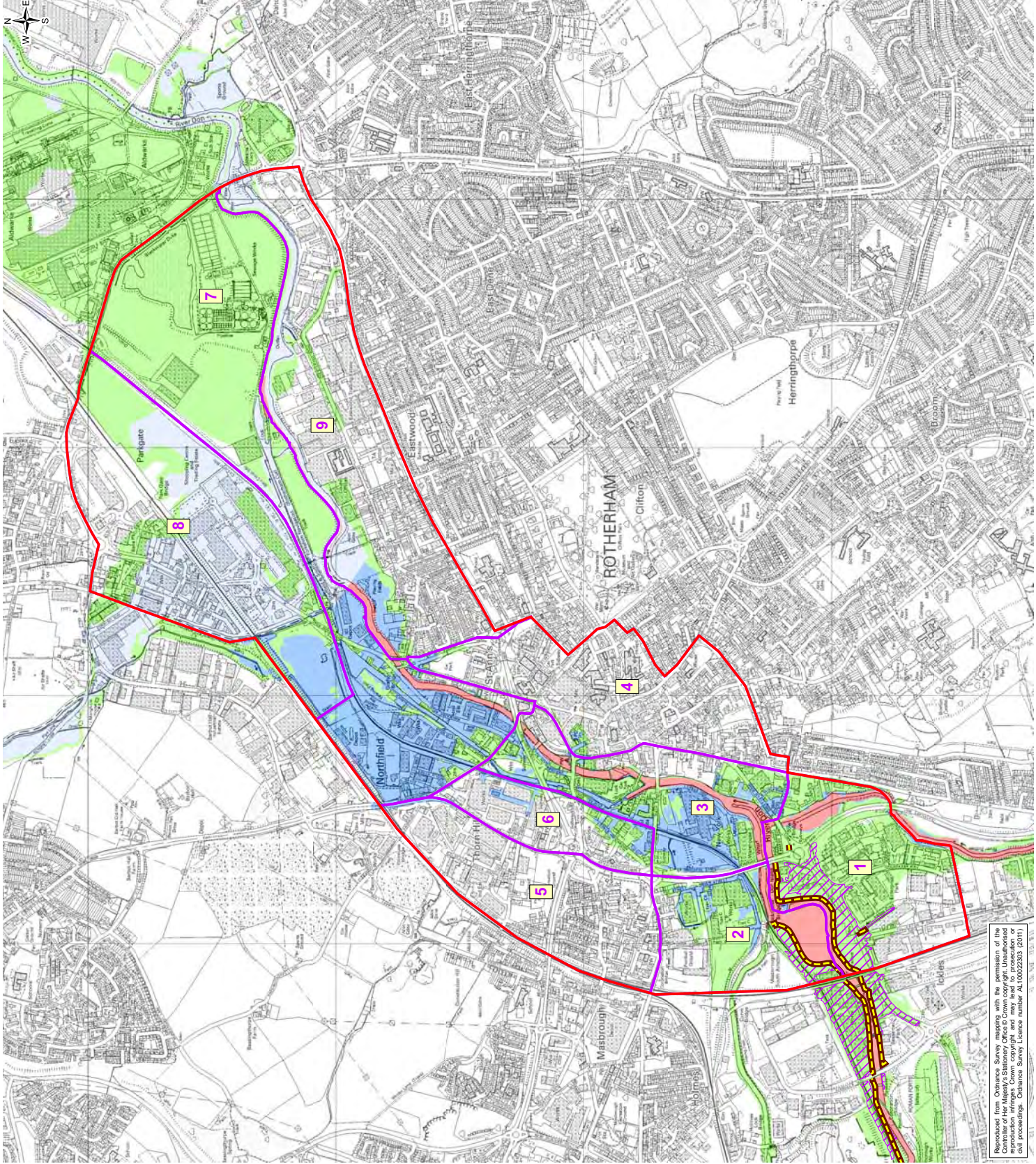
**Legend**

- Rotherham Regeneration Area
- Character Areas
- Implemented Rotherham Flood Alleviation Scheme
- Area Benefitting from Defences
- Modelled Flood Zone 3b 'Functional Floodplain'
- Modelled Flood Zone 3a 'High Probability'
- National Flood Zone 3a 'High Probability'
- National Flood Zone 2 'Medium Probability'

The flood risk shown on this plan is based on a locally specific flood risk model except in parts of Character Areas 7, 8 and 9 where this was not available. In the Character Areas 7, 8 and 9 which are hatched in a blue, the National Map of Flood Risk has been used because the local model is not available. The National Map is recognised as a "coarser" method of modelling flood risk and therefore it has the potential to over-estimate the areas of land within Zone 3a.

Phase 1 of the RRFAS has already been implemented and the detailed modelling indicates that risk in this area has been reduced, as shown on the plan.

However, for planning purposes the National Flood Zone Map should still be used as the first step in determining the requirements for preparation of a Flood Risk Assessment for proposed development areas.



Rev	Date	Initial Issue	AD	PG	MM	DD
0	1 APR 2011					
Purpose of revision						
			Drawn	Checked	Revised	Approved

**JACOBS**  
 1 City Walk, Leeds, LS11 9QX, UK  
 Tel: +44(0)113 242 8771 Fax: +44(0)113 389 1389  
 www.jacobs.com

**Client**  
**MAR**  
 Rotherham Metropolitan Borough Council  
 Baking House, Rotherham Road,  
 Rotherham, S60 1TD

Project: ROTHERHAM SFRA 2

Drawing Title: FLUVIAL FLOOD RISK ZONES FOR ROTHERHAM TOWN CENTRE CHARACTER AREAS

Drawing Status	FINAL
Scale @A3	1:15,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA_06.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.  
 P:\B0000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA1486900\_SFRA\_06.mxd

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL100022303 (2011)

Character Area		Flood Zone		Character Area	Flood Zone		Character Area	Flood Zone	
Area 1: Bradmarsh & Templeborough	Zone 1	Approx 30% of Character Area	Area 4 – Town Centre	Zone 1	Approx 90% of the Character Area.	Area 7 – Northfield	Zone 1	Approx 0% of the Character Area	
	Zone 2	Approx 65% of character area		Zone 2	Approx 5% of the Character Area		Zone 2	Approx 10% of the Character Area	
	Zone 3	Approx 5% of Character Area (zone 3b)		Zone 3	Approx 5% of the Character Area.		Zone 3	Approx 90% of the Character Area	
Area 2 : Masborough west of Centenary Way	Zone 1	Approx 15% of Character Area.	Area 5 – Masborough-Thornhill.	Zone 1	Approx 95% of the character area.	Area 8 – Parkgate Retail Park.	Zone 1	Approx 30% of Character Area	
	Zone 2	Approx 65% of Character Area.		Zone 2	Approx 5% of the Character Area.		Zone 2	Approx 0% of the Character Area	
	Zone 3	Approx 20% of Character Area (some 3b).		Zone 3	None		Zone 3	Approx 70% of the Character Area	
Area 3: Central Riverside Area	Zone 1	Approx 25% of the Character Area.	Area 6 – College Street	Zone 1	Approx 10% of the Character Area.	Area 9 – Eastwood	Zone 1	Approx 50% of the Character Area	
	Zone 2 and 3 inter-mixed	Approx 75% of the Character Area.		Zone 2	Approx 80% of the Character Area.		Zone 2	Approx 20% of the Character Area	
				Zone 3	Approx 10% of the Character Area.		Zone 3	Approx 30% of the Character Area	

**Table 3 Non Technical Summary - Description of Each Character Area within the Rotherham Regeneration Area and Current Fluvial Flood Risk.**

## Conclusion

The flood risk and regeneration challenges within the Rotherham Regeneration Area can be overcome through a pro-active and comprehensive strategy towards flood risk management. This will involve all parties working together from the outset to deliver the vision by managing flood risk. The principles established and guidance set out in this SFRA 2 should be followed throughout so that a safe, attractive, economically viable and sustainable Town Centre is developed.

The requirements of PPS 25 do not mean that sites in this area cannot be developed safely until the entire RRFAS is in place, but bespoke site specific solutions will be required to reduce flood risk to an acceptable level and to manage the safety risks which flooding poses, for example, by raising habitable areas and means of access above the flood defence level and incorporating Sustainable Drainage.

Development sites that are adjacent to the riverside will need to ensure that:

- *The alignment of any flood risk management infrastructure or raised land is no nearer the river than shown in Figure 4 of the Design Guidance in Section 5 of the flood Risk Toolkit; and,*
- *They will not prevent the future implementation of the Rotherham Renaissance Flood Alleviation Scheme.*

Further guidance is contained in the Sequential Approach Guide and the Design Guidance, Sections 4 and 5 of the Flood Risk Toolkit.



**This page is intentionally left blank.**

# 1 Introduction

**This chapter introduces the Rotherham Regeneration Area and the approach to flood risk within it.**

## 1.1 Rotherham Regeneration Area

The focus on flood risk is particularly aligned to the regeneration aspirations of the Council, especially to reinvigorate the economy of the Town Centre and surrounding industrial areas. A specific strategic objective is investing in the regeneration of former heavy industrialised land and other key development sites adjacent to the River Don throughout the whole area.

This area is of critical importance in terms of providing a stronger employment, retail, social, community and living function so it represents the heart of the Borough. This area also contains many existing businesses which will benefit from reduced flood risk from the next phase of RRFAS. This area will be specifically referred to as the Rotherham Regeneration Area in the emerging Core Strategy. It will be divided into 9 specific Character Areas to reflect the regeneration objectives and land use patterns of each one.

The Environment Agency has agreed that these Character Areas can form the basis for assessing flood risk. The Flood Risk Toolkit must therefore be taken into account when submitting planning applications within this area.

The Rotherham Regeneration Area and the Character Areas within can be seen in Figure 4.

## 1.2 Strategic Flood Risk Assessments

A Level 1 Strategic Flood Risk Assessment (SFRA 1) for the whole Borough was published by RMBC in 2008. It was produced in consultation with the Environment Agency. It will form a key piece of supporting evidence for the Local Development Framework (LDF) as well as informing day to day decisions on planning applications and other matters.

As a SFRA 1 is completed at a broad strategic level, it does not take into account locally specific factors which affect flooding. This requires an increase in the scope of the SFRA 1 as required by PPS 25 to identify more accurately the cause, risk and measures to mitigate and reduce the risk from flooding in the study area:

*“Where decision-makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test<sup>6</sup>, taking account of the flood vulnerability category of the intended use, it will be necessary to increase the scope of the SFRA to provide the information necessary for application of the Exception Test.”<sup>7</sup>*

In order to apply the Exception Test it is necessary to assess:

- *The beneficial effects of flood risk management infrastructure in generally reducing the extent and severity of flooding when compared to the Flood Zones on the {Environment Agency} Flood Map.*

As flood risk impacts on the future function, including promoting new development and regeneration activity within the Rotherham Regeneration Area, a more detailed understanding of flood risk is necessary. Development is planned on sites which fall within Zone 3a. Without the SFRA 2 and additional guidance, flood risk will be assessed by individual planning applications in a more piecemeal approach making this process more time consuming and difficult for all stakeholders.

### 1.3 Report Structure

The structure of this SFRA 2 is as follows:

- *Chapter 2 sets out the relevant National Planning Policy relevant to this SFRA 2;*
- *Chapter 3 sets out the methodology followed by the SFRA 2;*
- *Chapter 4 establishes the baseline position in terms of how flood risk is currently affecting the Town Centre;*
- *Chapter 5 sets out how flood risk would be reduced by RRFAS;*
- *Chapter 6 sets out the residual flood risks which would still remain in the Town Centre even with the completion of the RRFAS and how these would need to be managed and mitigated. This includes an assessment of overtopping and breaching; and*
- *Chapter 7 provides an overall summary and conclusion.*

<sup>6</sup> The Sequential Test requires proposed development to be allocated to areas of lowest flood risk depending on the vulnerability of the development. Where this is not possible, and there are no alternative sites, the Exception Test can be applied to demonstrate that the proposed development has wider sustainability benefits; and that it can be made safe from flooding without increasing flood risk elsewhere. For further details see PPS 25 Annex D, p.21-29 and Section 5 of this report which applies this test to Rotherham Town Centre.

<sup>7</sup> PPS 25, Annex E, Paragraph E6, p.31.

## 1.4 Supporting Figures and What They Show

The following Figures support this document:

Figure Reference	Title	What the Figure Shows
Figure 4	Rotherham Regeneration Area	This plan shows the boundary of the study area and the 9 Character Areas and some of the key development areas.
Figure 5	Topography of the Study Area	This shows the topography of the study area.
Figure 6	Fluvial Flood Risk Zones for Rotherham Town Centre Character Areas	This shows the current level of flood risk across the study area, based on PPS 25 flood risk zones.
Figure 7	Modelled Flood Zone 3 Areas – Flood Depths	This shows the depth of river flooding which would occur during a 1% AEP (1 in 100 annual chance) flood event.
Figure 8	Modelled Flood Zone 3 - Fluvial Flood Risk Hazard	This shows the level of hazard that flooding from rivers would cause in the study area.
Figure 9	Rotherham Town Centre Surface Water Flood Risk By Character Area	This shows the level of surface water flood risk.
Figure 10	Surface Water Flood Depths in High Risk Flood Zones	This shows the depth of surface water flooding which would occur during a 1% AEP (1 in 100 annual chance) flood event.
Figure 11	Surface Water Flood Risk Hazard in High Risk Flood Zones	This shows the level of hazard that flooding from surface water would cause in the study area.
Figure 12	Rotherham Renaissance Flood Alleviation Scheme	This shows the approximate flood defence alignment.
Figure 13	Modelled Reduction in Flood Risk with the Rotherham Renaissance Flood Alleviation Scheme in Place	This shows the level of flood risk with the RRFAS constructed based on the PPS 25 Flood Risk Zones.
Figure 14	Fluvial Breach Hazard of RRFAS – 1% Annual Probability	This models the impact if a breach in flood defences occurred once they are completed.
Figure 15	Flood Depth to Defence Breaching – 1% Annual Probability	This shows the depth of flood water if a breach occurred.

**Table 4 - Figures to support the assessment and what they show**

For ease of reference, the above figures are included within both the main text of this document, and, within Section 6 of this Flood Risk Toolkit.

## 2 National Planning Policy

This chapter identifies relevant national planning policy on flood risk and climate change.

### 2.1 National Planning Policy

There are a number of national Planning Policy Statements (PPS) which are relevant to this study.

#### 2.1.1 PPS 25: Development and Flood Risk

PPS 25 was introduced in December 2006 (updated March 2010) and contains Government Guidance on how Local Planning Authorities, Developers and Regulators should approach flood risk. The guidance sets out a number of key principles which this study must consider and they are briefly described in Table 5 below:

PPS 25 Principle	Simple Explanation
<b>Flood Risk Zones</b>	Table D1 of Annex D of PPS 25 sets out four Flood Zones which define the probability of flooding for a given area.
<b>Consistent Approach and Methodology</b>	PPS 25 provides a methodology on which to base SFRA work, the key aspects of which are set out in this table.
<b>Flood Risk Sequential Test</b>	The principle of this test is based on using the four Flood Zones to manage development so where possible new development occurs in the areas at the lowest risk of flooding in preference to high risk areas.
<b>Flood Risk Vulnerability Classifications</b>	Tables D2 and D3 of Annex D of PPS 25 set out what types of land uses are compatible with each Flood Zone. The greater the flood risk, the more restricted development is.
<b>Exception Test</b>	The Exception Test is applied after the application of the Sequential Test, as it is recognised that some development in areas of higher risk may be required to support a particular objective. This is true in Rotherham Town Centre where the objectives of the LDF will not be achieved unless new development takes place. There are three criteria to the Exception Test set out in paragraph Annex D of PPS 25 paragraph D9.
<b>Non Compatibility with Flood Risk Zones</b>	The Exception Test will not be appropriate in every case. Where a development which is particularly vulnerable to the effects of flooding the potential impact of flooding may be so significant that development should not proceed. In such circumstances, action would be required to modify the area so that it can be classed as a lower flood risk zone, for example through the construction of flood defences or land raising.
<b>Residual Risks</b>	Even where mitigation for flood risk is put in place to protect an area, there will always remain a risk that flooding could still occur. This could be as a result of the failure of a flood defence or because a rainfall event is more severe than the mitigation was designed to cope with.

PPS 25 Principle	Simple Explanation
<b>Flood Resilience and Resistance</b>	In some circumstances, it may be possible to construct buildings in areas of higher flood risk that are designed and constructed to withstand the impacts of flooding. However, such buildings would still need to ensure safe public access during periods of flooding.
<b>Planning for Climate Change</b>	New development must also plan for the potential impacts of climate change and that more severe weather events may occur in the future.

*Table 5 – PPS 25 Key Principles*

These concepts are highlighted and discussed in more detail throughout this report.

### 2.1.2 PPS 1A: Planning for Climate Change

Sustainable Development is established as an underlying principle of the Planning System under National Planning Guidance PPS 1: Planning for Sustainable Development. A supplementary document to PPS 1, PPS 1A on Planning and Climate Change was issued by the Government in December 2007<sup>8</sup>.

PPS 1A sets out how the planning system can help to reach decisions which lead to a reduction in emissions and energy consumption, and why a pro-active approach to the potential impacts of climate change is required.

This means that when setting out policies in LDF's, Council's must demonstrate how they have taken into account the potential impacts of climate change, when planning for regeneration and new development. As such, the Rotherham Core Strategy will need to set out where new infrastructure is required to reduce the potential impacts of climate change and show how new development can be made to withstand, and be more resilient to, these potential impacts.

### 2.1.3 PPS 4: Planning for Sustainable Economic Development

Through this guidance, the Government seeks to help achieve sustainable economic growth by, amongst other things, improving the economic performance of towns and cities, promoting regeneration, tackling deprivation and promoting the vitality and viability of town centres as important places for communities.

The policies in PPS 4<sup>9</sup> support the use of previously developed land, promote competitive town centre environments and encourage a positive and constructive approach towards planning applications for economic development. In particular, Policy EC10.2 requires development proposals to be assessed in terms of accessibility by a choice of means of transport and the impact on economic and physical regeneration in the area, including the impact of deprived areas and social inclusion objectives.

Therefore, the completion of RRFAS to provide the wider regeneration benefits for Rotherham Town Centre is a key objective in terms of the aims of PPS 4.

<sup>8</sup> DCLG: Supplement to PPS1: Planning and Climate Change, December 2007

<sup>9</sup> DCLG, Planning for Sustainable Economic Growth.

### 2.1.4 PPS 12: Local Spatial Planning

This document sets out how the system of LDFs in England operates. The document establishes a number of 'Tests of Soundness' which LDF documents must meet for them to be accepted by the Government.

Paragraph 4.8 of this document sets out what evidence is required to demonstrate that an LDF Core Strategy is deliverable:

*The core strategy should be supported by evidence of what physical, social and green infrastructure is needed to enable the amount of development proposed for the area, taking account of its type and distribution. This evidence should cover who will provide the infrastructure and when it will be provided. The core strategy should draw on and in parallel influence any strategies and investment plans of the local authority and other organisations.<sup>10</sup>*

Demonstrating what infrastructure is required to support the vision and objectives contained in a Core Strategy is a further Test of Soundness. Paragraph 4.45 states that:

*Core Strategies should show how the vision, objectives and strategy for the area will be delivered and by whom, and when. This includes making it clear how infrastructure which is needed to support the strategy will be provided and ensuring that what is in the plan is consistent with other relevant plans and strategies relating to adjoining areas. This evidence must be strong enough to stand up to independent scrutiny. Therefore it should:*

- *Be based on sound infrastructure delivery planning (see paragraph 4.8 above);*
- *Include ensuring that partners who are essential to the delivery of the plan such as landowners and developers are signed up to it. LPAs should be able to state clearly who is intended to implement different elements of the strategy and when this will happen; (These issues are handled through early involvement of key stakeholders in the preparation of options for the plan.)<sup>11</sup>*

This SFRA 2 is therefore important to demonstrating that the Core Strategy objectives for the Town Centre can be implemented and that mechanisms are in place to manage and reduce flood risk.

### 2.1.5 Flood Water Management Bill

Following the Pitt Review of the summer 2007 floods, new legislation has been introduced. The Flood Water Management Act gained Royal assent in April 2010. Key features of this Act are:

- *Giving the Environment Agency an overview of all flood and coastal erosion management;*

<sup>10</sup> Planning Policy Statement 12 Local Spatial Planning, Communities and Local Government, 2008, P8

<sup>11</sup> Planning Policy Statement 12 Local Spatial Planning, Communities and Local Government, 2008, P17

- *Giving Unitary and County Council's the lead in managing the risk of all local floods as lead Local Flood Authorities;*
- *Giving Unitary and County Council's the ability to adopt SUDS for new developments and redevelopments; and*
- *Removing the automatic right to connect to sewers, to encourage uptake of SUDS.*

RMBC have been designated as a Lead Local Flood Authority. As such, they will be required to undertake a Preliminary Flood Risk Assessment, Surface Water Management Plan and Local Flood Risk Strategy through 2010 and 2011.



**This chapter sets out the approach and methodology in assessing the impact of flood risk in the SFRA 2.**

### 3.1 SFRA 2 Methodology

The assessment has been undertaken in accordance with nationally recognised approaches and has been agreed with the Environment Agency.

A key aspect of the methodology has been to reflect the specific topography, layout and known causes of flooding in the study area so that its findings reflect the local nuances and water flow regimes. As such, the SFRA 2 has been produced to take account of a wide range of technical factors to respond to the locally distinctive characteristics of the study area. This provides credible and robust evidence to support the emerging LDF Core Strategy Vision and should ultimately enable the delivery of development in the Rotherham Regeneration Area.

The flood risk modelling is based on a model undertaken to develop RRFAS in 2003. However, this model does not extend fully into the Rotherham Regeneration Area. Therefore, the flood risk zones into the eastern extent of Character Area 7 and the whole of Character Areas 8 and 9 are based on the National Flood Maps. This is important as it is based on a more coarse method of modelling and is therefore a less precise reflection of what the actual flood risk is. This is important because large parts of these areas are within Flood Zone 3a on the National Flood Map. As such, promoters of development sites in these areas may wish to undertake additional modelling to this SFRA 2.

Additional modelling has been undertaken as part of the development of this SFRA 2 to show:

- *Flood depths;*
- *Flood hazards;*
- *Surface water; and*
- *Breaching and overtopping.*

The Surface Water modelling is based on using local topographical data to model the distribution of rainfall events based on the terrain. This is sometimes referred to as a 'scatter ball' approach as it is similar to dropping balls onto a given terrain and seeing which route they would take before stopping. However, this approach should not be entirely relied on as the routes can differ during actual flood events because of physical obstructions, which force water via natural flow channels such as communication routes.

**This chapter sets out the current position in the Town Centre in terms of the current levels of flood risk.**

#### 4.1 Topography, Watercourses and Sewers

Rotherham is situated on the confluence of the Rivers Don and Rother. The Regeneration Area occupies the flat area on either bank of the river, immediately downstream of the confluence.

The River Don rises in the Pennines to the west of Rotherham and flows eastwards through the urban areas of Sheffield, Rotherham, Mexborough, Conisbrough, Doncaster and Stainforth. The River Don flows into the River Ouse at Goole.

The River Rother is a principle tributary of the River Don and joins the Don at Rotherham. The Rother rises at Pilsley in Derbyshire and flows northwards towards Rotherham through the urban area of Chesterfield.

In addition to the smaller watercourse of Ickles Goit, Holmes Tail Goit, and Greasborough Dyke flow into both the Don and Rother. Goits are man made watercourses which were usually constructed to transport water to factories or mills.

Figure 5 shows the topography of the Rotherham Regeneration Area and the surrounding area. It illustrates that this area is sited in a valley with the topography rising gently away from the centre. This means there is a natural flow path for water from the surrounding area to the Rotherham Regeneration Area.

A section of the Sheffield and South Yorkshire Navigation canal runs through Rotherham, allowing the navigation of the River Don up to Sheffield. The canal runs alongside the Don, immediately to the north, and allows boats to bypass sections of the river considered to be un-navigable. The canal is separated from the River Don by locks at its upstream and downstream ends. It is a significant feature as it provides a low lying flow path for flood flows. This means it can convey water to areas remote from the point where it originally entered the canal.

Another major feature is the railway line which runs along the north bank of the River Don. It is mainly contained within a cutting at a lower level than the adjacent ground. The railway acts in a similar manner to the canal, as it provides a low lying flow path, along which water is conveyed during flood events. The recovery time for the railway, compared to the canal, after a flood event is much greater, due to the damage caused to railway infrastructure.

## 4.2 Previous Flood Events

Major rainfall events during November 2000 and June 2007 caused flooding in a number of low lying areas through Templeborough and Rotherham Town Centre.

The November 2000 event resulted in flooding of existing infrastructure and to some of the areas assessed within this SFRA 2. This was mainly limited in extent to the Templeborough area; however, widespread disruption was experienced on the local road network throughout the town. This was a direct result of both river flooding and surface water flooding.

The rainfall experienced in June 2007 was far greater than in November 2000 and so more extensive flooding was experienced during this event, with impacts again in Templeborough and Rotherham Town Centre.

The damage and disruption to properties and infrastructure was also much greater during the 2007 flood event. This has resulted in subsequent economic impacts on local businesses and disruption to peoples lives. A number of the Character Areas assessed in this SFRA 2 were flooded during this event, as a direct result from both river and surface water flooding. Some examples of the damage/disruption caused are:

- *Rotherham Central station was closed for several months as the railway line was not operable until railway infrastructure was assessed and in some areas replaced;*
- *Main roads were closed for several days causing significant disruption;*
- *Pedestrian subways were flooded to their full height in several areas;*
- *Utility company facilities failed (e.g. sub stations);*
- *Civic facilities, including the Magistrates Court, were not operable for several months;*
- *Many commercial, industrial and retail properties were damaged, with some moving away from the area; and*
- *Emergency control facilities such as those in the Council's and Environment Agency's offices were not accessible.*

The cumulative impact of the above was that the Rotherham Regeneration Area could not function properly for a long period of time whilst repair work was carried out.

## 4.3 Current Flood Risk in Rotherham Town Centre

The SFRA 1 identified that the current flood risks that are most significant to the study area are both fluvial (river) and surface water sources. This SFRA 2 therefore focuses on providing an assessment of these risks.

Areas affected by fluvial flooding are determined by considering the following River sources:

- *Flooding from the main rivers that flow through Rotherham, namely, the River Don and River Rother; and*
- *Flooding from small watercourses that flow into these two main rivers at various locations in the study area.*

Areas of land affected by surface water flooding sources are determined by considering:

- *Where rainfall would flow or pond on its journey to the river system, taking account of the natural topography of land, but assuming that no man made drainage systems are operational at the time rainfall is experienced.*

It should be recognised that this latter situation is assessed as the ‘worst case scenario’ and should not be taken as an automatic assumption that this would be the case in practice.

#### 4.3.1 Assessing Fluvial Flood Risk

For fluvial flood risks (flooding caused by rivers), PPS 25 defines four flood risk zones indicating the probability of flooding in Table D1 of Annex D, as set out below.

Fluvial Flood Risk Zone	Description of Risk
<b>Flood Zone 1</b> Low Probability	This zone comprises land assessed as having greater than 0.1 % AEP <sup>12</sup> (greater than 1 in 1000 annual chance) of river flooding in any year.
<b>Flood Zone 2</b> Medium Probability	This zone comprises land assessed as having between a 1% and 0.1% AEP (1 in 100 and 1 in 1000 annual chance) of river flooding in any year.
<b>Flood Zone 3a</b> High Probability	This zone comprises land assessed as having a greater than a 1% AEP (1 in 100 or greater annual chance of river flooding in any year).
<b>Flood Zone 3b</b> Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Land which would flood with a 5% AEP or greater (1 in 20 annual chance or greater), or is designed to flood in an extreme flood (0.1% AEP), should provide a starting point for consideration and discussion to identify the functional flood plain.

**Table 6<sup>13</sup> - Assessing Fluvial Flood Risk**

Figure 6 illustrates the areas of the Rotherham Regeneration Area which fall within the flood zones above. This shows the following:

- *The main areas of Flood Zone 3a are on the left bank of the River Don in the Central Riverside (3) and Northfield (7);*
- *The 2003 model does not extend into parts of Northfield, Parkgate and Eastwood (Character Areas 7, 8 and 9). The SFRA 2 has relied on the National Flood Zone Plans. These show that large parts of these areas are in Flood Zone 3a, but if bespoke modelling was completed this could show that the Flood Zone 3a shown by the National Flood Plan covers less land than indicated on Figure 6;*
- *Small parts of the right bank are also within Flood Zone 3a, but the main part of the Town Centre (Character Area 4) has a low level of flood risk;*

<sup>12</sup> AEP stands for Annual Exceedance probability – so a 0.1% AEP means that there is 0.1% annual probability of flooding. An alternative way of explaining this terminology is to say that there is a 1 in 1000 chance of flooding in any given year (i.e. 1 in 1000 annual chance).

<sup>13</sup> Planning Policy Statement 25, March 2010, Communities and Local Government, P22

- *The areas around Bradmarsh/Templeborough and Masborough (Character Areas 1 and 2) are already defended by the first phase of RRFAS. This effectively reduces flood risk on both the left and right bank of the River Don in this area to Flood Zone 2, although the Environment Agency's National Flood Maps do not take account of flood defences and will still show this area as Flood Zone 3a;*
- *Masborough/Thornhill (Character Area 5) predominantly has a low level of flood risk; and*
- *Parts of Masborough west of Centenary Way (Character Area 2) and Bradmarsh/Templeborough (Character Area 1).*

### **Fluvial Flood Depths**

Figure 7 shows the fluvial flood depths across the study area during a 1% AEP (1 in 100 annual chance) flood event.

- *Deep flooding on the right bank of the River Don is generally confined to a small isolated pocket in Eastwood; and*
- *On the left bank of the Don flooding is much more extensive and large areas of deep flooding are encountered. In particular, depths greater than 1.0m are experienced in parts of Northfield and the Central Riverside with large parts of these areas still affected by flooding to a depth between 0.5m and 1.0m.*

Flood depths are not modelled for the areas where the Environment Agency's National Flood Map has been used as the underlying data.

### **Fluvial Flood Hazard**










Flood Hazard is a combination of the depth and velocity of flooding and represents how dangerous flood waters are likely to be during a flood event. The level of hazard is calculated using a score. Figure 8 shows the flood hazard for a 1% AEP (1 in 100 annual chance) flood event in accordance with the methodology outlined in the DEFRA Report 'FRA Guidance for new Development: Phase 2 FD2320/TR2. Hazard is categorised as:

- *Low Risk – Caution;*
- *Moderate Hazard – Dangerous for some, particularly vulnerable groups;*
- *Significant Hazard – Dangerous for most people;*
- *Extreme Hazard – Dangerous for all, including the emergency services.*

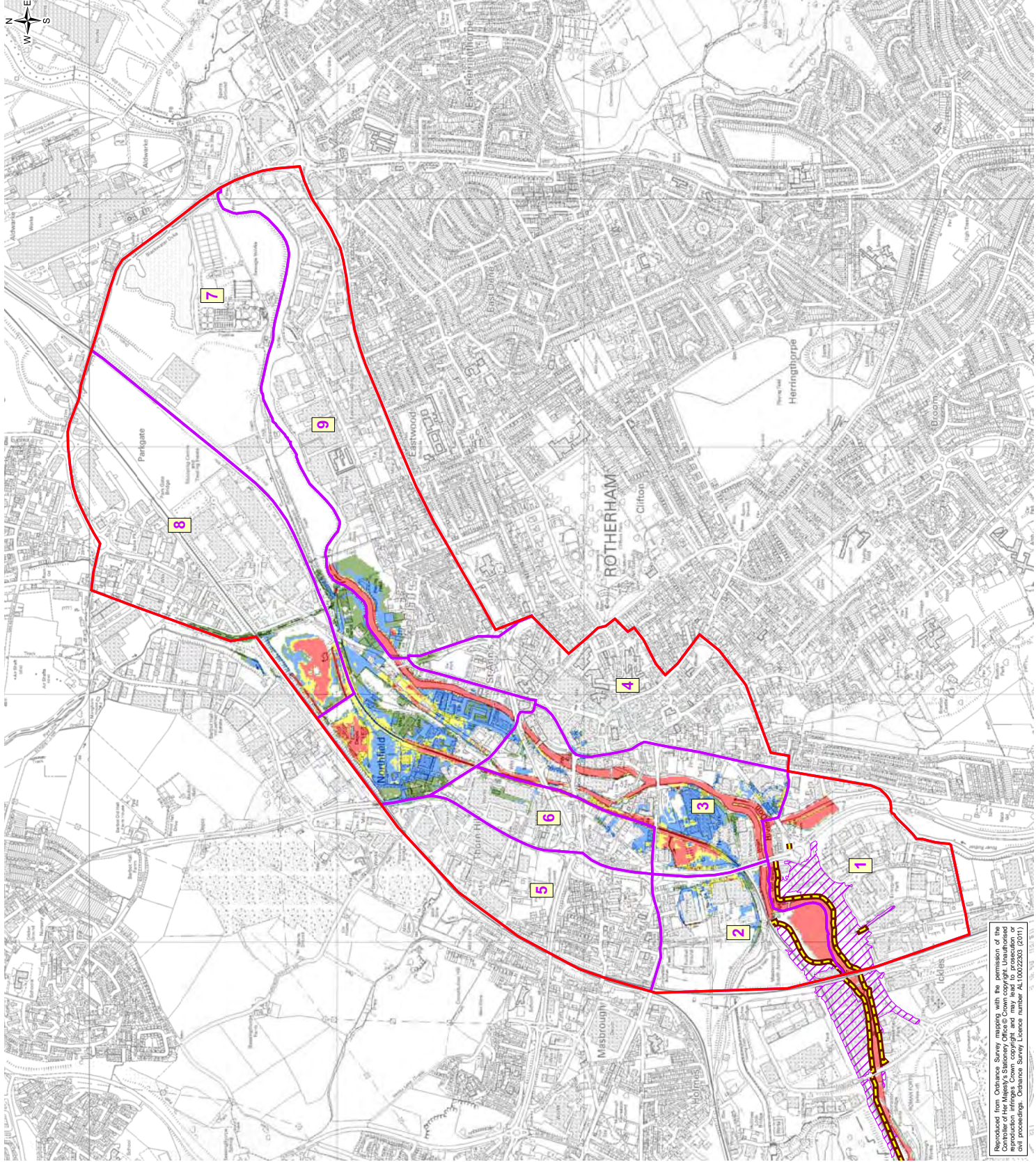
Predictably, the level of hazard is greatest where water is at its deepest (as indicated on Figure 7). The left bank of the Don, particularly around Northfield and the Central Riverside, have most areas where flooding is a significant or extreme hazard, which means that flooding will represent a danger to all members of the public within this area and potentially also the emergency services. The level of hazard is a result of the high velocities and significant depths encountered, particularly where water has been channelled into low lying areas along the canal and railway line cutting.

# FIGURE 7

## Legend

-  Rotherham Regeneration Area
  -  Character Areas
  -  Implemented Rotherham Flood Alleviation Scheme
  -  Area Benefiting from Defences
- Modelled Flood Zone 3 Flood Depths
-  0 - 0.05m
  -  0.05 - 0.50m
  -  0.50 - 1.00m
  -  1.00 - 1.50m
  -  > 1.5m

The flood risk shown on this plan is based on a locally specific flood risk model except in parts of Character Areas 7, 8 and 9 where this was not available. In the Character Areas 7, 8 and 9 which are hatched in a blue, the National Map of Flood Risk has been used because the local model is not available. The National Map is recognised as a "coarser" method of modelling flood risk and therefore it has the potential to over-estimate the areas of land within Zone 3a.



Rev	Date	Initial Issue	AD	PG	MM	DD
0	JPR/2011					
Purpose of revision		Drawn	Checked	Revised	Approved	

**JACOBS**  
 1 City Walk, Leeds, LS11 9QX, UK  
 Tel: +44(0)113 242 8771 Fax: +44(0)113 386 1389  
 www.jacobs.com

**MARE**  
 Client

**Rotherham Metropolitan Borough Council**  
 Rotherham Flood Alleviation Programme  
 Rotherham, S60 1TD

Project	ROTHERHAM SFRA 2	
Drawing Title	MODELLED FLOOD ZONE 3 AREAS - FLOOD DEPTHS	
Drawing Status	FINAL	
Scale @A3	1:15,000	DO NOT SCALE
Jacobs No.	B1486900	
Client No.		
Drawing No.	B1486900_SFRA_07.mxd	

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL10002203 (2011)

**FIGURE 8**

**Legend**

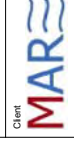
- Rotherham Regeneration Area
- Character Areas
- Main River
- Implemented Rotherham Flood Alleviation Scheme
- Area Benefitting from Defences
- Flood Risk Hazard
- Low Hazard: Caution
- Moderate Hazard: Dangerous for some - includes children, the elderly and the infirm
- Significant Hazard: Dangerous for most people - includes the general public
- Extreme Hazard: Danger for all - includes the emergency services

Flood hazard has been calculated in accordance with the methodology outlined in Defra Report "FRA GUIDANCE FOR NEW DEVELOPMENT: PHASE 2 FD2320/TR2"

Rev	Date	Initial Issue	AD	PG	MM	DD
0	JPR/2011					
		Purpose of revision				
			Drawn	Checked	Revised	Approved



1 City Walk, Leeds, LS11 9DQ, UK  
Tel: +44(0)113 242 8771 Fax: +44(0)113 386 1389  
www.jacobs.com



The Interreg IER North Sea Region Programme



Client

Project

ROTHERHAM SFRA 2

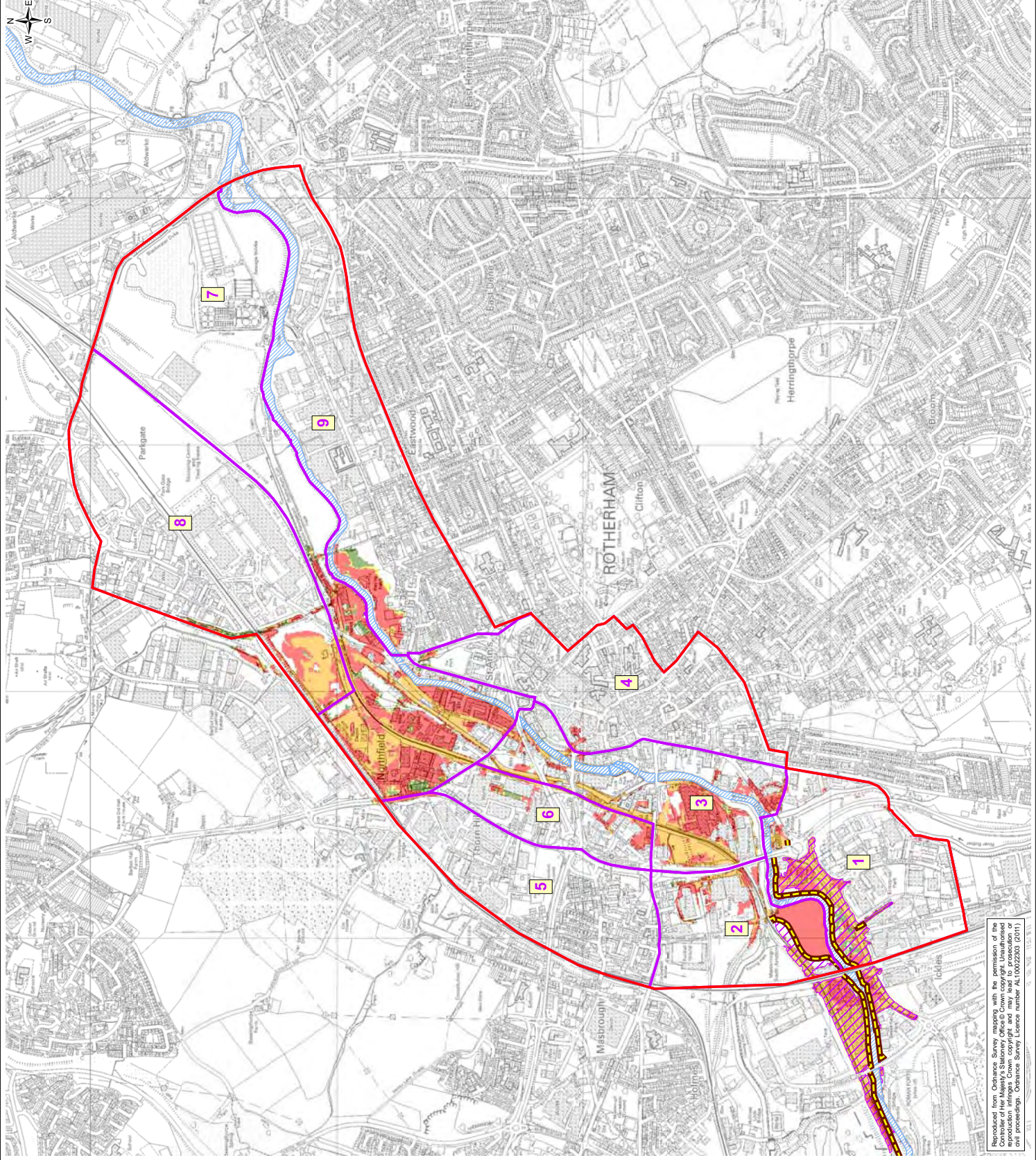
Drawing Title

MODELLED FLOOD ZONE 3 - FLOOD RISK HAZARD

Drawing Status	FINAL
Scale @A3	1:15,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA_08.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

F:\B0000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA\B1486900\_SFRA\_08.mxd



Reproduced from Ordnance Survey mapping with the permission of the Ordnance Survey. All rights reserved. Crown Copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL10002203 (2011)

### 4.3.2 Assessing Surface Water Flood Risk

For surface water risks, PPS 25 does not define flood risk zones in the same way as it does for fluvial flood risk. This study has therefore defined three flood risk zones for surface water flooding taking account the depth, velocity and impacts of surface water flooding. These are categorised into Low, Medium and High risk zones so they are similar to the PPS 25 definitions for fluvial risk.

Surface Water Flood Zone	Description of Risk	Flood Risk Characteristics
Low Risk	The site is unlikely to be at risk of surface water flooding.	Modelling or other evidence suggests that the site is: <ul style="list-style-type: none"> <li>- affected by only minor flow paths</li> <li>- flooded to a very shallow depth</li> <li>- is impacted by low velocity flows</li> </ul>
Medium Risk	The site is likely to be affected by surface water flooding but this should not pose a significant risk to people and property and/or the site could be affected by significant flooding if there were changes to local topography.	Modelling or other evidence suggests that the site is: <ul style="list-style-type: none"> <li>- situated in a minor flow path; and/or</li> <li>- affected by some ponding; and/or</li> <li>- affected by medium to low velocity flows through the site; and/or</li> <li>- situated in close proximity to a major flow path.</li> </ul>
High Risk	The site is likely to be affected by flooding that could pose a significant risk to people and property.	Modelling or other evidence suggests that the site is: <ul style="list-style-type: none"> <li>- situated in a major flow path; and/or</li> <li>- affected by deep ponding; and/or</li> <li>- impacted by high velocity flows.</li> </ul>

**Table 7 - Assessing Surface Water Flood Risk**

Figure 9 shows the level of surface water flood risk across the area and shows:

- *Many areas which are at a high risk of fluvial flooding are also at a high risk of surface water flooding, particularly around Northfield and Parkgate; and*
- *The Town Centre, which is not at risk from fluvial flood risk, has some areas which are at surface water flood risk due to its low lying topography.*

### Surface Water Flood Depths

Figure 10 shows the likely characteristics of surface water flooding during a 1% AEP (1 in 100 annual chance) rainfall event.

Localised surface water flooding occurs across the study area but depths rarely exceed 0.5m. The areas affected by deeper and more extensive surface water flooding are in the Town Centre and Northfield.



## Surface Water Hazard

Figure 11 shows surface water flood risk hazard based on the same definitions used for fluvial flood risk:

- *Low Risk – Caution;*
- *Moderate Hazard – Dangerous for some, particularly vulnerable groups;*
- *Significant Hazard – Dangers for most people;*
- *Extreme Hazard – Dangerous for all, including the emergency services.*

Areas of extreme hazard are where the surrounding topography is relatively steep and there is large catchment area. Modelling indicates that flow paths along Wellgate and around Parkgate would be characterised by deep and fast surface water flows, which could represent a significant or extreme hazard to people.

There are also a number of isolated instances where surface water flooding may represent an extreme hazard. These are generally low points where surface water could accumulate such as subways and underpasses. In these locations the hazard is due the depth of water rather than velocity.

## Flood Routes

Inundation of the railway line, which runs in an east west direction through Rotherham results in deep (greater than 1.0m) ponding and flows along the railway. A similar effect is seen along the canal which is also inundated by flood waters from the Don. Widespread flooding occurs along the length of the railway line and canal as a result of water flowing along these features away from the original location of flooding.

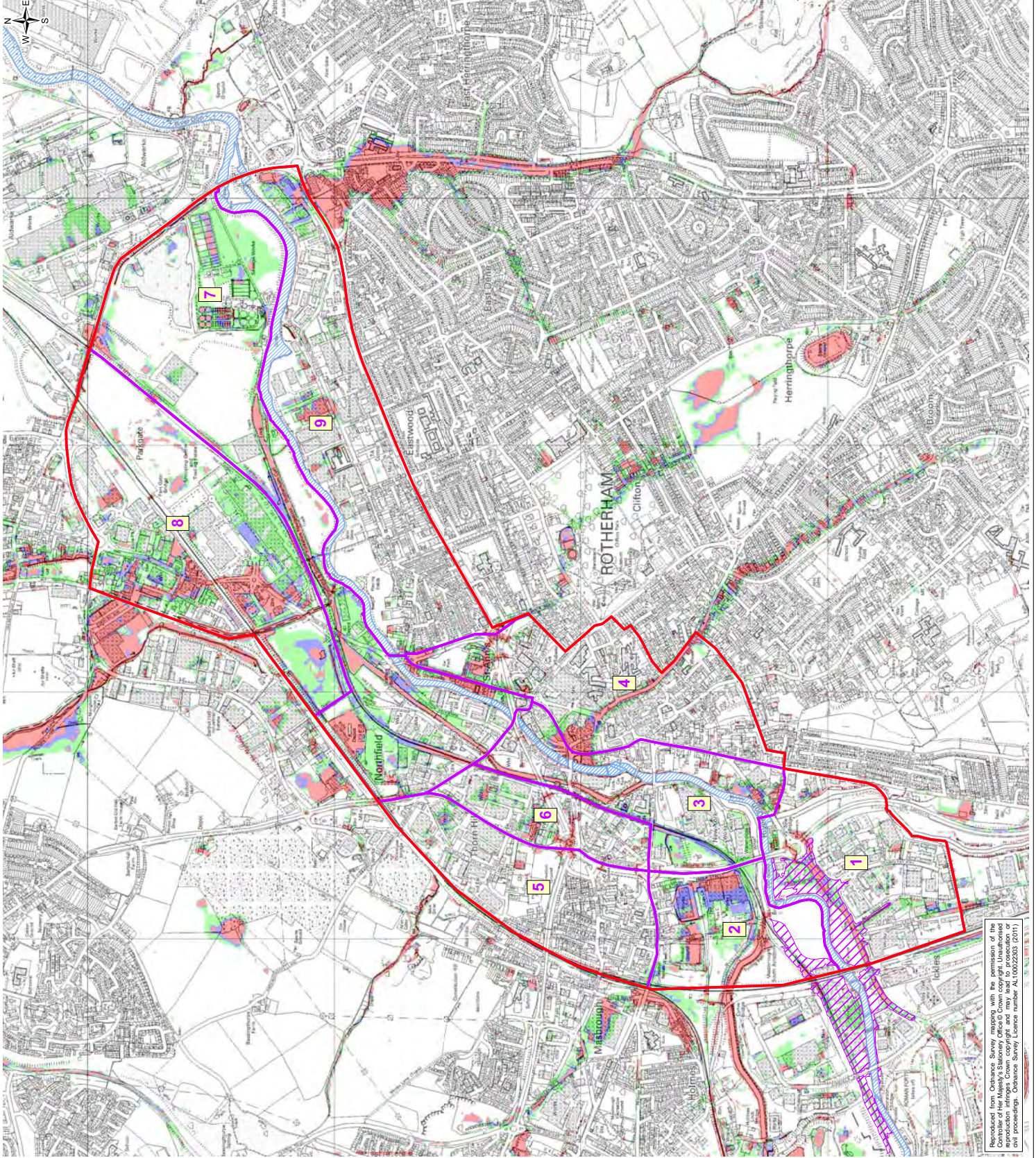
A number of major flood flow paths and consequent areas of deep surface water flooding can also be identified from Figures 9, 10 and 11. This plan shows that a number of main flow routes can be identified. The steeper topography around the Rotherham Regeneration Area results in high runoff rates and this water collects on the flat land around the river unable to drain away.

**FIGURE 9**

**Legend**

- Rotherham Regeneration Area
- Character Areas
- Main River
- Area Benefitting from Defences
- High Surface Water Flood Risk
- Medium Surface Water Flood Risk
- Low Surface Water Flood Risk

This plan shows surface water flood risk using the available topographic data. As a result, we are aware that during actual flood events the flow of water will take the easiest route and therefore in certain locations variance to the modelled route may occur due to physical obstructions. For example, during the 2007 flood event, water flowed along Broom Valley Road rather than through residential properties. Similarly, water flows from Herrington Playing Fields and Clifton Park also flowed along public highways rather than through gardens.



Rev	Date	Initial Issue	AD	PG	MM	DD
		Purpose of revision	Drawn	Checked	Revised	Approved
0	1 APR 2011					

**JACOBS**  
 1 City Walk, Leeds, LS11 9QX, UK  
 Tel: +44(0)113 242 8777 Fax: +44(0)113 288 1389  
 www.jacobs.com

**Client**  
**MAR**  
 Rotherham Metropolitan Borough Council  
 Bailey House, Ravenshead Road,  
 Rotherham, S60 1TD

**Project**  
 ROTHERHAM SFRA 2

Drawing Title		ROTHERHAM SFRA 2	
ROTHERHAM TOWN CENTRE SURFACE WATER FLOOD RISK BY CHARACTER AREA			
Drawing Status	FINAL	DO NOT SCALE	
Scale @A3	1:15,000		
Jacobs No.	B1486900		
Client No.			
Drawing No.	B1486900_SFRA_09.mxd		

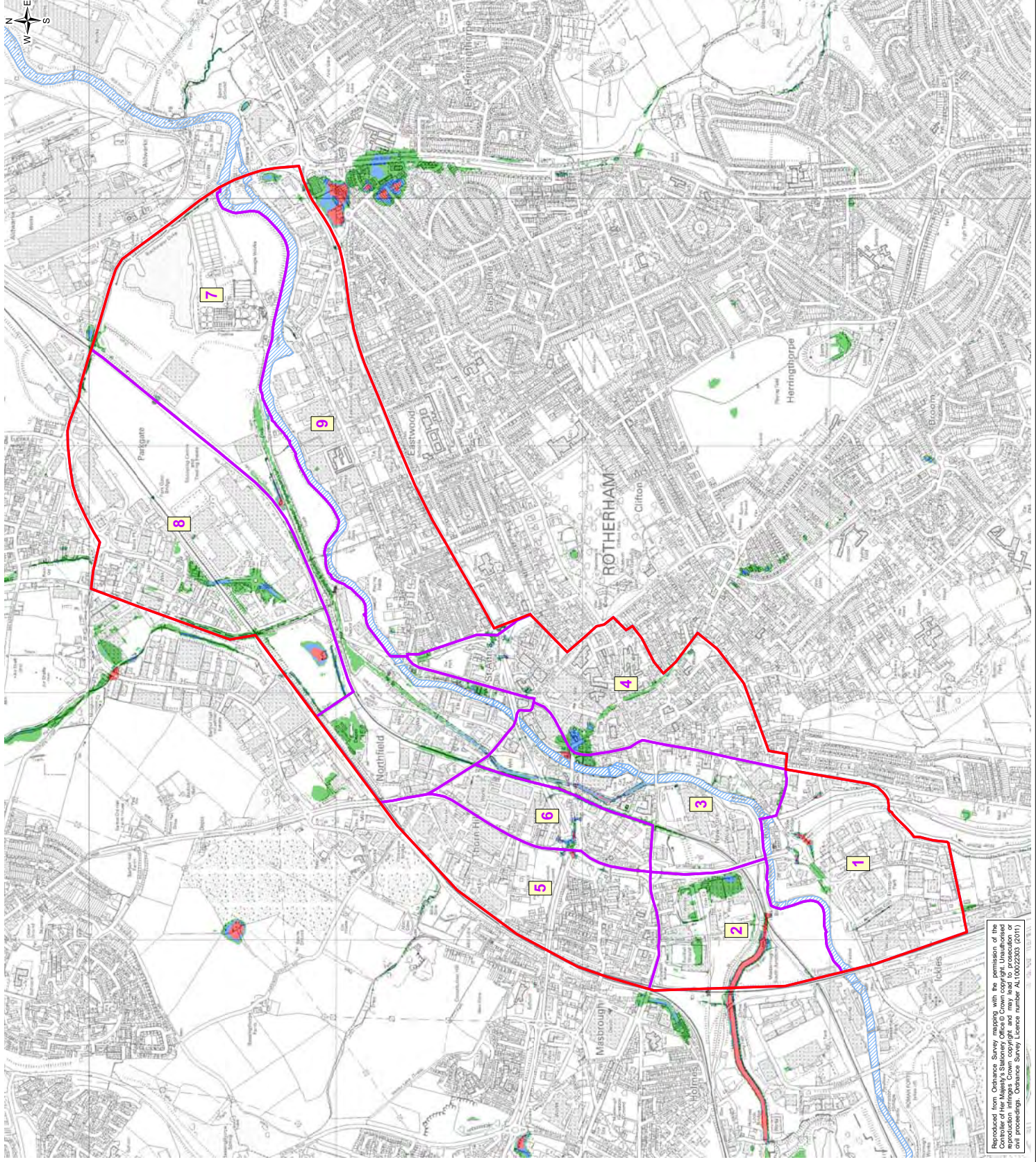
Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL100022303 (2011).

**FIGURE 10**

**Legend**

- Rotherham Regeneration Area
  - Character Areas
  - Main River
- Surface Water Flood Risk Depths
- 0.50 - 1.00m
  - 1.00 - 1.50m
  - > 1.50m

In order to improve legibility, hazard scores below 0.5 have been removed from the map. This should not be taken to indicate that no flooding occurs in this location, or that flooding may not represent a hazard in some cases.



Rev	Date	Initial Issue	AD	PG	MM	DD
0	JPR/2011	Purpose of revision	Drawn	Checked	Revised	Approved

**JACOBS**

1 City Walk, Leeds, LS11 9DQ, UK  
Tel: +44(0)113 242 8771 Fax: +44(0)113 389 1389  
www.jacobs.com

Client  
**MAR**  
Rotherham Metropolitan Borough Council  
Bakewell House, Rawmarsh Road,  
Rotherham, S60 1TD

The Interreg I7B  
North Sea Region  
Programme

Project

ROTHERHAM SFRA 2

Drawing Title

SURFACE WATER FLOOD RISK  
DEPTHS IN HIGH RISK FLOOD ZONES

Drawing Status	Scale @A3	Jacobs No.	Client No.	Drawing No.
FINAL	1:15,000	B1486900		B1486900_SFRA_10.mxd

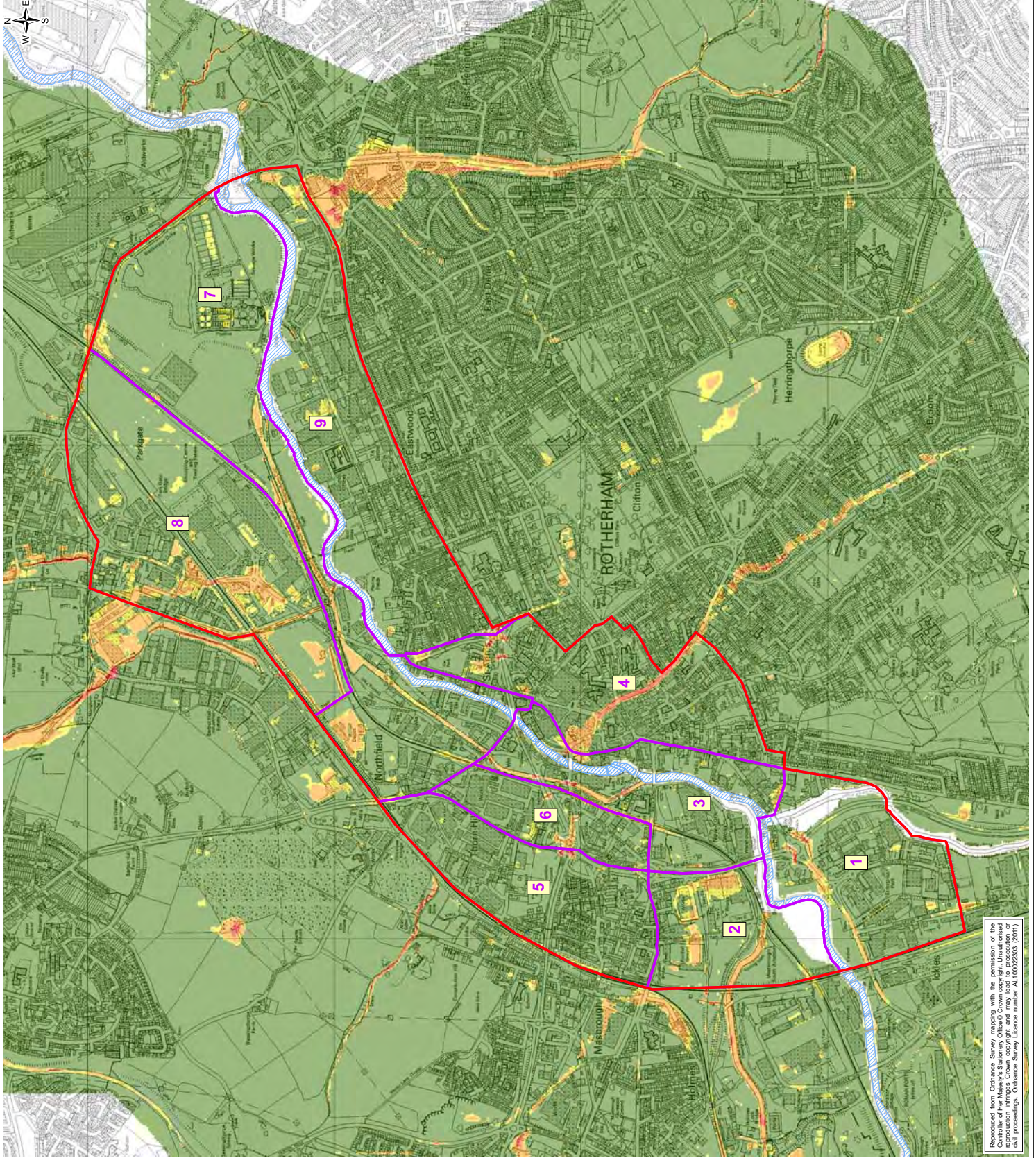
DO NOT SCALE

Reproduced from Ordnance Survey mapping with the permission of the Ordnance Survey. All rights reserved. Crown Copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL100022303 (2011)

**FIGURE 11**

**Legend**

- Rotherham Regeneration Area
- Character Areas
- Main River
- Surface Water Flood Risk Hazard
- Low Hazard: Caution
- Moderate Hazard: Dangerous for some - includes children, the elderly and the infirm
- Significant Hazard: Dangerous for most people - includes the general public
- Extreme Hazard: Danger for all - includes the emergency services



Rev	Date	Initial Issue	AD	PG	MM	DD
0	JAPR 2011	Purpose of revision	Drawn	Checked	Revised	Approved

**JACOBS**  
 1 City Walk, Leeds, LS11 9DX, UK  
 Tel: +44(0)113 242 8771 Fax: +44(0)113 389 1389  
 www.jacobs.com

**MARE**  
 Client  
**Rotherham Metropolitan Borough Council**  
 Balfour House, Rawmarsh Road,  
 Rotherham, S60 1TD

Project  
**ROTHERHAM SFRA 2**

Drawing Title  
**SURFACE WATER FLOOD RISK  
 HAZARD IN HIGH RISK FLOOD ZONES**

Drawing Status	FINAL
Scale @A3	1:15,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA_11.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.  
 P:\B000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA\B1486900\_SFRA\_11.mxd

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. All rights reserved. No reproduction in any form is permitted without the prior written permission of Ordnance Survey. Ordnance Survey Licence number AL10002203 (2011).

### 4.3.3 Summary of Flood Risk

The level of fluvial and pluvial (surface water) flood risk in each character area is summarised in the table below. This shows that the Town Centre has a number of character areas which contain areas which are both at a high risk of river flooding and especially surface water flooding.

Character Area	Main Fluvial Flood Risk Zones			Surface Water Risk		
	1	2	3a	Low	Medium	High
Area 1 Bradmarsh and Templeborough		Yellow			Yellow	
Area 2 Masborough west of Centenary Way		Yellow				Red
Area 3 Central Riverside Area		Yellow	Red	Green		Red
Area 4 Town Centre	Green					Red
Area 5 Masborough Thornhill	Green				Yellow	
Area 6 College Street		Yellow				Red
Area 7 Northfield			Red			Red
Area 8 Parkgate Retail Park		Yellow	Red			Red
Area 9 Eastwood	Green	Yellow	Red		Yellow	

*Note: Surface water risk is very locally specific – refer to plans as the table above is only a general indication.*

**Table 8 - Flood Risk in Each Character Area**

## 5 Flood Risk with RRFAS in Place

**This chapter sets out the full implementation of the RRFAS, which would reduce the risk of flooding and is a fundamental part of delivering renaissance.**

### 5.1 Rotherham Renaissance Flood Alleviation Scheme (RRFAS)

The RRFAS is a fundamental part of the response to reducing flood risk in the Rotherham Regeneration Area. This includes a combination of hard and soft flood defences through raised defences (walls and land raising), creating a new area of compensatory floodplain and improving the flow of water along the River.

Progress to date has included:

- *Delivering an award winning £15 million first phase of then RRFAS. This included 2km of new defences on both banks of the River around the Templeborough Area, which has been designed to withstand climate change;*
- *The installation of flood release mechanisms should overtopping of the defences occur. This means standing water can be released back into the River as soon as it is safe to do so;*
- *Creating a new area of functional flood plain at Centenary Riverside, which is urban wetland; and*
- *The removal of Don Bridge which improves the flow of the River and reduces flood risk over a significant length upstream of it.*

Some of the key benefits of the above are:

- *The area upstream of Templeborough is protected and therefore flood risk is reduced. This has attracted new investment on a number of development sites in close proximity to the Town Centre. It also protects major infrastructure in this area, in particular transport access into the Town Centre;*
- *The combination of Centenary Riverside and the removal of Don Bridge compensates for any floodplain lost as a result of development in the Town Centre. The Environment Agency has agreed that if new development is designed to be fully compatible with RRFAS, then individual development sites in flood risk areas of the Town Centre will not need to create their own on-site compensatory floodplain (thus maximising the developable area in each site);*
- *The works constructed set the requirements in terms of the levels of defences for the next phase of the scheme through the Town Centre. This will extend the scheme from Templeborough (near the Magna Centre), to Frank Price Lock just downstream of Parkgate Retail Park; and*
- *The fully completed scheme will provide protection from river flooding up to a 1% AEP (1 in 100 annual chance) event throughout this area (i.e. a flood event which has a 1 in 100 annual chance of occurring in any year would be defended against).*

The next phase of the RRFAS will be delivered incrementally as development on sites comes forward and funding from other sources becomes available. In some cases, the protection of specific sites by the RRFAS will give rise to a wider benefit in that it will then protect the whole flood cell (these are areas where the extent of flooding can be clearly defined). However, the full flood risk protection benefits of the scheme will only occur once it is fully completed.

Phase 1 of RRFAS set the requirements of the levels of defences for the next phase of the scheme through the Town Centre. This will extend the scheme from phase 1 near Templeborough (near the Magna Centre), to Frank Price Lock just downstream of Parkgate Retail Park (see Figure 12 below).

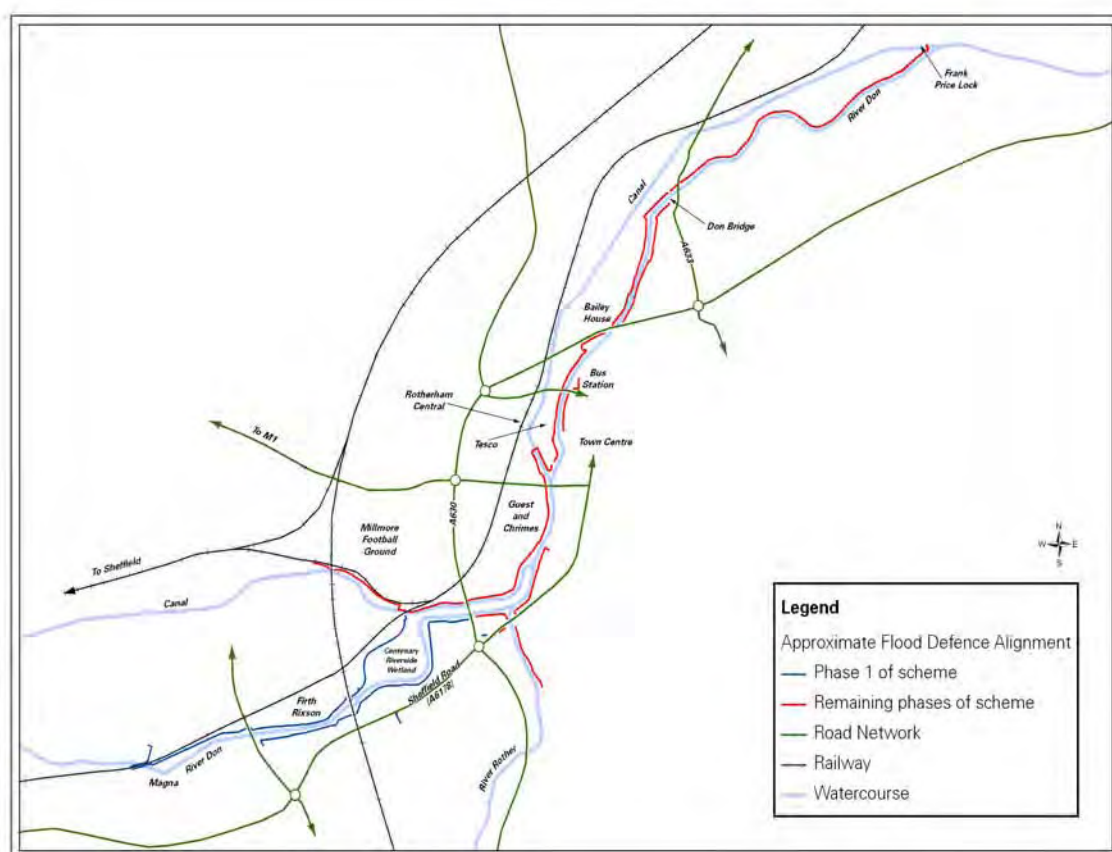


Figure 12 - Rotherham Renaissance Flood Alleviation Scheme

## 5.2 How the RRFAS Reduces Flood Risk

Once fully completed, RRFAS will provide a 1% AEP (1 in 100 annual chance) level of protection from river flooding throughout this area. In other words, the implementation of the full RRFAS will reduce the risk of flooding from the river to a 1% chance in any given year.

As shown on Figure 13, this would mean that flood risk across much of the Rotherham Regeneration Area is effectively reduced to the equivalent of Flood Zone 2. However, as the Environment Agency National Flood Maps are the starting point for assessing flood risk as part of planning applications, these always indicate flood risk without defences in place. As such, these maps will still show large parts of the Town Centre Regeneration Area as within Flood Zone 3a even when defences are completed.

### 5.3 Phased Implementation of RRFAS Phase 2

Phase 2 may take some time to deliver as it is not proposed to complete it in a single construction phase. A small part of the scheme on the right bank between the Tesco Footbridge and Chantry Bridge is programmed to commence construction during 2011. The new council offices on the former Guest and Chrimes site incorporate part of RRFAS. Planning permission was also recently granted for land raising on the former Guest and Chrimes sites as part of the construction of a new community stadium. This land raising effectively provides a section of RRFAS near the upstream end of the left bank flood cell.

The ideal solution would be to complete the remaining parts of the overall community wide scheme as a single project and utilise public funding for all flood defence works. However, this is not going to be possible and therefore a number of publicly funded phases are needed, alongside investment from private development on key sites.

The implementation of the overall community wide scheme is therefore likely to require an incremental approach. Scheme phasing is therefore of critical importance to ensure that flood risk to existing businesses and infrastructure is not increased in the interim period (which will be several years) before the overall scheme is completed.

There are two parts of the works already completed through the partnership between RMBC and the Environment Agency that are of critical importance to subsequent phases of the scheme:-

- *The creation of compensatory floodplain at the Centenary Riverside Wetland site as part of the 2008 works; and*
- *The removal of Don Bridge in 2010.*

The combination of the above will offset the impacts of 'channelisation' of flood levels throughout the study area that are inherent in the construction of flood defences, as illustrated in the table below. This means that, provided that development is compatible with the overall community wide flood alleviation scheme, then individual development sites in flood prone areas will not have to create their own on site compensatory floodplain, thus maximising their development potential. This has been agreed between RMBC and the Environment Agency.



Location	Change to 1 % AEP (1 in 100 annual chance) flood levels after full implementation of RRFAS, compared to pre-scheme conditions (m) (2005 Baseline)
Railway Bridge at Magna	+0.3
Bessemer Way Bridge	+0.3
Firth Rixson Weir	+0.1
Centenary Riverside	-0.1
Main Street Bridge	0
Chantry Bridge	-0.1
Crinoline Bridge	-0.2
Don Bridge	-0.6
Downstream areas	0

**Table 9 - River Channelisation**

In terms of not making flood risk worse to adjacent areas, either through the implementation of new defences or through raised development platforms that are built in areas at risk of flooding, compatibility with RRFAS can be achieved by ensuring works are constructed no nearer to the river than was modelled in 2005 and constructed to the levels defined in the Design Guidance (Section 5 of the Flood Risk Toolkit). If the defences are set back from this modelled alignment, then this will result in less channelisation of flows than has been assumed to derive the data in the above table.

Where development delivers a part of RRFAS, then the works need to be done in a manner that they can readily be tied into others in the future. For example, space should be left to allow cranes, piling rigs, excavators etc to safely access and work.

**FIGURE 13**

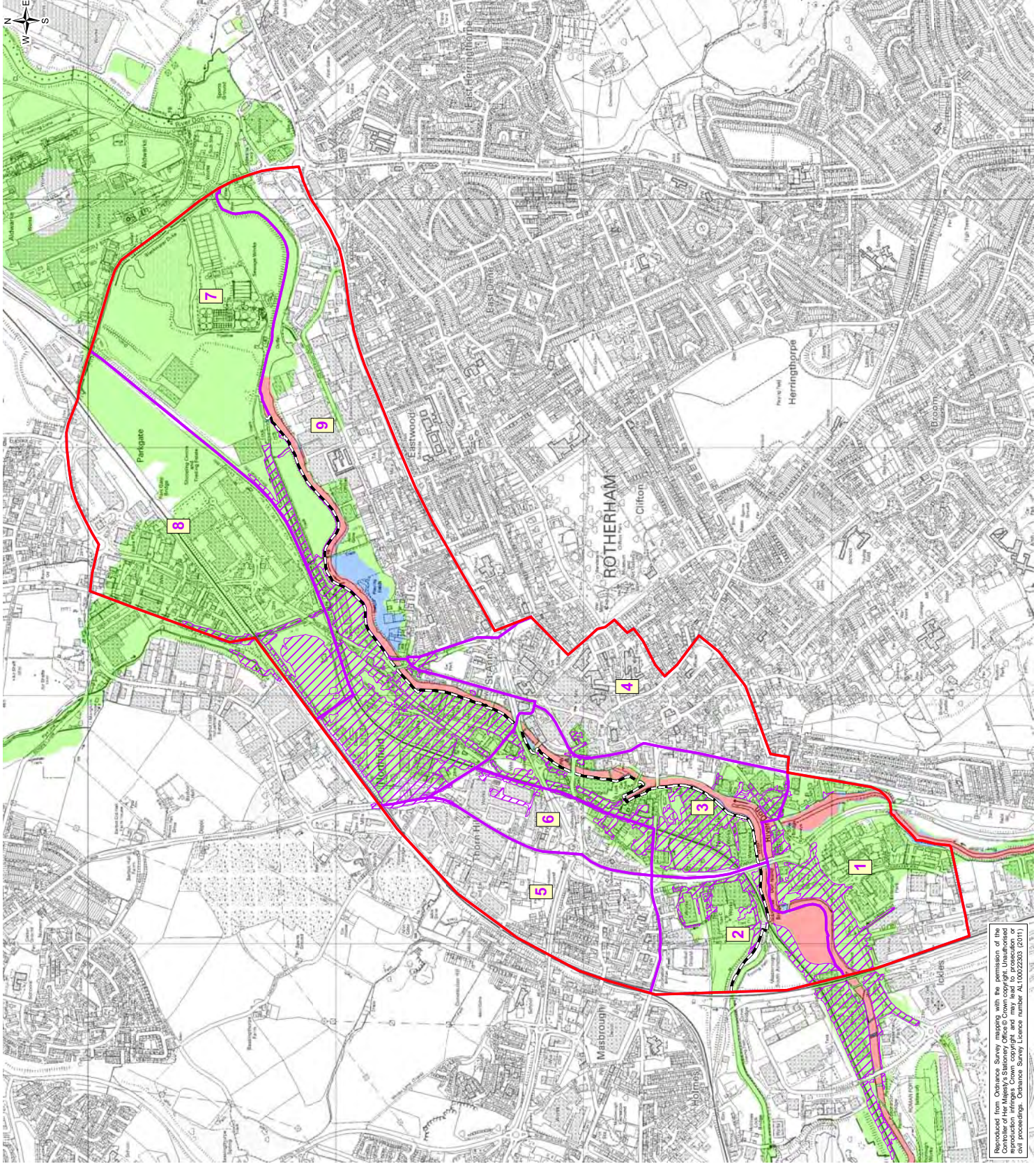
**Legend**

- Rotherham Regeneration Area
- Character Areas
- Area Benefitting from Defences
- RRFAS Raised Defences
- 1:25: Flood Extent - 'Functional Flood Plain'
- 1:100: Flood Extent - 'High Probability'
- 1:1000: Flood Extent - 'Medium Probability'
- 1:1000: Flood Extent has not been included in the detailed modelling undertaken. National Flood Zone 2 has therefore been used.

This plan shows the modelled flood risk from the River Rother following the full implementation of the RRFAS. It indicates that flood risk is likely to be greatly reduced over the current situation.

Note that this assessment does not cover flood risk from minor watercourses that might impact on proposed development sites, but will not affect spatial planning at a strategic level.

For planning purposes the National Flood Zone Map should still be used as the first step in determining the requirements for preparation of a Flood Risk Assessment for proposed development areas.



Reproduced from Ordnance Survey mapping with the permission of the Ordnance Survey. All rights reserved. Crown Copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL10002203 (2011).

Rev	Date	Drawn	Checked	Revised	App'd
0	JPR/2011	AD	PG	MM	DD
Purpose of revision					

**JACOBS**  
 1 City Walk, Leeds, LS11 9QX, UK  
 Tel: +44(0)113 242 8777 Fax: +44(0)113 389 1389  
 www.jacobs.com

**MAR**  
 Client  
**Rotherham**  
 The Interreg ITR North-Sea Region Programme  
 Rotherham Council  
 Bakery House, Rowntree Road,  
 Rotherham, S60 1TD

Project: ROTHERHAM SFRA 2  
 Drawing Title: MODELLED REDUCTION IN FLOOD RISK WITH THE ROTHERHAM RENAISSANCE FLOOD ALLEVIATION SCHEME IN PLACE

Drawing Status	FINAL
Scale @A3	1:15,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA_13.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.  
 P:\000000\000486900 - TRFAS Phase 2\GIS\output\SFRA1486900\_SFRA\_13.mxd

DO NOT SCALE

## 6 Residual Risks With RRFAS in Place

This chapter considers the ongoing (residual) flood risk which would remain after the RRFAS is implemented. This is because the risk of flooding is still an issue even with the construction of flood defences. There is always the possibility of a flood event occurring which is of a greater magnitude than the scheme was designed for or because it does not work in the way it was intended. This is an important consideration as there is a need to make sure public safety is maintained for development on any site within areas at risk from flooding, even after this risk is greatly reduced by flood risk management infrastructure.

### 6.1 Assessment of Residual Flood Risk

The residual flood risks associated with development in Rotherham Regeneration Area are considered to be:

- *The potential for flood defences to be overtopped i.e. water rises to a level greater than what they are designed for;*
- *Flood defences are breached i.e. a hole or gap in the defences occurs allowing water to flow through them; and*
- *The impact of climate change i.e. more severe weather patterns occur.*

#### 6.1.1 Overtopping of Defences

Raised flood defences are designed to withstand a particular magnitude of flood event plus freeboard, the 'design event'. In the case of the RRFAS this is the 1% AEP (1 in 100 annual chance) event.

Should a flood event occur that exceeds this 'design event', water would spill over the defences and flood the areas behind it. For example, the 0.1% AEP (1 in 1000 annual chance) event would still result in widespread flooding across Rotherham because all the areas within Fluvial Flood Zones 2 and 3 would still flood in the same way as if the defences were not in place.

The probability of various flood events that might occur (in a given time period) are set out in the table below.

Overtopping Event Percentage Likelihood (within a given time period)					
Time	Probability or chance of flooding (size of flood event)				
Annual Probability	1%	0.66%	0.5%	0.2%	0.1%
Annual Chance	1 in 100	1 in 150	1 in 200	1 in 500	1 in 1000
10	10%	6%	5%	2%	1%
20	18%	13%	10%	4%	2%
30	26%	18%	14%	6%	3%
40	33%	23%	18%	8%	4%
50	40%	28%	22%	10%	5%
100	63%	49%	39%	18%	10%
200	87%	74%	63%	33%	18%

Table 10 - The Probability of Various Flood Events

This means that the probability of the 1% AEP (1 in 100 annual chance) standard RRFAS defences being overtopped over a 100 year time period is 63%. In other words, there is a 37% probability that they will not be overtopped over a 100 year time period. Caution is obviously required when relying on this kind of assessment. The probability is not evenly spread so for example two severe events could occur in quick succession and then not occur again for numerous years. For example, the March 1999 and November 2000 events that severely affected North Yorkshire

If overtopping of a defence did occur, it is likely that it would have been predicted and therefore appropriate warning would be given by the Environment Agency to evacuate the area. All development which in areas at risk of flooding (Flood Zone 2 and 3) and potentially at risk of flooding due to defence overtopping, should therefore be placed on their flood warning system as a standard practice.

### 6.1.2 Assessment for Overtopping Scenarios

In order to assess the likely impacts of flood defences overtopping, modelling work was undertaken to assess the impacts of a 0.1% AEP (1 in 1000 annual chance) flood event (a very severe weather event). However, the results from the modelling suggest that extents of flooding would be similar to the current, undefended, 0.1% AEP (1 in 1000 annual chance) flood event. Therefore, the existing Flood Zone 2 outlines have been retained.

### 6.1.3 Breaching of Defences

Breaching of defences can occur through structural failure or operational failure, as described below.

#### Structural Failure

This scenario presents a major risk to the safety of people and property protected by defence structures, with loss of life being a potential consequence.

A defence breach can occur when part of a flood defence scheme suffers a structural failure during a flood event, allowing water to rapidly pass through it and inundate areas of land behind it.

The risk of defence breaching is very low on newly constructed flood defences, however, the risk increases with the age of the defences or if older structures are incorporated into the design of a new scheme. This risk also increases if repair and maintenance is not undertaken at regular frequencies. The Design Guidance (Section 5 of the Flood Risk Toolkit) sets out the responsibilities and roles of organisations in maintaining the flood defences.

#### Operational Failure

A risk of breach arises from failure or in-operation of a component of the Flood Alleviation Scheme. These components will be maintained and operated in accordance with predefined procedures in advance of significant increases in flood water level. Like structural failure, the risk of operational failure is lower with newly constructed defences. Secondary processes and measures can be identified for implementation in the event of failure of the key operational elements of the scheme.

A further breach risk would be if an operational element of a flood alleviation scheme, such as a floodgate or a barrier, is not closed before the flood event occurs. As the RRFAS includes flood gates to maintain access to the River, this is a possibility. Measures to avoid this happening are a specific emerging operating procedure for these features, with the responsibilities for operation being clearly identified. Regular testing of the implementation of this emerging procedure should also be undertaken.

#### 6.1.4 Assessment for Breach Scenarios

In order to assess the potential impacts if a breach of the RRFAS did occur, modelling work was undertaken to simulate a series of breaches occurring along the defences. These breaches were located in areas which would lead to a 'worst-case' flooding scenario. The simulation of multiple breaches at the same time also represents a worst-case scenario which also allows the effect of individual breaches to be considered. A 1% AEP (1 in 100 annual chance) flood event, including an allowance for climate change, has been used in the breach assessment.

Figure 14 shows if the defence was breached, this would put areas of the Rotherham Regeneration Area along the left bank most at risk of flooding with water channelling along either side of the railway and the canal. Water from a breach further downstream would travel along these flow paths before ponding in the area around Northfield, where the topography changes and where lower lying land is contained.

Areas within 25m of the riverbank are modelled by the SFRA 2 as Rapid Inundation Zones. This is where if a breach occurred, water would flow very quickly and cause the greatest hazard to people and properties. Rapid inundation of floodwater would impact the areas adjacent to flood defences if they failed or overtopping occurred. Where stored water is suddenly released it flows rapidly causing extreme danger. When rapid inundation occurs, there is limited time to provide warnings so this is a very dangerous form of flooding.

If a breach occurred downstream, flooding would be extensive as shown by Figure 15, where most Character Areas would experience some inundation. Water depths greater than 1.5m could be experienced in areas either side of the railway and canal.

In the part of the Rotherham Regeneration Area south of the River Don, Bradmarsh and Templeborough and a small area in the Central Riverside Area would be affected if a breach occurred.

The highest residual flood risk (as shown on Figure 14) as a result of defence breaching or overtopping occurs in the following Character Areas:

- *Bradmarsh and Templeborough (Character Area 1);*
- *Masborough west of Centenary Way (Character Area 2);*
- *Central Riverside Area (Character Area 3);*
- *Northfield (Character Area 7); and*
- *Parkgate Retail Park (Character Area 8).*

## 6.2 Mitigating Residual Flood Risk

Measures to manage the residual flood risk in the areas identified above will therefore be required. This includes:

- *Seeking to ensure that development which is at the most vulnerable to flooding takes place in the areas of lowest flood risk (Steps 2 and 3 of the flood management hierarchy);*
- *Raising land, particularly on sites adjacent to the river, where the flood risk is highest (Step 4 in the flood management hierarchy); and*
- *The distance between defences and development should be maximised to increase the time elapsed before the development becomes flooded to reduce the potential risk (Step 5 in the flood management hierarchy).*

As described above, it is possible that mitigation measures including flood defences will be overwhelmed by a flood event of greater magnitude than the mitigation was designed to protect against. To minimise the impact of such a scenario, the following can be done:-

- *Incorporate facilities to release the majority of trapped flood water back into the river (i.e. flood release mechanism);*
- *Incorporate localised facilities to release small volumes of water trapped in low points (e.g. appropriate contouring of land to direct water to collector drains, pumping facilities etc); and*
- *Incorporate resilience into developments.*

New developments should ensure that safe access can be ensured even during breaching or overtopping events. Flood warning and evacuation plans should be made to ensure that occupants can keep themselves safe during an event. This should take into account the risk of rapid inundation resulting from a breach of the flood defences.

New developments should consider the incorporation of flood resistance and resilience measures to reduce the impact of flood events should they occur (assuming the Sequential Approach Guidance (Section 4 of the Flood Risk Toolkit) is met). The Design Guidance (Section 5 of the Flood Risk Toolkit) provides further information on this.

### **6.2.1 Flood Release Mechanisms**

Flood release mechanisms have already been incorporated into Phase 1 of RRFAS and are located within the flood defence structures. Similar features will be incorporated in subsequent phases of RRFAS and it is envisaged that they will be designed, maintained and operated in a similar manner to those already in place. Further information is contained in the Design Guidance.

### **6.2.2 Resilience Advice**

Developments can be designed in order to survive, or more easily recover from, the effects of flooding, through incorporation of measures to improve flood resistance or resilience.

Whilst these measures should not be used to justify the construction of inappropriate developments in high risk zones, they can be used to mitigate the residual risks of construction behind flood defences.

Further information can be found in the Design Guidance that is contained in Section 5 of the Flood Risk Toolkit.

### 6.3 Climate Change Adaptation

Climate change will result in an increase in rainfall intensities and peak flows. PPS 25 and PPS1 require proposed developments to consider the impacts of climatic change on flood risk over the course of the developments life.

The assessment of flood risk in this SFRA 2 has already considered the impacts of climate change when modelling flood risk through Rotherham. Also, the defences forming part of RRFAS have considered the impacts of climate change, so will continue to protect the town against a 1% AEP (1 in 100 annual chance) event over the 120 year life of the defences, provided that:

- *Flood defence structures need to be designed in a manner that they can readily be raised in the future without structural work to below ground foundations (as they have been designed for RRFAS);*
- *Land raising needs the development platform to be set at a level that takes account of climate change from the outset; and*
- *Drainage systems need to be able to accommodate the increase in peak flows and run off volumes that may occur in the future.*

Through appropriate design of development the above can readily be incorporated and so the risks of flooding from climate change can currently be considered to be low.

Information on how this can be achieved is contained in the Design Guidance (Section 5 of the Flood Risk Toolkit).

**FIGURE 14**

**Legend**

- Rotherham Regeneration Area
- Character Areas
- RRFAS Raised Defences
- Rapid Inundation Zone
- Flood Risk Hazard
- Low Hazard: Caution
- Moderate Hazard: Dangerous for some - includes children, the elderly and the infirm
- Significant Hazard: Dangerous for most people - includes the general public
- Extreme Hazard: Danger for all - includes the emergency services

Flood Hazard due to defence breaching is based on the detailed modelling of a series of breaches in the defences. The hazard classification has been manually extended, based on the topography, to consider areas where breaches have not actually been modelled.

Note that, because of this, this map may not represent the actual breach hazard at a site scale. For specific site analysis, detailed modelling should be undertaken to determine breach hazard in more detail and measures to manage the residual flood risk should be clearly identified.

Flood hazard has been calculated according in accordance with the methodology outlined in Defra Report 'FRA GUIDANCE FOR NEW DEVELOPMENT: PHASE 2 FD2320/TR2.

A notional 25m 'Rapid Inundation Zone' has been added along the length of the defences. A Rapid Inundation Zone is an area which is at greatest risk of rapid flooding should a defence fail. New development should be sited away from this area unless in exceptional circumstances.

Rev	Date	Drawn	Checked	Revised	Appr'd
0	JPR/2011	AD	PG	MM	DD

**JACOBS**  
 1 City Walk, Leeds, LS11 9QX, UK  
 Tel: +44(0)113 242 8771 Fax: +44(0)113 381 1389  
 www.jacobs.com

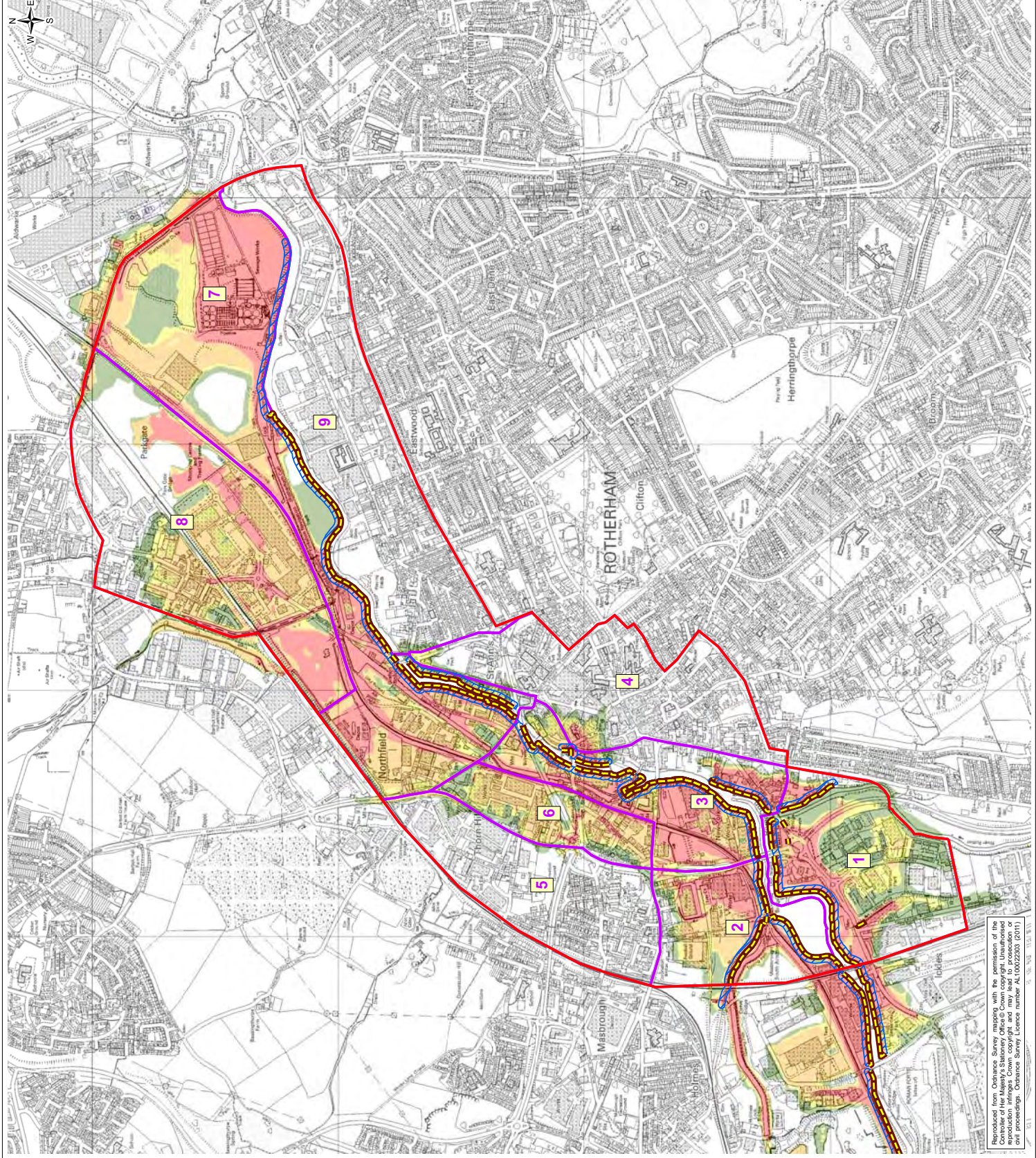
**MARE**  
 Client: Rotherham Metropolitan Borough Council  
 Project: ROTHERHAM SFRA 2

Project: ROTHERHAM SFRA 2

Drawing Title: BREACH HAZARD OF RRFAS DEFENCES - 1% ANNUAL PROBABILITY EVENT

Drawing Status	FINAL
Scale @A3	1:15,000
Jacobs No.	B1486900
Client No.	

Drawing No: B1486900\_SFRA\_14.mxd  
 This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on the drawing. Refer to the contract for full terms and conditions.  
 P:\00000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA1486900\_SFRA\_14.mxd



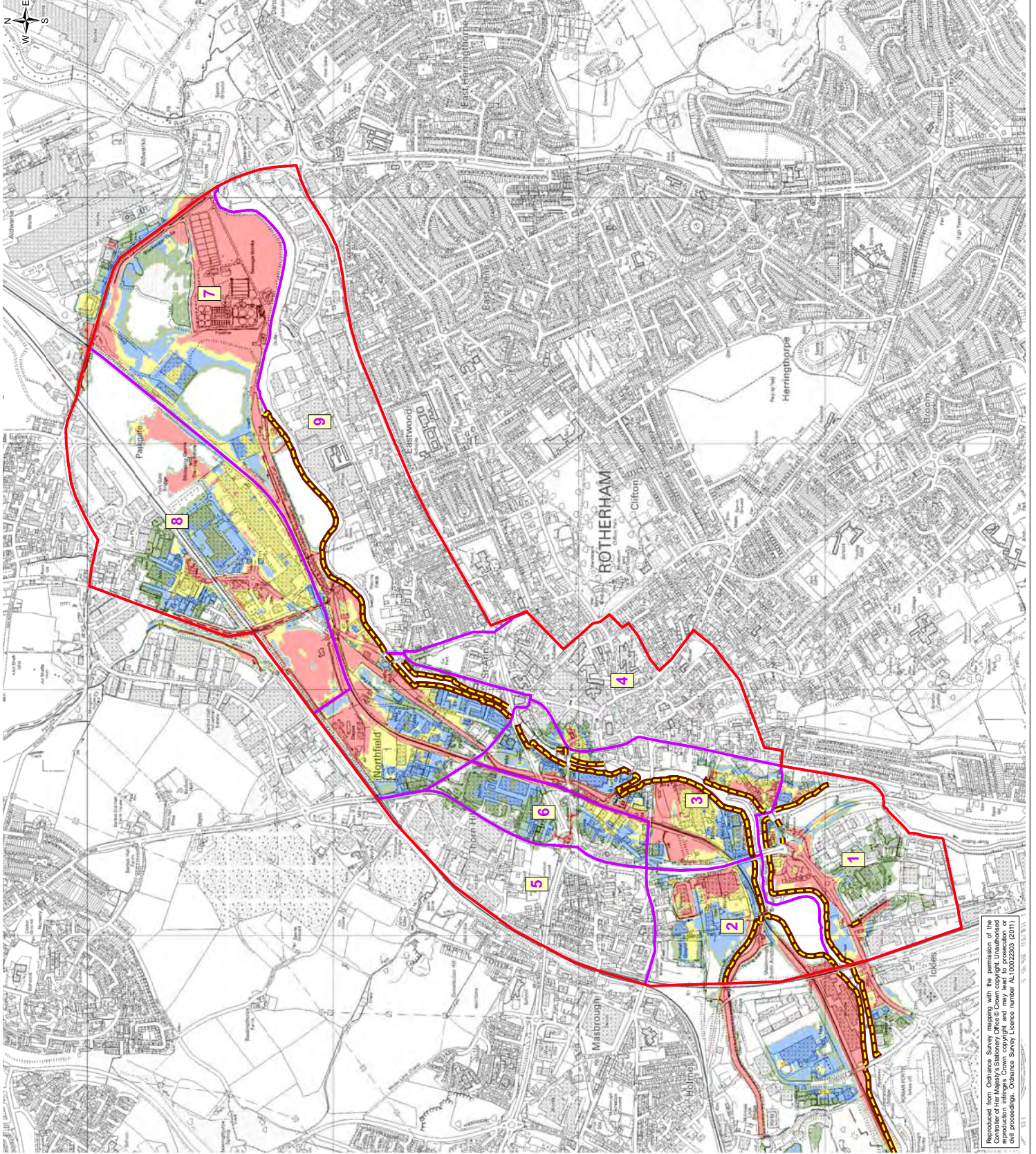
Reproduced from Ordnance Survey mapping with the permission of the Ordnance Survey. All rights reserved. Reproduction or distribution of this information without the prior written permission of the Ordnance Survey may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL100022303 (2011)



**FIGURE 15**

**Legend**

- Rotherham Regeneration Area
- Character Areas
- RRFAS Raised Defences
- Flood Risk Depth**
- 0 - 0.05m
- 0.05 - 0.50m
- 0.50 - 1.00m
- 1.00 - 1.50m
- > 1.5m



Rev	Date	Initial Issue	AD	PG	MM	DD	
0	JPR/2011						
		Purpose of revision					Drawn
							Checked
							Revised
							Approved

**JACOBS**  
 1 City Walk, Leeds, LS11 9QX, UK  
 Tel: +44(0)113 242 6771 Fax: +44(0)113 389 1389  
 www.jacobs.com

Client  
**MAR**  
 Rotherham Metropolitan Borough Council  
 Bailey House, Rawmarsh Road,  
 Rotherham, S60 1TD

Project  
 ROTHERHAM SFRA 2

Drawing Title  
 FLOOD RISK DEPTH IF DEFENCES  
 BREACHED - 1% ANNUAL PROBABILITY EVENT

Drawing Status	FINAL
Scale @A3	1:15,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA_15.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.  
 P:\B0000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA\B1486900\_SFRA\_15.mxd

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL10002203 (2011)

## 7

**Conclusions**

The flood risk to the Rotherham Regeneration Area has been the subject of considerable focus by RMBC and the Environment Agency since floods occurred during November 2000.

This has determined a comprehensive approach through RRFAS and other measures to achieve an overall adaptive response. The driver for mitigating flood risk has in particular aligned to the regeneration aspirations of the Council, in order to reinvigorate investment in the economy through facilitating the re-use of degraded former heavy industrial riverside sites and creating a more attractive area with a sustainable future. Considerable public sector investment has been made in the first phase of the comprehensive scheme.

The flood risk and regeneration challenges can be overcome through a pro-active and comprehensive strategy to flood risk management as outlined throughout the Flood Risk Toolkit. The principles established and guidance set out should be followed throughout so that a safe, attractive, economically viable and sustainable heart of the Borough is developed.

## Development in Rotherham Regeneration Area

### Flood Risk Toolkit

#### Sequential Approach Guide

## FLOOD RISK TOOLKIT

Introduction

How to Use Guide

Level 2 Strategic Flood Risk Assessment

**Sequential Approach Guide**

Design Guidance

Large Scale Plans

April 2011

y.

## Contents

<b>1</b>	<b>Introduction</b>	<b>4 - 1</b>
1.1	Introduction	4 - 1
1.2	The Sequential Approach	4 - 1
1.3	The Sequential Test	4 - 2
<b>2</b>	<b>Applying the Sequential Test</b>	<b>4 - 4</b>
2.1	Flood risk Vulnerability	4 - 4
2.2	Applying the Sequential Test	4 - 5
2.3	Sequential Test by Character Area	4 - 6
2.4	PPS 25 Exception Test	4 - 10

### **Appendix A: Rotherham Regeneration Area**

### **Appendix B: Site Specific Case Studies**

## **Table of Figures**

Figure 1 – Contents of Flood Risk Toolkit	4 - 1
Figure 2 – Flood Risk Management Hierarchy	4 - 2

## **Table of Tables**

Table 1 – PPS 25 Vulnerability Classifications from Table D.2 of PPS 25	4 - 5
Table 2 – Sequential Test ‘At a Glance’ in the Rotherham Regeneration Area	4 - 9
Table 3 – Fluvial Flood Risk Classifications	4 - 9
Table 4 – Surface Flood Risk Vulnerability Classifications	4 - 10

**This page is intentionally left blank.**

# 1 Introduction

## 1.1 Introduction

This document is part of the Flood Risk Toolkit for the Rotherham Regeneration Area. The purpose of this document is to set out how the PPS 25 Sequential Approach will be applied. Figure 1 below highlights how it fits within the overall toolkit.

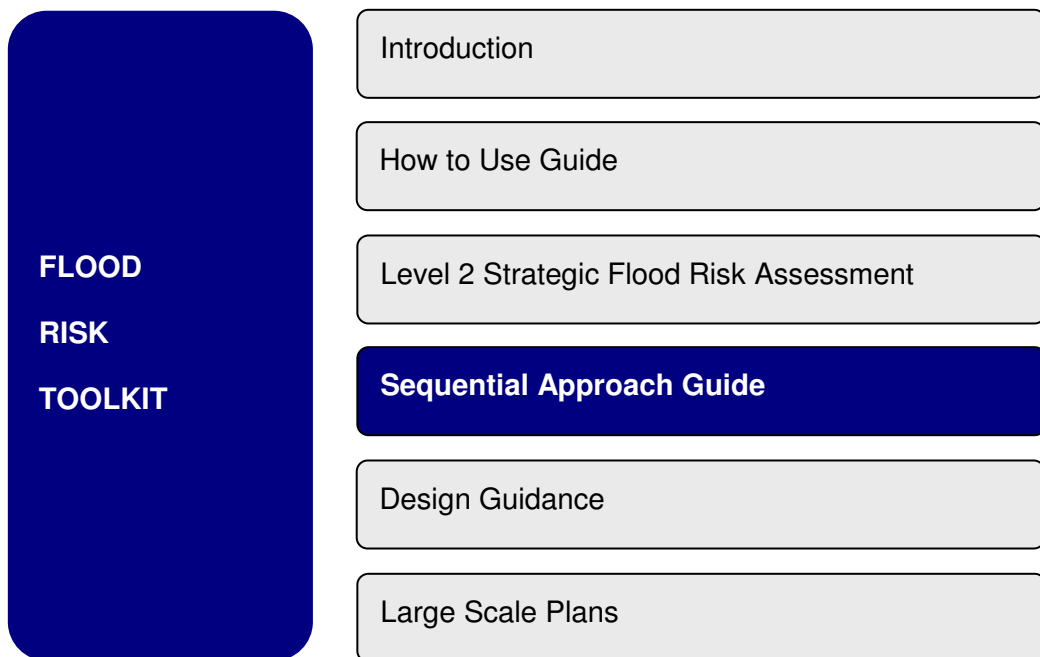


Figure 1 – Contents of Flood Risk Toolkit

## 1.2 The Sequential Approach

Step 2 in the flood risk management hierarchy set out in Figure 2 highlights that the first part of the Sequential Approach is to avoid development in areas at a higher risk of flooding. The PPS 25 Good Practice Guide<sup>1</sup> outlines that there are circumstances where this approach will not be automatically applied where it could be detrimental to wider planning and sustainability objectives.

The wider regeneration and land use objectives for the Rotherham Regeneration Area means it is necessary to develop land within Flood Zones 2 and 3a. This includes a number of key brownfield riverside development sites, such as the former Guest and Chrimes site. There are also important existing industrial and employment locations, such as those around Rawmarsh Road and Templeborough.

<sup>1</sup> Where redevelopment is ongoing as part of an existing regeneration strategy in Flood Zones 2 or 3, it has to be accepted that the redevelopment cannot go anywhere else, as there are no other reasonably available sites. Nevertheless, the sequential approach should still be applied within the regeneration area (PPS 25 Good Practice Guide – Para 4.38).

The reasons for defining the boundary of the Rotherham Regeneration Area and the regeneration objectives for the 9 Character Areas that make up this area is provided in Appendix A. The regeneration and flood risk objectives for this area will be reflected in the emerging Core Strategy, which will provide specific policies on flood risk and propose to adopt the Flood Risk Toolkit as Supplementary Planning Guidance (SPG).

This means for development proposed within the boundary of the Rotherham Regeneration Area, the strategic Sequential Approach has already been met i.e. the principle of development is accepted despite the higher level of flood risk. This means some forms of development which are normally avoided in higher risk flood zones can proceed where the site level Sequential Test (Step 3) is met and appropriate flood risk, control and mitigation is demonstrated (Steps 4 and 5).

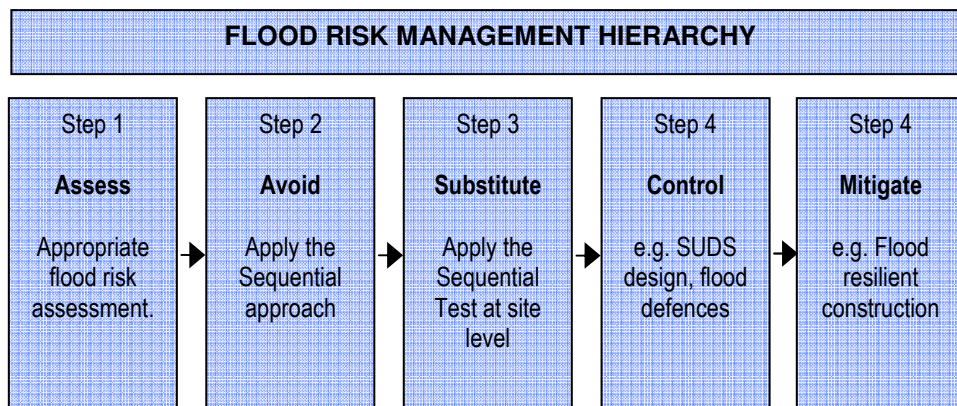


Figure 2 – Flood Risk Management Hierarchy<sup>2</sup>

### 1.3 The Sequential Test

The Sequential Test is Step 3 in the flood risk management hierarchy and is defined as follows by PPS 25:

*Local Planning Authorities (LPA's) allocating land in Local Development Documents (LDDs) should apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed. A sequential approach should be used in areas known to be at risk from other forms of flooding.<sup>3</sup>*

PPS 25 and the practice guide state<sup>4</sup>: *If a proposed development is identified in a sequentially tested LDD that is supported by an SFRA, the site will already have been through the Sequential Test. As long as the development types making up the proposal are in accord with the LDD, a developer can rely on the outcome of the testing. However, there may still be opportunities for the sequential approach to be considered within the site (flood risk substitution).*

<sup>2</sup> Planning Policy Statement 25: Development and Flood Risk. Communities and Local Government. March 2010:

<sup>3</sup> Planning Policy Statement 25, March 2010, Communities and Local Government, P7

<sup>4</sup> Planning Policy Statement 25, March 2010, Communities and Local Government, P7



RMBC will produce a Site and Policies Development Plan Document (DPD) as part of the Local Development Framework (LDF) once the emerging Core Strategy is Adopted. The status of this Sequential Approach Guide will be reviewed after the Sites and Policies DPD is adopted as it is likely that the information contained in this document can be incorporated into the policies of this DPD.

Until the Sites and Policies DPD is Adopted, the Sequential Test will need to be applied to all planning applications in Flood Zones 2 and 3a of the Rotherham Regeneration Area as a best practice approach.

## 2 Applying the Sequential Test

### 2.1 Flood risk Vulnerability

PPS 25 Table D.2 classifies different land uses according to how vulnerable they are to flood risk as repeated in Table 2 below. These classifications must be used when applying the Sequential Test.

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

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

**Table 1 - PPS 25 Vulnerability Classifications from Table D.2 of PPS 25**

## 2.2 Applying the Sequential Test

The following principles apply to the Sequential Test in the Rotherham Regeneration Area:

- *Only potential alternative locations within the defined boundary of the Rotherham Regeneration Area need to be considered. Therefore, alternative sites outside this boundary can be discounted from the Sequential Test; and*
- *The 9 Character Areas will be used as the basis for applying the site specific Sequential Test.*

The Sequential Test will be passed if it is demonstrated through site specific Flood Risk Assessments that new development in Flood Zones 2 and 3a are in accordance with the following sequence:

- *Flood Zone 1 sites within the same Character Area should be considered in preference to sites in higher Flood Zones, i.e. sites that are in Flood Zones 2 and 3;*
- *Where alternative Flood Zone 1 sites within the same Character Area are not suitable, deliverable or available, alternative sites in other Character Areas will need to be considered where they are in a lower risk flood zone than the proposed development site;*
- *Where a development is proposed in Flood Zone 3a (including where only part of the site is in Flood Zone 3a), the same sequence should apply considering Flood Zone 1 sites first and then sites in Flood Zone 2 where these are not available; and*
- *Where the development is an extension or redevelopment of an existing industrial or employment use within the existing site boundary, the site specific Sequential Test will not need to be applied. However, it may need to be applied where a change of use is proposed.*

If the Sequential Test is passed at the site level, it is then necessary to consider how flood risk can be reduced within the internal layout of the proposed development site:

- *Built development should, where possible, take place in the lowest risk zone flood parts of the site in preference to the highest risk areas allowing for safe access at all times including during times of flood (mitigation may still be required to reduce overall flood risk). Consideration of designing site layouts and buildings to maximise flood resilience should be demonstrated through Design and Access Statements which are a statutory part of the planning application process and also through Flood Risk Assessments.*

**Rotherham Metropolitan Borough Council will determine when considering planning applications if the site specific Sequential Test has been met.**

### 2.3 Sequential Test by Character Area

Table 2 below indicates 'at a glance' how the Sequential Test will be applied within each Character Area. This is based on the PPS 25 flood vulnerability classifications of potential developments which are considered as the most likely to occur in the future within each Character Area. It is not intended as an exhaustive list. Some site specific case studies of how the Sequential Test will be applied are set out in Appendix B.

Developers are advised to use the table as a guide to considering flood risk when formulating proposals. They should contact RMBC if they wish to confirm how the sequence will be applied to specific proposals.

**Sequential Approach in the Rotherham Regeneration Area – ‘At a Glance’**

Character Area	Highest Level of Flood Risk	Sequential Test
(1) Bradmarsh & Templeborough;	<p>Effectively now Flood Zone 2 as Phase 1 of the RRFAS has effectively reduced parts of this Character Area from Flood Zone 3a.</p> <p>The area is already defended against a 1% AEP (1 in 100) flood event.</p> <p>Area of Zone 1 to the south.</p>	<ul style="list-style-type: none"> <li>• The predominant current use of this area is for industrial and office uses which are categorised in PPS 25 as ‘less vulnerable’. This is likely to continue to be the predominant use in this area.</li> <li>• Given that the area is already defended by RRFAS, only potential alternative industrial sites within Flood Zone 1 of this Character Area and Flood Zone 1 of Masborough/Thornhill (Character Area 5) would need to be considered as lower risk alternatives (land north of New Wortley Road).</li> <li>• It is not generally anticipated that this Character Area would be developed for new housing as part of the renaissance.</li> <li>• It is possible that a more vulnerable use (such as a hotel) maybe proposed in this area. Any such uses would need to consider if alternative sites are available within the low Flood Zones within the Town Centre (Character Area 4).</li> </ul>
(2) Masborough west of Centenary Way;	<p>Predominantly Flood Zone 2 with small parts of Flood Zone 3a around Armer Street.</p> <p>Flood Zone 1 around the area of the former RUFC football ground.</p>	<ul style="list-style-type: none"> <li>• The renaissance of this area may include more flood risk vulnerable uses such as housing. These uses should be focused in the lowest Flood Zone 1 parts of this Character Area.</li> <li>• Housing proposals should also consider alternative sites within the low risk flood zone of Masborough/Thornhill (Character Area 5) south of New Wortley Road).</li> <li>• Employment and industrial development should consider the Flood Zone 1 part of the Character Area. Potential alternative industrial sites within the Flood Zone 1 of Masborough/Thornhill Character Area 5 would need to be considered (land north of New Wortley Road) and Bradmarsh/Templeborough (Character Area 1).</li> <li>• Where possible the Flood Zone 3a areas should be left undeveloped as they are only small isolated pockets.</li> </ul>
(3) Central Riverside	<p>Predominance of Flood Zone 3a and also high risk of surface water flooding.</p>	<ul style="list-style-type: none"> <li>• This is a key riverside regeneration area. Some more vulnerable flood risk uses are proposed as well as less vulnerable flood risk uses.</li> <li>• Proposals for leisure uses (more or less flood risk vulnerable) and housing (more vulnerable) in Flood Zone 3a should consider alternative Flood Zone 1 locations which exist on the right bank of River Don.</li> <li>• Alternative sites in Town Centre (Character Area 4) also need to be considered as this is Flood Zone 1.</li> <li>• The next sequence for development in Flood Zone 3a is to consider alternative sites in Flood Zone 2 areas within Character Area 3.</li> </ul>

Character Area	Highest Level of Flood Risk	Sequential Test
(4) Town Centre	Surface Water Flood Risk is the Main Issue.	<ul style="list-style-type: none"> <li>Existing Town Centre uses and the diversification of land uses are supported.</li> <li>This area has a low fluvial flood risk so it is a main Character Area in terms of considering potential alternatives sites with a low flood risk and focusing more and less vulnerable flood risk developments in this area.</li> <li>Refer to the SFRA 2 for locations with high surface water flood risk. This would need to be mitigated.</li> </ul>
(5) Masborough - Thornhill	Majority of the area is Flood Zone 1.	<ul style="list-style-type: none"> <li>Sequential Test passed for all forms of development except in the area around Primrose Hill which is Flood Zone 2.</li> <li>This area has a low fluvial flood risk so it is a main Character Area in terms of considering potential alternatives low Flood Zone sites.</li> </ul>
(6) College Street	Nearly all Flood Zone 2 with a small area of Flood Zone 3a.	<ul style="list-style-type: none"> <li>New employment and industrial developments would need to consider if alternative sites existed in the Flood Zone 1 areas of Masborough/Thornhill (Character Area 5) and Bradmarsh/Templeborough (Character Area 1).</li> <li>Development in Zone 3a areas should be avoided where possible but if development is proposed it would need to consider the Flood Zone 2 parts of the Character Area in addition to the above.</li> <li>Flood Zone 2 areas of Character Area 1 would also need to be considered if development takes place in Zone 3a.</li> </ul>
(7) Northfield	Predominance of Flood Zone 3a and a high risk of surface water flooding.	<ul style="list-style-type: none"> <li>Already predominantly developed for warehouse style retail and employment.</li> <li>Additional retail floorspace or leisure/restaurant (more or less vulnerability to flood risk) development in Flood Zones 2 and 3a must consider potential alternative sites in Character Area 4 (Town Centre) which are in Flood Zone 1.</li> <li>Employment development should consider alternative sites in the Flood Zone 1 area of Masborough/Thornhill (Character Area 5) and Bradmarsh/Templeborough (Character Area 1).</li> <li>New housing which is a more vulnerable flood risk use would need to consider alternative lower flood risk locations throughout the Renaissance Area. New housing development will not generally be encouraged in this Character Area and should be avoided.</li> </ul>
(8) Parkgate Retail Park	Predominance of Flood Zone 3a and a high risk of surface water flooding.	<ul style="list-style-type: none"> <li>Already predominantly developed for out of town retail and employment.</li> <li>Additional retail floorspace or leisure/restaurant (more or less vulnerability to flood risk) development in Flood Zones 2 and 3a must consider potential alternative sites in Character Area 4 (Town Centre) which are in Flood Zone 1.</li> <li>Employment development should consider alternative sites in the Flood Zone 1 area of</li> </ul>

Character Area	Highest Level of Flood Risk	Sequential Test
		<p>Masborough/Thornhill (Character Area 5) and Bradmarsh/Templeborough (Character Area 1). Then Flood Zone 2 areas within the Character Area and so forth.</p> <ul style="list-style-type: none"> <li>Any new housing development which is a more vulnerable flood risk should be focused in the Flood Zone 1 part of the Character Area.</li> </ul>
(9) Eastwood	Mix of all three flood zones.	<ul style="list-style-type: none"> <li>New housing in Zone 3a should be avoided as this is more vulnerable to flood risk.</li> <li>Any proposed housing in Flood Zone 2 should apply the Sequential Test to other riverside sites that are in Flood Zone 1 in the Central Riverside (Character Area 3) and the Town Centre (Character Area 4).</li> <li>Employment and Industrial development would need to consider the Flood Zone 1 area of the rest of the Character Area. Then Flood Zone 1 areas of Masborough/Thornhill (Character Area 5) and Bradmarsh/Templeborough (Character Area 1). Then Flood Zone 2a areas of the Character area and so forth.</li> </ul>

Table 2 - Sequential Test 'At a Glance' in the Rotherham Regeneration Area

\*All other types of development which are not referred to in the table may also need to apply the Sequential Test and consider alternatives in lower risk flood zones. The table is meant as a guide and not as an exhaustive interpretation. Consult RMBC if in doubt.

Once the Sequential Test has been applied, it then needs to be identified if the proposal is compliant with the flood risk classifications of Table D3, Annex D of PPS 25 (see Table 3 below).

No development, other than raised flood defences, should be proposed in Flood Zone 3b, as the only areas with this level of flood risk are the river channel and Centenary Riverside.

Fluvial Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
	Zone 3b	Exception Test required	✓	✗	✗	✗

Key:  
 ✓ Development is appropriate  
 ✗ Development should not be permitted

Table 3 - Fluvial Flood Risk Classifications

PPS 25 does not set out a similar table for surface water flooding. The following restrictions set out in Table 4 have been agreed as a suitable way to consider surface water in the same way as fluvial flood risk. This is important as the consequences of surface water flooding can be as severe as fluvial flooding so it is important that its potential implications are considered just as seriously.

Surface Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Low	✓	✓	✓	✓	✓
	Medium	✓	✓	Exception Test required	✓	✓
	High	Exception Test required	✓	✗	Exception Test required	✓
Key: ✓ Development is appropriate ✗ Development should not be permitted						

**Table 4 - Surface Flood Risk Vulnerability Classifications**

After the Sequential Test has been applied and passed, some forms of development would also need to pass the Exception Test.

## 2.4 PPS 25 Exception Test

The Exception Test is required where developments which are vulnerable to flooding (highly or more vulnerable) are proposed in high risk flood zones because there is no sequentially preferably alternative and where it meets a particular land use objective, for example the regeneration objectives for a Character Area.

**Where the Sequential Test is demonstrated and a development is in accordance with the regeneration objectives set out for each Character Area in Appendix A of this report, parts A and B of this test would be fulfilled<sup>5</sup>.**

Site specific flood risk assessments would be required to demonstrate compliance with Part C of the Exception Test. RMBC would consult the Environment Agency on Part C of the Exception Test as part of the planning application determination process to agree that this test has been satisfied. More guidance on this is provided within the Design Guidance (Section 5 of the Flood Risk Toolkit).

<sup>5</sup> See Figure 4.2 of the PPS 25 Practice Guide for a flow chart on the Exception Test



**Appendix A Rotherham Regeneration Area**

**This page is intentionally left blank.**

## Boundary of Rotherham Regeneration Area

The boundary of this area is based on the area targeted for regeneration by RMBC. It has been defined by taking into account the following factors:

- *That the creation of a strong vibrant centre is at the heart of creating a vibrant sustainable Borough;*
- *The need to regenerate a number of large previously developed sites, particularly along the riverside of the River Don. Some of these have been subject to public investment to deliver their remediation;*
- *The key brownfield regeneration area around Templeborough, which was previously the subject of European Objective 1 money. Flood risk in this area has already been reduced by the first phase of the RRFAS;*
- *The Core Area of the Town Centre, which is at the heart of the renaissance activity to breath new life into the town;*
- *The retail area of Parkgate, which is a main centre of retail activity for the Borough;*
- *Important existing employment areas such as those along Rawmarsh Road;*
- *Fringe employment and residential areas which are also subject to other regeneration initiatives and are important gateway areas into the Town Centre; and*
- *Major potential development sites which are previously developed land at Parkgate and Aldwarke.*

## Emerging LDF Core Strategy Vision for the Town Centre

Over the past few decades Rotherham has experienced a steady decline in its role as a key business and retail centre. In 2006, a Council Survey revealed that Rotherham residents were more likely to use Parkgate Retail World for shopping, Meadowhall/Sheffield City Centre for eating out and cinema/theatre, and local centres for pubs/clubs. The result has been the stagnation and decline of the Town Centre as both an economic and social centre for the Borough.

The Rotherham Community Strategy identifies that the Town Centre would continue to decline, without targeted public sector investment to stimulate its regeneration and renewal<sup>6</sup>.

In Autumn 2001, Yorkshire Forward launched its urban renaissance programme to help support the regeneration of major towns and cities in Yorkshire. For Rotherham, a broad 25 year vision and 10 supporting goals to deliver the vision have been identified and will be carried forward into the emerging LDF. The first of these goals relates strongly to flood risk management and development of land within the river corridor. It states:-

*“We want the river and the canal to form a key part in the town’s future. Development along the canal must be of an extraordinary quality and must follow an agreed master plan. We want the river and the canal to become much loved parts of the town with public spaces and walkways lining their banks.”*

<sup>6</sup> Rotherham Community Strategy 2005-2011.

It is critical for the future success of the whole Borough that the Town Centre provides a strong function which supports its role as an important commercial and business centre. Although significant progress has already taken place, this change will need to occur more rapidly if the Council's objectives for the renaissance of the Town Centre are to be achieved. The emerging LDF Core Strategy is critical to planning for this change.

The emerging LDF Core Strategy Vision for the Town Centre is to 'Transform the Town Centre'. The physical renaissance and development of the Riverside is a critical aspect of this Vision, as well as achieving a greatly enhanced function for the Town Centre.

**Emerging Core Strategy Vision for Rotherham Town Centre – Transforming Rotherham Town Centre**

*The Ten Renaissance Goals are:*

- 1. Make the river and the canal a key part of the town's future;*
- 2. Populate the town's centre by creating good quality living;*
- 3. Place Rotherham within a sustainable landscape setting of the highest quality;*
- 4. Put Rotherham at the centre of a public transport network;*
- 5. Improve parts of major road infrastructure;*
- 6. Make Forge Island a major new piece of the town centre;*
- 7. Establish a new civic focus that not only promotes a more open and accessible type of governance but also embraces culture and the arts;*
- 8. Demand the best in architecture, urban design and public spaces for Rotherham;*
- 9. Improve community access to health, education and promote social well being; and*
- 10. Create a broadly based, dynamic local economy with a vibrant town centre as its focus.*

**Investment and Other Challenges for the Rotherham Regeneration Area**

In land use terms the challenge is to focus on creating the conditions where confidence is increased to create a vibrant and sustainable area which provides a strong heart for the rest of the Borough. This includes:

- *Reducing the threat of flood risk;*
- *Supporting and encouraging the regeneration of key development sites;*
- *Creating an attractive riverside;*
- *Diversifying the land uses within this whole area;*
- *Reversing decline through creating the conditions which will enable people to make decisions to continue to invest in existing activity in the Town Centre. In turn this should help bring in new investment as the Town Centre becomes a more attractive place to live, work and visit;*
- *Encouraging more people to visit and use the Town Centre to improve its vitality; and*
- *Creating attractive gateway areas into the Town Centre.*

Key issues are:

- *The function and role of the Town Centre has steadily diminished over a number of years. This is due to a combination of reasons including, changes to the retail climate, proximity and ease of access from other parts of Rotherham to major Centres such as Meadowhall and Sheffield and because parts of the Town Centre have traditionally supported manufacturing industries. Until the more recent past, Rotherham was included in EU Objective 1 status and in this respect formally recognised as suffering from market failure and considerable decline;*
- *The renaissance and diversification of the Town Centre is vital to underpin the future growth and success of the Borough. Despite the economic climate and other challenges, investment momentum is growing. The completion of phase 1 of the community wide flood scheme has led to significant investment on brownfield sites upstream of Templeborough and has protected key infrastructure. This demonstrates the importance of completing the scheme through the Town Centre; and*
- *Previous flood events, especially in 2007.*

Positive regeneration activities which have taken place recently are:

- *The completion of Phase 1 of RRFAS, Centenary Riverside and the removal of Don Bridge;*
- *Construction of a small section of Phase 2 of RRFAS between the vicinity of the bus station, Chantry Bridge and Tesco Footbridge is due to commence in 2011;*
- *Within the Town Centre, construction of a new Civic Building on the former Guest and Chrimes site is well underway. The latter is the first phase of 'freeing' other sites for redevelopment elsewhere in the Town Centre to attract new uses;*
- *A community health centre has recently opened on Greasbrough Road;*
- *Rotherham United Football Club has been playing in Sheffield for two years and is planning to relocate to the town. Planning permission for a new Community Stadium was recently granted on the former Guest and Chrimes site;*
- *The railway station is currently being rebuilt at a cost of £8.5 million and will form a new modern gateway into the Town Centre; and*
- *RMBC, with other key partners, has invested a significant amount of money into a number of regeneration sites. Of particular importance is the riverside through the Town Centre, which is underused and undervalued and has the potential to be a major regeneration corridor. The regeneration sites either side of the River Don, particularly the former Guest and Chrimes site, Forge Island and Westgate, are therefore integral to the future development of the Town Centre. A clear approach to dealing with flood risk on these sites is required.*

Within the Rotherham Regeneration Area, 9 different character areas have been defined to be used in the emerging LDF. The boundary of each Character Area is based on the following factors:

- *The existing land uses;*
- *The existing function;*
- *Specific regeneration objectives for each area;*
- *Development sites within them;*
- *Taking into account physical features such as the river and canal and key communication routes such as railways and roads; and*
- *The extent of Flood Zones.*

Each character area is described in Table A.1 below:

	<b>Description</b>	<b>Boundary</b>	<b>Current Land Uses</b>	<b>Renaissance Objective</b>
1	Bradmarsh and Templeborough	South of River Don and Rother Confluence/ Enterprise Park.	Office/ Industrial	This was formerly a steelmaking area regenerated to business/employment uses and is an RMBC Strategic Regeneration Area fundamental to the Town as a whole. The area is also currently defended by the recently completed Rotherham Renaissance Flood Alleviation Scheme (Phase 1) which included creating an area of functional flood plain at Centenary Riverside. This will primarily remain as an industrial and employment area.
2	Masborough West of Centenary Way	South of Masborough Street, north of Sheffield Road, west of Centenary Way.	Industrial	To diversify the land uses and improve the appearance and coherence of the area. Some key vacant sites such as Milmoor, the former football ground.
3	Central Riverside Area	West, North and East of the River Don, East of Centenary Way.	Vacant and degraded land/ Redevelopment Sites	To regenerate and develop key riverside sites and enhance the riverside.
4	Town Centre	Town Centre Core - East of Westgate, Corporation Street and Effingham Street.	Main Town Centre Uses (retail, Council offices)	To regenerate the Core Town Centre through improving vitality through encouraging more visitors and diversifying land uses.

	Description	Boundary	Current Land Uses	Renaissance Objective
5	Masborough – Thornhill	North of Masborough Street, West of Greasborough Street, South of Greasborough Road.	Industrial/ Housing	To diversify the land uses and improve the appearance of the area.
6	College Street	Area to the North of Main Street, West of the Railway Line, East of Centenary Way and Greasborough Street.	Industrial	To continue to support the industrial and employment function of the area.
7	Northfield	From Rawmarsh Road to Aldwarke Waste Water Treatment Site including land either side of the Sheffield and South Yorkshire Navigation.	Retail/ Industrial/ Offices	To continue to support the industrial and employment function of this area.  To support the regeneration of previously developed sites and surplus land.
8	Parkgate Retail Park	Area around Northfield Road, north of Effingham Street and north of the River Rother.	Retail	To continue to support the industrial and employment function of this area.  To support the regeneration of previously developed sites.
9	Eastwood	North of Erskine Road and Chesterton Road and South of the River Rother.	Offices/ Industrial	To support the riverside regeneration and mixed employment and residential use of this Town Centre fringe neighbourhood

**Table A.1 - Description of Rotherham Regeneration Character Areas.**

With respect to the ambitions for the Town Centre, compliance with the provisions of PPS 25 is of critical importance to delivering success. To deliver major change, a pro-active set of responses are required to attract investment and deliver regeneration whilst managing and reducing flood risk to an acceptable level. There are a number of distinctive local elements to this challenge where RMBC is leading on specific responses and these actions are set out in Table A.2.

Challenge	Issues for the LDF and Town Centre Renaissance	Response
<p>Providing new flooding infrastructure to protect existing properties and infrastructure.</p>	<p>The area contains a high proportion of commercial properties presently at risk of flooding but not a significant amount of residential properties. As such, the study area is very low in terms of qualifying for national grants to aid funding for new flood risk management infrastructure. This puts the area at an economic disadvantage as retaining existing investment and employment is fundamental to maintaining current economic activity within the Town Centre. In addition, critical infrastructure to the operation of the town such as the main road network, utility company facilities, the bus station and railway station, are within high risk flood zones meaning the Town Centre can be severely affected during and after flood events.</p> <p>The flood risk reduction through the proposed community wide scheme would prevent flooding from a 1% Annual Exceedance Probability (1 in 100 annual chance) river flood extent to specific riverside regeneration sites.</p>	<p>Rotherham Renaissance Flood Alleviation Scheme.</p> <p>Design Guidance (produced as part of the flood risk toolkit and anticipated to be adopted as a Supplementary Planning Document (SPD)).</p>
<p>Planning for New Development in the LDF.</p>	<p>There are a number of major development sites in the Town Centre all of which are previously developed land. The development of these sites would introduce new and strategically important uses to the Town Centre as well as enabling the development of more modern facilities for a number of existing employers and locally important organisations. This is essential to achieve the vision for the Borough. However, these sites must meet the requirements of PPS 25 before they can be developed. Without a comprehensive approach to flooding, this will be difficult.</p> <p>The development potential of some Town Centre sites is dependent on alternative sites becoming available elsewhere in the study area. Not being able to overcome flood risk on one site can have a knock on effect to the potential to develop other sites. Equally, if regenerative development (including flood risk reduction that conforms to the community wide scheme) is not achieved those economic investments activities and infrastructure presently existing would remain at considerable flood risk and the principle supporting the £15m investment in Phase 1 of the scheme not maintained. Elements of PPS 25 such as the Sequential Test which look at flooding on a site by site basis mean a comprehensive flood risk strategy for the Town Centre rather than a piecemeal approach is required if the vision is to be delivered.</p>	<p>Clear Flood Risk Strategy in LDF Core Strategy Policy and Site Allocations. Document informed by clear and robust evidence (comprehensive approach and significant resources invested in the flood risk toolkit)</p> <p>Rotherham Renaissance Flood Alleviation Scheme.</p> <p>Design Guidance (produced as a separate document and anticipated to be adopted as a SPD).</p>



Challenge	Issues for the LDF and Town Centre Renaissance	Response
<p>Locally distinctive elements of flood risk.</p>	<p>The canal and the railway link from the main line via Rotherham Central station run through the study area, on the north bank of the River Don. For both, the local topographical characteristics mean that these low lying corridors provide a flow path for flood waters through the extensive north bank flood cell, so they can transfer flood water to areas remote from the point where the water originally spilled into them. This can then affect adjacent low lying areas.</p> <p>There are a small flood cells on the south bank of the River Don that contain existing infrastructure. The topographical nature of these areas means that surface water flows through them and can affect properties in low lying areas.</p> <p>There are a number of ‘pinch’ points in terms of physical infrastructure such as bridges, subways and highways which means surface water flooding also represents a significant flood risk.</p> <p>The topographical nature of the study area means that surface water flows into the study area from the surrounding area.</p>	<p>Surface Water and Fluvial Risk assessments in the SFRA 2.</p> <p>Detailed modelling undertaken so local topographical features are accurately reflected to provide a much better understanding of water flows during rainfall events.</p> <p>The combined impact of river and surface water flooding is considered giving a comprehensive and robust assessment of flood risk.</p> <p>Rotherham Renaissance Flood Alleviation Scheme.</p> <p>Design Brief (produced as a separate document and anticipated to be adopted as a SPD).</p> <p>Surface Water Management Strategy to be produced in time.</p>

*continued Table A.2: Flood Risk Objectives in the Rotherham Regeneration Area.*

**This page is intentionally left blank.**

**Appendix B    Site Specific Case Studies**

**This page is intentionally left blank.**

## Site Specific Case Studies

To assist developers apply the Sequential Test a number of site specific case studies are set out in Table B.1.

There are only very specific parts of the Town Centre Renaissance Area which are within Flood Zone 1 and therefore at a low risk of flooding. The Sequential Approach means that in all circumstances where development is proposed in Flood Zones 2 and 3, alternative sites within the Flood Zone 1 areas will need to be considered first. The predominance of Flood Zones 2 and 3 means the potential for lower flood risk alternatives are limited to very specific areas:

- *A very small part of the southern extent of the Bradmarsh Templeborough Character Area (Character Area 1);*
- *The area around Milmoor football ground (Masborough, west of Centenary Way - Character Area 2);*
- *The right bank of the Central Riverside Character Area (Character Area 3);*
- *The Town Centre (Character Area 4);*
- *Masborough/Thornhill - Character Area 5; and*
- *The Eastern part of the Parkgate Retail world in Character Area 8.*

The Town Centre (Character Area 4) is generally at a low risk of flooding so where more vulnerable uses are proposed in Flood Zone 2 or 3a, this will generally be an alternative which will need to be considered.

All developments in Flood Zone 3a will also need to demonstrate that alternative sites within Flood Zone 2 and Flood Zone 1 are not available.

Table B.1 shows Sequential Approach Case Studies (Sites are shown on Figure 4 of the SFRA 2, Section 3 of the Flood Risk Toolkit):

Character Area	Potential Development Area	Potential Land Uses	Sequential Approach Issues	Regeneration Objectives for the Character Area	Applying Rotherham Town Centre Renaissance Sequential Approach Sequence
<b>Bradmarsh and Templeborough (1)</b>	Land west and North of Riverside Way	Industrial and Employment	Already defended by RRFAS – Effectively reduced to Flood Zone 2.	To continue to support the industrial and employment function of this area.	<ol style="list-style-type: none"> <li>1. Not required if an existing business within the same development site boundary.</li> <li>2. Food risk zone 1 area of Bradmarsh/Templeborough(C haracter Area 1).</li> <li>3. Flood Zone 1 of Thorn Hill Industrial Area – (Character Area 5).</li> <li>4. Lower risk flood area within the site.</li> </ol>
<b>Masborough west of Centenary Way (2)</b>	Armer Street	Mixed uses including housing	Mainly Flood Zone 2 but isolated parts are Flood Zone 3a.	To continue to support the industrial and employment function of this area and to create an attractive neighbourhood.	<ol style="list-style-type: none"> <li>1. Flood Zone 1 part of the Character Area.</li> <li>2. Flood Zone 1 part of Masborough/Thornhill Character Area (5), Town Centre (4). Central Riverside (3) and Bradmarsh Templeborough (1).</li> <li>3. Zone 2 of same Character Area.</li> <li>4. Seek to avoid development in Flood Zone 3a where possible.</li> </ol>

Character Area	Potential Development Area	Potential Land Uses	Sequential Approach Issues	Regeneration Objectives for the Character Area	Applying Rotherham Town Centre Renaissance Sequential Approach Sequence
<b>Central Riverside Area (3)</b>	Former Guest and Chrimes Sites and Brinsworth Street Development Site (areas within Flood Zone 3a)	New riverside land uses of social facilities, bars, restaurants, conference facilities and possibly housing. Within Zone 3a.	Parts of the site incorporating land raising through development already with planning permission or under construction for the new Community Stadium and the Civic Area.	To support the regeneration of the Riverside.	<ol style="list-style-type: none"> <li>1. Flood Zone 1 of the same Character Area.</li> <li>2. All of Character Area 4 (Town Centre).</li> <li>3. Flood Zone 2 areas of the same Character Area.</li> <li>4. Flood Zone 2 areas of other Character Areas not required if 'town centre' type uses.</li> <li>5. Lower risk flood areas of site.</li> </ol>
	Forge Island	Potential Mixed Use including leisure, bars, employment and housing.	Within Zone 2	To enhance the vitality and function of the Town Centre and to diversify the land uses in the Town Centre.	<ol style="list-style-type: none"> <li>1. Flood Zone 1 area of Character Area 3.</li> <li>2. All of Character Area 4 (Town Centre).</li> </ol>
<b>Town Centre (4)</b>	Existing key uses along Wellgate	Retail, employment, bars/restaurants.	Within a high risk surface water flood zone.	To enhance the vitality and function of the Town Centre and to diversify the land uses in the Town Centre.	<ol style="list-style-type: none"> <li>1. Not required if an existing business (but additional resilience measures may be necessary)</li> <li>2. Areas of the Town Centre not affected by surface water flooding.</li> </ol>

Character Area	Potential Development Area	Potential Land Uses	Sequential Approach Issues	Regeneration Objectives for the Character Area	Applying Rotherham Town Centre Renaissance Sequential Approach Sequence
Northfield (7)	Existing industrial and employment uses along Rawmarsh Road (including Bailey House).	Employment including offices	Zones 2/3a	<p>To continue to support the industrial and employment function of this area.</p> <p>To support the regeneration of previously developed sites.</p>	<ol style="list-style-type: none"> <li>1. Not required if an existing industrial business within the same development site boundary.</li> <li>2. Flood Zones 1 of Thorn Hill Industrial Area – Character Area 5 and Flood Zone 1 of Bradmarsh/Templeborough (Character Area 1).</li> <li>3. Flood Zone 2 areas of same Character Area and Bradmarsh Templeborough (Character Area 1).</li> <li>4. Town centre if a new office use not linked to an existing business.</li> <li>5. Lower risk flood area within the site.</li> </ol>
	Aldwarke Development Sites	Mixed uses but not housing.	The National Flood Plan indicates that parts of these sites are within Flood Zone 3a.		<p>Assuming housing is not included as part of a mixed use:</p> <ol style="list-style-type: none"> <li>1. All zone 1 flood risk areas in the Rotherham Regeneration Area.</li> <li>2. Flood Zone 2 areas of the Character Area.</li> <li>3. Flood Zone 2 areas of the rest of the Regeneration Area.</li> </ol> <p>NOTE: THE SFRA 2 RELIES ON THE NATIONAL FLOOD MAP IN THIS AREA.</p>



Character Area	Potential Development Area	Potential Land Uses	Sequential Approach Issues	Regeneration Objectives for the Character Area	Applying Rotherham Town Centre Renaissance Sequential Approach Sequence
<b>Parkgate (8)</b>	Land North East of Parkgate Retail World	Mixed uses but not housing	The National Flood Plan indicates that the site is within Flood Zone 3a.	<p>To continue to support the industrial and employment function of this area.</p> <p>To support the regeneration of previously developed sites.</p>	<p>Assuming housing is not included as part of a mixed use:</p> <ol style="list-style-type: none"> <li>1. All zone 1 flood risk areas in the Rotherham Regeneration Area.</li> <li>2. Flood Zone 2 areas of the Character Area.</li> <li>3. Flood Zone 2 areas of the rest of the Regeneration Area.</li> </ol> <p>NOTE: THE SFRA 2 RELIES ON THE NATIONAL FLOOD MAP IN THIS AREA WHICH DEFINES LARGE AREAS OF ZONE 3a..</p>
<b>Eastwood (9)</b>	Off Esrkine Road	Housing	Flood Zone 2	To support the riverside regeneration and mixed employment and residential use of this Town Centre fringe neighbourhood	<ol style="list-style-type: none"> <li>1. Flood Zone 1 of Character Area 9.</li> <li>2. Flood Zone 1 of the riverside areas of Character Area 3 and 4.</li> </ol> <p>NOTE: THE SFRA 2 RELIES ON THE NATIONAL FLOOD MAP IN THIS AREA.</p>

*Table B.1 – Sequential Approach Example Case Studies*

## Development in Rotherham Regeneration Area

### Flood Risk Toolkit

#### Design Guidance

#### FLOOD RISK TOOLKIT

Introduction

How to Use Guide

Level 2 Strategic Flood Risk Assessment

Sequential Approach Guide

**Design Guidance**

Large Scale Plans

April 2011



## Contents

<b>1</b>	<b>Aim and Context</b>	<b>5 - 1</b>
1.1	Introduction	5 - 1
1.2	Aim	5 - 2
1.3	What This Document Covers	5 - 2
1.4	Coordinated Approach Being Adopted	5 - 3
1.5	How Flood Risk Can Be Mitigated	5 - 3
1.6	Flood Risk Management Works Successfully Implemented and Their Significance	5 - 4
1.7	Summary	5 - 4
<b>2</b>	<b>Flood Risk and Regeneration</b>	<b>5 - 6</b>
2.1	Existing Flood Risk	5 - 6
2.1.1	Predicted Extents and Mechanisms of River Flooding	5 - 6
2.1.2	Surface Water Flooding	5 - 8
2.2	Urban Renaissance and Public Realm Strategy	5 - 8
2.2.1	Urban Renaissance Aspirations	5 - 8
2.2.2	Public Realm Strategy	5 - 8
2.2.3	Key Development Sites	5 - 9
2.3	Planning policy relating to flood risk	5 - 9
2.3.1	Planning Policy Statement 25: Development and Flood Risk (PPS 25)	5 - 9
2.3.2	Council Policy Documentation Relating to Flood Risk	5 - 10
2.4	Rotherham Renaissance Flood Alleviation Scheme	5 - 11
2.4.1	Measures Included	5 - 11
2.4.2	Purpose of the Scheme	5 - 11
2.4.3	Scheme Details	5 - 12
2.4.4	Scheme Phasing and its Significance	5 - 12
<b>3</b>	<b>Technical Requirements in order to comply with the community wide scheme</b>	<b>5 - 15</b>
3.1	Technical Requirements	5 - 15
3.1.1	Community Wide Flood Protection	5 - 15
3.1.2	Development Management Constraints	5 - 15
3.1.3	Technical Requirements for Flood Defence Structures	5 - 17
3.1.4	Technical Requirements for Land Raising	5 - 19
3.1.5	Surface Water Drainage Paths, Outfalls and Runoff from Development Sites	5 - 20
3.1.6	Riverside access and river edge treatments	5 - 23
3.1.7	Adaptation and Resilience to Flooding	5 - 23
3.2	Handover Requirements	5 - 25
<b>4</b>	<b>Development to be approved by RMBC Development Management Teams</b>	<b>5 - 26</b>
4.1	Site Specific Flood Risk Assessment	5 - 26
4.2	Development Control	5 - 27
4.3	Expectations of Development Control Teams	5 - 28
4.4	Overview of Flood Risk Issues to be Addressed by Developers	5 - 29

**Appendix A Flood Defence Levels**

**Appendix B Safety in Design RAG List**

**Appendix C Best Practice Guide**

**List of Figure**

Figure 1 – Flood Risk Toolkit Contents	5 - 1
Figure 2 – Extent of the flood alleviation scheme in Templeborough and Rotherham.	5 - 3
Figure 3 – Flood Extents for Part-Defended Rotherham Regeneration Area	5 - 7
Figure 4 – Water Levels from 2005 baseline after RRFAS is Fully Complete	5 - 14
Figure A1 – Model Cross Sections	Appendix A
Figure A2 – Model Cross Sections	Appendix A
Figure A3 – Model Cross Sections	Appendix A

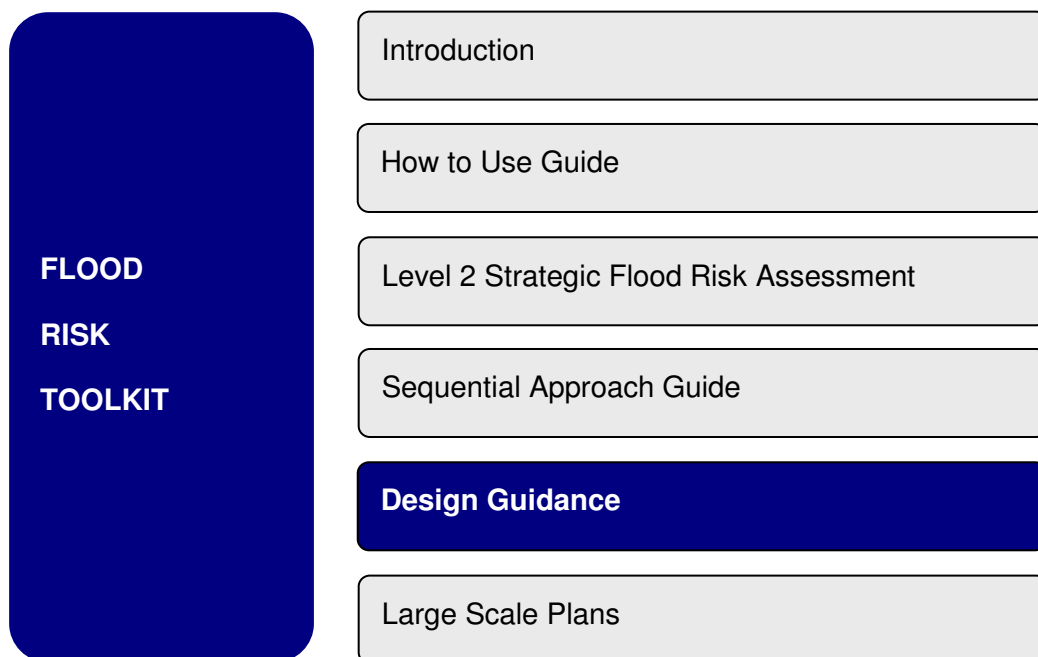
**List of Tables**

Table 1 – Change in flood levels after implementation of RRFAS, compared to pre-scheme conditions.	5 - 13
Table 2 – SUDS Techniques	5 - 22
Table 3 – Expectations of the Environment Agency and RMBC Development Management Teams	5 - 28
Table 4 – Flood Risk issues to be addressed by Developers.	5 - 30

# 1 Aim and Context

## 1.1 Introduction

This Design Guidance is a part of the Flood Risk Toolkit.



**Figure 1 - Flood Risk Toolkit Contents**

In addition, this Design Guidance is closely associated with the Level 2 Strategic Flood Risk Assessment (SFRA 2) for the Rotherham Regeneration Area and should be read in conjunction with this and other documents which are all included in the Flood Risk Toolkit. The Flood Risk Toolkit has been created to assist developers to take account of flooding and provide the necessary information to achieve planning permission for sites within the Rotherham Regeneration Area. It is intended to form ‘Supplementary Planning Guidance’ in the future.

It must be used by any parties involved in planning, designing, implementing or approving development within the Rotherham Regeneration Area.

To mitigate the impacts of flooding such as those experienced in November 2000 and June 2007, Rotherham Metropolitan Borough Council (RMBC) have worked in partnership with the Environment Agency to develop a community wide flood alleviation scheme. This extends from Magna (in the Templeborough area) to Frank Price Lock (located just downstream of Parkgate Retail Park), a distance of approximately 4km, as shown in Figure 2.

Work on the scheme to date has included:

- *Construction of the £15m first phase of the scheme, located in the Templeborough area, was completed in late 2008. This included new defences, modifications to bridges, protection of key services and the creation of compensatory floodplain;*
- *Don Bridge was removed in early 2010. This structure was a significant constriction to flood flows near the downstream end of the scheme and removing it reduces flood levels in key regeneration areas upstream of the bridge; and*
- *Works around the Chantry Bridge/bus station area are due to start on site in 2011. These will protect a busy part of the town centre and ensure a key emergency access route out of the floodplain during a flood event.*

A common factor in the success of all of these projects has been the willingness of all parties involved to work closely together, from concept design through to implementation, and to deliver works that are fully compatible with the requirements of the community wide flood alleviation scheme.

## **1.2 Aim**

The aim of this document is to provide clear information on the requirements of flood risk management that will be placed on any development in the Rotherham Regeneration Area.

In order for new development in this area to achieve planning support it must be shown to be safe through a Flood Risk Assessment and incorporation of appropriate flood alleviation measures.

## **1.3 What This Document Covers**

This document provides information about flood risk issues in the river corridor area. Crucially, this document sets out the design standards/criteria that must be complied with when developing sites within the Rotherham Regeneration Area.

The key aspects are:

- *An overview of existing flood risk, the constraints this imposes on development and, where possible, how flood risk can be safely mitigated;*
- *A summary of previous flood risk management studies and information on the community wide Rotherham Renaissance Flood Alleviation Scheme (RRFAS) that is crucial for successful regeneration of river corridor area;*
- *Design parameters, including flood defence levels and technical standards for implementation, for future phases of the flood alleviation scheme that will enable continuous community wide flood protection to be achieved once the scheme is complete; and*
- *Information required by planning and development management teams within RMBC and the Environment Agency in order to achieve support for the development.*

### 1.4 Coordinated Approach Being Adopted

Areas within the natural floodplain with the River Don corridor are significantly at risk of flooding from the river, as experienced in November 2000 and June 2007. The November 2000 flood caused significant disruption to a number of properties and the local transport network, particularly in the very low lying Templeborough area. However, to some degree, this event was a ‘near miss’ for many areas and it served as a warning of the very real risk to other businesses located in the river corridor.

The June 2007 event was much more severe and affected the entire river corridor, causing widespread damage to almost all properties and business alongside the river. Those businesses which were less vulnerable to flooding recovered reasonably quickly, but many suffered damage that prevented them from trading for many months whilst large scale repair work was carried out.

### 1.5 How Flood Risk Can Be Mitigated

Following the November 2000 event, flood risk management within the river corridor was reviewed and investigated in great detail. This has been successfully achieved through a partnership approach between RMBC and the Environment Agency.

The investigation demonstrated that the impacts of flooding can be mitigated by the implementation of a community wide flood alleviation scheme that provides a high level of flood protection.

For flood risk management to be a success in Rotherham it must protect the whole community and it must contribute to the regeneration of the riverside and the social community.

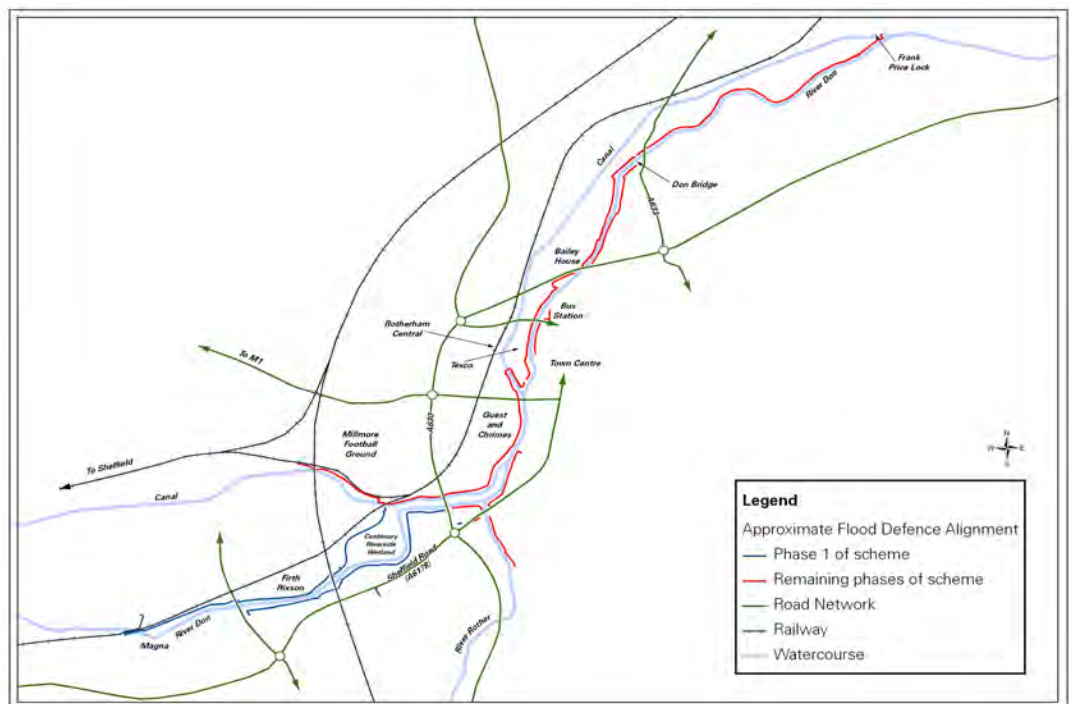


Figure 2 – Extent of the flood alleviation scheme in Templeborough and Rotherham.



## 1.6 Flood Risk Management Works Successfully Implemented and Their Significance

The first phase of the scheme, located in the Templeborough area, was successfully completed in late 2008. This created new defences on both banks along a 2km reach of the river, raised bridges that adversely affected flood flows, protected services critical to the operation of nearby industrial areas and created an area of compensatory floodplain at the Centenary Riverside site.

A further flood alleviation project within the river corridor was the removal of Don Bridge, located near the downstream end of the community wide scheme. This reduced water levels in an extreme flood event by up to 0.6m in areas upstream of the bridge. This was completed in early 2010.

The combination of the 2008 works and the removal of Don Bridge will offset the impacts of 'channelisation' of flood levels throughout the study area that are inherent in the construction of flood defences.

The Environment Agency consider the combination of the Centenary Riverside compensatory floodplain site, and, the removal of Don Bridge, to be substantive enough to enable development of subsequent individual development sites in the river corridor to be undertaken without the need for their owners to create on site compensatory floodplain. RMBC will only allow this to occur if it is shown that the remainder of the development proposals are fully compatible with the community wide flood alleviation scheme, as set out in this guidance document.

The major advantage to the site owners is that this will result in more land being available for development.

## 1.7 Summary

Investment in areas behind the first phase of defences, from both existing and new businesses, is now happening and therefore contributing to the stimulation of 'Rotherham Renaissance'. All of the above projects have required the various parties involved to work closely together from concept to implementation, demonstrating that flood risk can successfully be mitigated and Rotherham Renaissance can be achieved.

Key advantages of development adopting Design Guidance that is compatible with the community wide flood alleviation scheme:

- *Contribution to Rotherham Renaissance, in terms of a high level of flood protection to existing and new development;*
- *No need to create individual compensatory floodplain, resulting in more land being available for development;*
- *A large proportion of the data required to assess flood risk for 'Site Specific Flood Risk Assessments' is readily available, providing savings on pre-development costs;*
- *Individual development sites do not have to demonstrate that they will have no adverse affect on adjacent sites due to water 'channelisation' effects, removing the need for each site to do expensive hydraulic modelling of individual proposals; and*
- *Confidence in resilience of development to future flooding.*

Consequences of Not Achieving Compatibility:

- *Rotherham Renaissance will not be achieved and vulnerable areas will remain at significant risk of flooding; and*
- *Approval of development on individual sites will be extremely difficult to achieve and significant evidence will be required to satisfy the stringent flood risk policies set out in PPS 25.*

**This chapter provides background information on:**

- *Existing flood risk;*
- *Urban Renaissance and public realm strategy initiatives; and*
- *The community wide Rotherham Renaissance Flood Alleviation Scheme.*

**Additional data to illustrate the details of the above are also included in the SFRA 2 and Large Scale Plans included in this Flood Risk Toolkit.**

Many areas of low-lying land within the River Don corridor are situated within the fluvial floodplain. This includes several brownfield sites that have been targeted for regeneration as part of RMBC's 'Rotherham Renaissance' initiatives for the town, many of which are currently at risk during a 1% AEP (1 in 100 annual chance) flood event. The events of November 2000 and June 2007 clearly demonstrate the risks that currently exist.

Flood risk presents a significant constraint to the regeneration of areas that are located within the river floodplain. Government guidance contained in Planning Policy Statement 25: Development and Flood Risk (PPS 25)<sup>1</sup> imposes constraints on the type of development that can be implemented within floodplains.

The community wide RRFAS will protect a large number of businesses and key infrastructure and it will also help overcome the identified flood risk constraints. The SFRA 2 has also identified the risk surface water flooding in the Rotherham Regeneration Area with the RRFAS in place. Therefore, there is information available to identify the risks of both surface water and river flooding and to incorporate mitigation measures into planned development.

## **2.1 Existing Flood Risk**

### **2.1.1 Predicted Extents and Mechanisms of River Flooding**

#### **(a) Predicted Extents of River Flooding**

As part of the development of the RRFAS and SFRA 2 work, detailed hydrological and hydraulic modelling work has been undertaken and mapping produced to fully describe the existing flood risks.

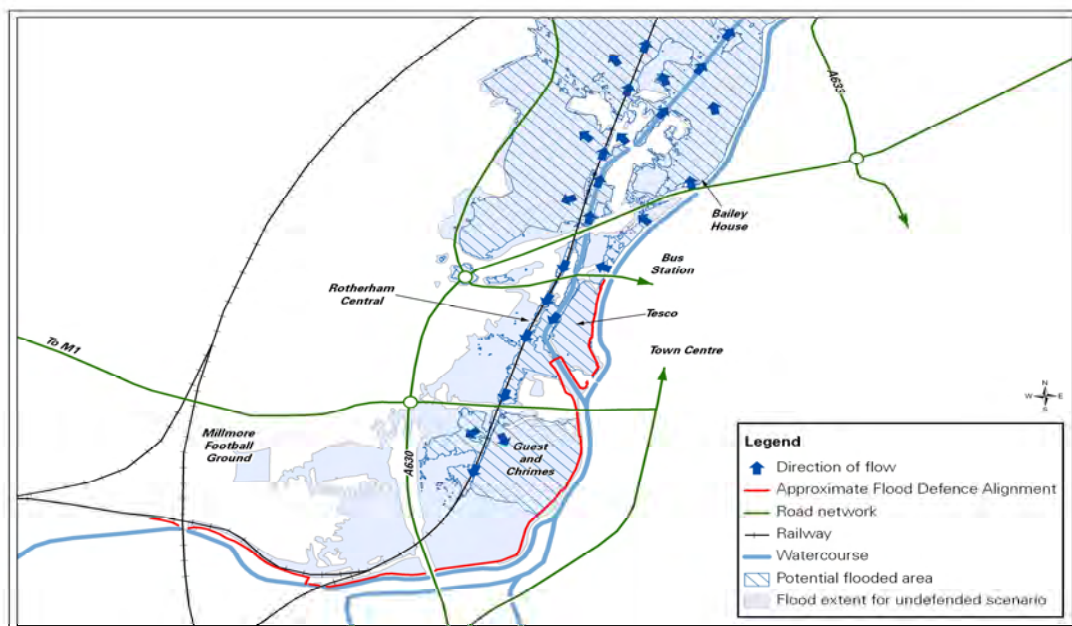
Plans showing the predicted extents of fluvial flood risk, based on existing peak flows and catchment management regimes are shown in Figure 1 SFRA 2 (Section 3 of the Flood Risk Toolkit). This mapping indicates that large areas of land, including many key development sites, are located in the floodplain and in PPS 25 Flood Zones 2 and 3.

---

<sup>1</sup> PPS 25 Development and Flood Risk, Communities and Local Government March, 2010

**(b) Mechanisms of River Flooding**

The left bank of the River Don through Rotherham is a single extensive flood cell. It contains low-lying corridors (i.e. railways and canals) that enable floodwater to be transferred to areas that are remote from the original spill point. Accordingly, the left bank requires flood risk management works to be effective over a river frontage of nearly 5km, which extends both upstream and downstream of the main town centre area.



**Figure 3 – Flood Extents for Part Defended Rotherham Regeneration Area**

The terms left and right bank is used throughout to define each river bank. The left bank is always the bank that is to your left when facing in the direction of river flow.

The right bank of the River Don has a more straight forward flood mechanism and is categorised by small discrete flood cells. On this bank, flood risk management works only need to be effective over relatively short lengths of less than 1km per flood cell.

In addition to the risks posed by river flooding, there is also the possibility of surface water flooding, both within and outside the rivers’ natural floodplain. This is discussed in more detail below.

### 2.1.2 Surface Water Flooding

The SFRA 2 has assessed the risks of surface water flooding from direct rainfall and for ineffective drainage in detail and in the SFRA 2 (Section 3 of the Flood Risk Toolkit) contains detailed mapping illustrating the findings of the assessment. In general terms, this identifies the following:

- *Surface water flooding is a risk on both banks of the river in a number of locations, both before and after construction of the flood alleviation scheme; and*
- *Surface water flooding is likely to be an issue for development sites in the river floodplain areas, particularly at the downstream end of the left bank flood cell and in all right bank flood cells.*

Surface water flooding therefore needs to be carefully considered as part of any development proposal.

At the time of writing, a Surface Water Management Plan is still being developed. When available, this document should be referred to for additional information on surface water flooding and its management.

## 2.2 Urban Renaissance and Public Realm Strategy

### 2.2.1 Urban Renaissance Aspirations

The Rotherham Renaissance Charter sets out a comprehensive 25 year vision for the town and a series of 10 goals against which future development proposals are to be tested.

The first of these goals relates strongly to flood risk management and development of land within the river corridor. It states:

*“We want the river and the canal to form a key part in the town’s future. Development along the canal must be of an extraordinary quality and must follow an agreed master plan. We want the river and the canal to become much loved parts of the town with public spaces and walkways lining their banks”.*

A full list of the 10 goals is included in the SFRA 2 (Section 3 of the Flood Risk Toolkit).

Rotherham’s Local Development Framework will take the aspirations for Rotherham Town Centre forward through appropriate policies and allocation of sites for new development.

### 2.2.2 Public Realm Strategy

The public realm is defined as:

*“Those parts of Rotherham (whether publicly or privately owned) that are available, without charge, for everyone to use or see, including streets, squares and parks”.*

RMBC are looking for the strategy to create change, capturing recent and emerging proposals, and, realising the inherent opportunities in the town’s environmental, economic and cultural assets.

The Vision for Rotherham’s Public Realm Strategy is:

*“To bring about transformational change in the image and identity of Rotherham by realising the distinctiveness and value of existing environmental assets, creating a sense of place and prosperous identity, attracting and drawing together individual regeneration projects and programmes, and stimulating activity and vitality leading to an increased sense of safety and security”.*

The public realm strategy was published in April 2008 and has a number of key objectives. The key objectives that affect flood risk management is the need to integrate the river and canal into the town centre, including emphasis on providing riverside access.

### 2.2.3 Key Development Sites

A number of development sites exist along the river corridor. Some of the key ones that form an important part of RMBC’s urban renaissance strategy and public realm strategy are located in or within close proximity to the existing floodplain and these are assessed in detail in the SFRA 2 (Section 3 of the Flood Risk Toolkit).

#### **Benefits of developing as part of Rotherham Renaissance**

**There are many benefits for developers wanting to develop sites in the Rotherham Renaissance areas. These are as follows:**

- *There is a willingness within RMBC to see river corridor sites developed;*
- *Sites are close to the town centre with potential for a variety of uses;*
- *The work done to date provides most the data required to complete a site specific Flood Risk Assessment;*
- *The documents within the Flood Risk Toolkit will enable appropriate flood risk measures to be identified; and*
- *When complete, the community wide flood alleviation scheme will provide protection from river flooding for up to a 1% AEP (1 in 100 annual chance) event.*

## 2.3 Planning policy relating to flood risk

### 2.3.1 Planning Policy Statement 25: Development and Flood Risk (PPS 25)

PPS 25 sets out the Government’s policies for development within floodplains. It is applicable to all areas at risk of flooding, including those that are protected by flood defences.

The key aspects of PPS 25 are that it:

- *Requires Council’s to adopt a risk based Sequential approach when allocating land for development;*
- *Defines four Flood Zones and identifies the type of development that is permitted in each zone. This takes account of the development’s ‘vulnerability classification’;*

- *Where necessary, requires an ‘Exception Test’, which provides the planning argument for development, and ensures that the development can be designed in a safe and sustainable manner; and*
- *All development in floodplains must be supported with a Flood Risk Assessment which demonstrates that the development can remain safe.*

More detailed information on the above can be downloaded from the Department for Communities and Local Government’s website:

<http://www.communities.gov.uk/>.

### **2.3.2 Council Policy Documentation Relating to Flood Risk**

This Design Guidance has been written in conjunction with other RMBC documents that relate to river corridor regeneration areas. An overview of the documents that address planning policy in relation to flood risk is given below.

#### **(a) Level 1 Strategic Flood Risk Assessment (SFRA 1)**

This provides an overview of flood risk issues within RMBC’s overall administrative area. The key outcomes of this study are that it:

- *Collates all known sources of flooding within the Metropolitan Borough;*
- *Provides flood mapping to delineate the four flood zones defined in PPS 25;*
- *Recommends appropriate land uses that take account of flood risk constraints within PPS 25; and*
- *Provides general planning and development control recommendations for each flood zone.*

The document is used by RMBC to support decisions on land allocation with the Local Development Framework (i.e. the application of the Sequential Test).

#### **(b) Level 2 Strategic Flood Risk Assessment (SFRA 2)**

This document builds on the findings of the SFRA 1. It focuses on the Rotherham Regeneration Area within the river corridor throughout the extent of the RRFAS.

The document establishes that the principle of developing land within the floodplain (throughout the extent of the Rotherham Regeneration Area) can pass the Sequential and Exception Test, provided that the development proposals incorporate reasonable measures to mitigate the impacts of flooding. This can be achieved by constructing flood risk management infrastructure that is fully compatible with the requirements of the RRFAS as described in this Design Guidance.

Through partnership working between RMBC and Environment Agency, it has been established that developments in the floodplain areas within the Rotherham Regeneration Area identified in SFRA 2 (Section 3 of the Flood Risk Toolkit), will therefore be compliant with PPS 25 provided that it can be shown that the flood risk has been appropriately mitigated. On an individual site basis, the Environment Agency will be consulted on planning applications through the development control process and will expect an appropriately detailed site specific Flood Risk Assessment to be submitted by Developers.

The SFRA 2 Assessment undertaken by RMBC has been agreed with the Environment Agency. This document establishes the following:

- *The principle of putting new development in the Rotherham Regeneration Area passes the PPS 25 Sequential Test; and*
- *Development in the Rotherham Regeneration Area will also pass the Exception Test, provided that a Site Specific Flood Risk Assessment can demonstrate that development accords with the requirements of the community wide flood alleviation scheme.*

## 2.4 Rotherham Renaissance Flood Alleviation Scheme

### 2.4.1 Measures Included

Since November 2000, flood risk management within the river corridor and its appropriateness for new development has been reviewed and investigated in detail. This has been successfully achieved through a partnership approach between RMBC and the Environment Agency.

Work started by assessing how flood risk management works could be implemented with a detailed risk based approach to the technical, environmental and economic appraisal of both catchment wide and local flood risk management measures.

This assessment took account of the following key measures:

- *Upstream storage;*
- *Improvements to hydraulic conveyance; and*
- *New flood defences.*

The assessment demonstrated that the best solution for the town centre area of Rotherham was the construction of new flood defences, in conjunction with measures to improve conveyance at a number of key locations.

### 2.4.2 Purpose of the Scheme

It is essential that a 'community wide flood alleviation scheme' that provides a consistent standard of flood protection to the entire community be provided in the Templeborough and Rotherham areas.

Therefore, the flood defences must all tie into each other, be built to the same design standards/criteria and be continuous along the entire river corridor. In order for development to be compatible with a community wide scheme approach there are two different possible approaches for providing flood defences; building flood defences or raising land above the flood level.

The overall purpose of the flood alleviation scheme is to provide community wide protection to the existing infrastructure, and unlock the development potential of brownfield land along the river corridor.

The scheme reduces the risk of flooding to a 1% AEP (1 in 100 annual chance) flood event.



### 2.4.3 Scheme Details

Flood defence structures have been designed in a manner that allows them to be raised in the future to allow for the impacts of climate change without the need for further structural works to the below ground foundations. Flood defence structures have been designed for a 120 year design life.

The scheme extends approximately 4km along the river from near Magna in the Templeborough area of Rotherham to Frank Price Lock, which is a short distance downstream of Rotherham town centre, as shown in Figure 2 in Chapter 1.5.

On the left bank, technical appraisal work was undertaken. It proved where flood defences could tie into high ground at the upstream end of the flood cell, and, what the downstream extent would be so that it would prevent water backing up and flooding land behind the defences via the low lying land. This was a complicated assessment process due to the presence of existing railways, roads and canals.

The right bank simply shows where flood defences need to tie into high ground at the upstream and downstream extents of the particular flood cell.

A sensitivity analysis showed that the lateral scheme extents are essentially the same for all standards of protection between 1.3% AEP (1 in 75 annual chance) and 0.5% AEP (1 in 200 annual chance), albeit that the tie in point to high ground changes by a few metres for each.

Key elements of the scheme include:

- *Construction of new flood defence structures along both banks of the river;*
- *Works to lock structures;*
- *Works to goits that discharge into the river;*
- *Raising of two bridges that cause obstructions to flood flows;*
- *Removal of two bridges that cause obstructions to flood flows;*
- *Creation of a low lying wetland area that acts as compensatory floodplain and provides ecological interest at the Centenary Riverside site; and*
- *Improvements to riverside access.*

A number of the above have been implemented already and these are described below.

### 2.4.4 Scheme Phasing and its Significance

The ideal solution would be to complete the remaining parts of the overall community wide scheme as a single project and utilise public funding for all flood defence works. However, this is not going to be possible and therefore a number of publicly funded phases are needed, alongside investment from private development on key sites.

The implementation of the overall community wide scheme is therefore likely to require an incremental approach. Scheme phasing is therefore of critical importance to ensure that flood risk to existing businesses and infrastructure is not increased in the interim period (which will be several years) before the overall scheme is completed. This is discussed below.

There are two parts of the works already completed through the partnership between RMBC and the Environment Agency that are of critical importance to subsequent phases of the scheme:

- *The creation of compensatory floodplain at the Centenary Riverside Wetland site as part of the 2008 works; and*
- *The removal of Don Bridge in 2010.*

The combined effect of the above reduces flood levels significantly below the pre-scheme baseline (2005) through the majority of the Rotherham Regeneration Area. Subsequent development may incrementally increase flood levels, however they will not exceed pre-scheme levels, hence completion of the RRFAS will still reduce flood levels in Rotherham

Developments that comply with the Design Guidance will be compatible with the RRFAS and will not need to provide any further compensatory floodplain storage.

Location	Change to 1% AEP (1 in 100 annual chance) flood levels after full implementation of RRFAS, compared to pre-scheme conditions (m)
Railway Bridge at Magna	+0.3
Bessemer Way Bridge	+0.3
Firth Rixson Weir	+0.1
Centenary Riverside	-0.1
Main Street Bridge	0
Chantry Bridge	-0.1
Crinoline Bridge	-0.2
Don Bridge	-0.6
Downstream areas	0

Note: Levels illustrated in Figure 4

**Table 1 – Change in flood levels after implementation of RRFAS, compared to pre-scheme conditions.**

**The creation of compensatory floodplain at the Centenary Riverside Wetland site, combined with removal of Don Bridge, means that individual development sites can be implemented without making flood risk to adjacent sites worse than before any flood risk management works were implemented.**

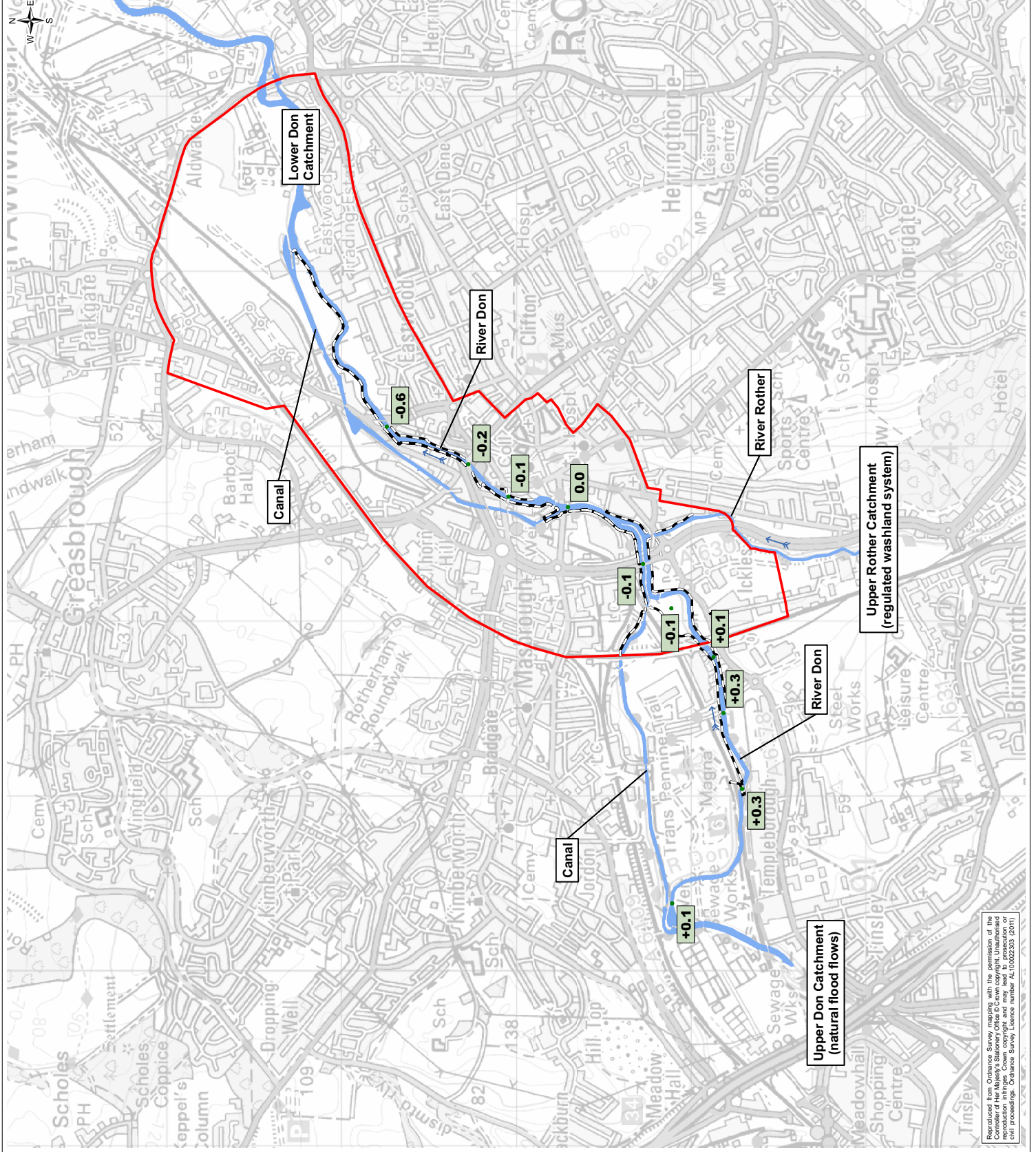
**The above means that subsequent individual development sites in the river corridor do not have to create their own compensatory floodplain.**

**However, RMBC will only approve planning applications for sites without compensatory storage if the remainder of the development proposals are fully compatible with the community wide flood alleviation scheme and have passed the PPS 25 Exception Test (where applicable).**

**FIGURE 4**

**Legend**

- Rotherham Regeneration Area
- RRFAS Raised Defences
- Watercourse
- Water Level
- X.X  
Reduction in water levels from 2005 baseline by X.Xm when RRFAS fully completed
- +Y.Y  
Increase in water levels from 2005 baseline by Y.Ym when RRFAS fully completed



Rev	Date	Initial Issue	AA	FL	HG	ID
0	JPR/2011					
Purpose of revision						
		Drawn	Checked	Revised	Approved	

**JACOBS**  
 1 City Walk, Leeds, LS11 0XX, UK  
 Tel: +44(0)113242 8777 Fax: +44(0)113 389 1389  
 www.jacobs.com

**MAR**  
 Client: Rotherham Metropolitan Borough Council  
 Project: ROTHERHAM SFRA 2

Drawing Title	WATER LEVELS FROM 2005 BASELINE AFTER RRFAS IS FULLY COMPLETED	
Drawing Status	FINAL	
Scale @A3	1:21,000	DO NOT SCALE
Jacobs No.	B1486900	
Client No.		
Drawing No.	B1486900_SFRA2_04.mxd	

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.  
 P:\B000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA2\B1486900\_SFRA2\_04.mxd

3

## Technical Requirements in order to comply with the community wide scheme

**It is essential that development complies with the following technical requirements for flood defence works in order to obtain planning approval and to ensure the flood defences will be built to sufficiently high design standards.**

### 3.1 Technical Requirements

#### 3.1.1 Community Wide Flood Protection

The general requirements for flood defence works within the Rotherham Regeneration Area are an integral community wide flood alleviation scheme that ensures that there is no flooding during a 1% AEP (1 in 100 annual chance) event from:

- *Overtopping of flood defences;*
- *Overland flows from areas remote from the flood defences (e.g. via low lying corridors such as canals, railways or roads);*
- *Below ground seepage through permeable ground;*
- *Backing up of other watercourses, goits or drainage outfalls;*
- *Flooding from surface water; and*
- *Flooding from groundwater.*

In addition to flood defence works, all development must comply with the requirements of PPS 25.

#### 3.1.2 Development Management Constraints

The development will need to adhere to constraints imposed by government through planning policy PPS 25 and these constraints will be considered as part of the planning process. Additional constraints are detailed below:

##### (a) Environment Agency Development Control Constraints

The Environment Agency's standard Development Control constraints are:

- *Development platforms and building floor levels will need to be at an appropriate level or alternatively flood defences may need to be installed. These levels will need to take account of a location specific peak river/flood water level, an allowance for freeboard, and, an allowance for climate change;*
- *The development should not increase flood risk to other infrastructure outside the boundary of the development site, either upstream or downstream from those that existed before any parts of RRFAS were built;*
- *No development should be allowed within an 8m zone of the top of the riverbank so as to maintain a level 'buffer strip' for Environment Agency access; and*
- *Provision of safe access to enable evacuation of the development during a flood event.*

With regard to occupation of development, PPS 25 will not permit occupation until the risk of flooding has been reduced to a level commensurate with the nature of the development, taking into account the requirements of PPS 25. The implications of this are:

- *If a development is located on a raised platform that is above the flood defence level required by the flood alleviation scheme, then it can be occupied before flood defences within the remainder of the flood cell have been completed;*
- *If a development is to be protected by flood defences, then all defences within the flood cell that the development lies within must be completed before occupation is permitted.*

With regard to the latter bullet point, it may be possible for a development to construct defences around its full perimeter. In such cases, the development effectively becomes a much smaller flood cell up to the point when the defences overtop. However, should the defences be overtopped, then the development will still be subject to the flooding mechanism within the overall 'natural' flood cell.

#### **(b) Operational and Maintenance Constraints**

The Environment Agency will require the following operational and maintenance issues to be taken into account by Developers:

- *Application of safety in design principles (see Chapter 3.1.3);*
- *Alignment of flood defences to provide a minimum 3m width between the top of the riverbank and the above ground part of the flood defence, so that access for plant on level ground can be achieved in the future on the riverward side of the flood defence structure;*
- *Access adjacent to the flood defence should not be hindered (e.g. by boundary fences, landscaping, car parking etc) and access gates on such routes should be avoided wherever possible;*
- *Elements of the scheme that need to be operated during a flood event need to be avoided, wherever possible (e.g. an access ramp is preferred to a floodgate); and*
- *Flood release mechanisms should be incorporated into the flood defence system. These should enable any floodwater trapped on the landward side of a flood defence (after a flood event that overtops the defence system) to be released back into the river as river levels fall.*

#### **(c) Compensatory Floodplain**

The Environment Agency would normally require development to be implemented in a manner that ensures that there is no net loss of the floodplain as a result of the development. For this constraint to be applied, any floodplain storage lost due to the development would need to be compensated for by an equal volume and on a level for level basis.

The purpose of flood defence works within the Rotherham Regeneration Area is overall community wide flood protection. RMBC has already created new compensatory floodplain at the Centenary Riverside site and removed Don Bridge. Therefore compensatory floodplain will not be required for individual

development sites, provided that the remainder of the development is compatible with the requirements of this Design Guidance.

**(d) Development Layout**

The layout of the development on the site will be at the discretion of the Developer; however, it needs to take full account of the maintenance and operation constraints. Policy on the type of development that is appropriate for different degrees of flood risk is given in PPS 25 Annex D, Table D2.

**3.1.3 Technical Requirements for Flood Defence Structures**

**(a) Flood Defence Levels**

Flood defence levels to which defences need to be built have been established. Design levels for hard defences are defined in Appendix A of this Design Guidance. The levels assume the following:

- *There is no encroachment into the channel beyond the line of flood defences, as shown in Figure 2 of this Design Guidance;*
- *Any new structures that span the river have a soffit level that is above the highest flood defence level at that location taking account of climate change; and*
- *The flood defence structures are ‘hard’ defences (such as concrete or sheet piles).*

If a Developer chooses to use ‘soft’ defences (e.g. embankments or land raising), then flood defence levels will need to be slightly higher to account for physical parameters such as settlement and wear and tear. Guidance on how Developers can calculate an appropriate allowance is contained within the Environment Agency’s ‘Fluvial Freeboard Guidance Note’.

**(b) Design Life**

A design life of 120 years is required for all structural elements of flood defences.

A lower design life will be acceptable for the following aspects:

- *Gabions (20 years);*
- *Penstocks (30 years);*
- *Flap valves (25 years);*
- *Mechanical/electrical equipment (The Developer will need to agree an appropriate design life with the party responsible for the long term maintenance and operation of the equipment).*

**(c) Climate Change**

Flood defence structures must be designed in a manner that they can be raised in the future to accommodate for the effects of climate change. This should be done in a manner that limits structural work to a minimum and above ground elements only.

Below ground foundations and above ground wall stems must therefore be capable of withstanding the higher loading that would be applied to them in the future taking account of higher water levels in the river that would result from higher peak flows in the catchment.

Any new structures that cross the river must also be located above the water levels predicted by the climate change scenario.

If land raising is selected by the Developer as their preferred method of flood defence, the development platform levels and building floor levels must be above the water levels predicted by the climate change scenario.

The flood defence levels required for climate change scenarios are included in Appendix A.

#### (d) Safety in Design

Any flood defences should be designed in a manner that takes account of the safety of personnel involved in the construction, future maintenance/operation and demolition of the scheme. Wherever possible, hazards should be designed out as part of the design process.

Appendix B contains a list of hazards that are typical to flood alleviation schemes. These are referred to as a RAG list where hazards are categorised as red, amber or green, whereby:

- **Red** - hazardous products, processes and procedures that should be eliminated on projects;
- **Amber** - hazards are products, processes and procedures to be eliminated or reduced as far as possible and only allowed if unavoidable. Including amber items would always lead to the provision of information on residual risk to the Contractor; and
- **Green** - products, processes and procedures to be encouraged on all projects.

#### (e) Key Loading Scenarios

The Developer shall consider all the following loading scenarios as a minimum:

- *Flood defences not overtopped by the water level in the river at the 1% AEP (1 in 100 annual chance) flood defence level, including an allowance for freeboard and climate change;*
- *Flood defences overtopped with the water level on the landward side of the defences at the low point of the defences within a particular flood cell, including an allowance for freeboard and climate change, with water in the river at the normal river level; and*
- *Vehicle impact loading where reinforced concrete flood defences could be struck by moving vehicles, where impact barriers are not installed.*

The Developer will need to provide a 'Approval in Principle' document for all flood defence structures. It is envisaged that this will be a concise document that includes, as a minimum, details of the load cases considered, Eurocodes or Design Standards used and how climate change is to be incorporated within the

design. These documents should also be suitable for inclusion within the Health and Safety File.

**(f) Overtopping events**

It is possible that a flood event that exceeds the 1% AEP (1 in 100 annual chance) design standard would occur at some point in the lifetime of the defences. As such, incorporating resilience into the design of all development in the natural floodplain is essential. This is discussed in more detail in Chapter 3.1.7.

Should defences be overtopped, any water trapped behind them needs to be readily released back into the river system. As such, flood release structures need to be incorporated within any defences and these would generally need to be located at:

- *The low point on the defences within the overall flood cell; and/or*
- *At any low points behind defences that could have small 'pockets' of trapped flood water*

**(g) Design Codes and Technical Specification**

Flood defences must be designed in accordance with all relevant Eurocodes or Design Standards.

The technical specification for flood defence works must meet the 'Specification for Highway Works', published by The Stationery Office (formerly HMSO) as Volume 1 of the Manual of Contract Documents for Highway Works.

**The key technical requirements for flood defences to be compatible with the overall community wide scheme are:**

- *Flood defence levels must, as a minimum, be at the 1% AEP (1 in 100 annual chance) level, including the allowances for freeboard;*
- *The defences must be designed in a manner that no future works are required to below ground structures to enable easy raising of levels in the future to accommodate the impacts of climate change;*
- *Design life, loading scenarios considered, safety in design compliance and technical standards are as set out in Chapter 3.1.3 of this Design Guidance.*

**The flood defence levels and climate change allowances are set out in detail in Appendix A of this Design Guidance.**

**3.1.4 Technical Requirements for Land Raising**

Land raising could be used as an alternative to flood defences as this has the advantage to Developers that buildings can be occupied before flood defences in the remainder of the flood cell have been completed.



The technical requirements for land raising are generally the same as those for flood defence structures, with the following exceptions:

- *The climate change allowance must be incorporated into the development platform and building floor levels;*
- *The development platform creates an area of high ground as opposed to a flood defence;*
- *Development platform levels will need to be slightly higher than the flood defence levels for 'hard' defences to take account of physical parameters such as settlement and wear and tear; and*
- *A safe egress route must be provided from the site which lies outside the flood risk zone.*

**The key technical requirements for land raising to be compatible with the overall community wide scheme are:**

- ***Development platform and building floor levels must, as a minimum, be at the 1% AEP (1 in 100 annual chance) level, including the allowances for freeboard, incorporating climate change allowances and land settlement allowances; and***
- ***Design life, loading scenarios considered, safety in design compliance and technical standards are as set out in Chapter 3.1.3 of this document.***

**The flood defence levels with climate change allowances are set out in detail in Appendix A of this Design Guide.**

### 3.1.5 Surface Water Drainage Paths, Outfalls and Runoff from Development Sites

In addition to the installation of appropriate flood defences or land raising, Developers must also take account of the method by which surface water runoff is dealt with.

#### (a) Drainage Paths

SFRA 2 contains detailed mapping of the areas prone to flooding from surface water. The methodology used to determine the surface water drainage pathways assumes that all man made drainage systems are ineffective, so this mapping presents a good representation of the risks that may occur through the lifetime of the development.

Developers need to determine the location of any drainage path on or adjacent to their land and provide appropriate mitigation from the flood risks that are present. Examples could be:

- *Locating non operational land (e.g. landscaping, open space areas) within the higher risk areas;*
- *Raising operational land above the risk areas, leaving a low corridor for the surface water drainage path;*
- *Re-directing the surface water drainage paths on the site; and*
- *Constructing culverts to deal with flows along the surface water drainage paths, sizing them to take account of impacts of climate change (note: this*

*is only likely to be acceptable to the Environment Agency and RMBC Land Drainage team if it is the only viable solution).*

For all of the above, the solution chosen must not increase the flood risk to the development itself or to any areas outside the developments boundary from the water levels that were predicted before any of RRFAS was built.

**(b) Outfalls**

The Developer will be responsible for determining the source of any outfalls and designing any works required to ensure that the outfalls do not form a route for water to bypass the flood defence structures.

Should the Developer be able to determine that a particular outfall is disused and this is continued by the relevant organisation, then it may be sealed. If the outfall is still operational, it will need to be fitted with a flap valve that ensures that an appropriate seal is made to prevent water bypassing the flood defences during a flood event.

For outfalls larger than 1m diameter, a penstock also needs be provided as a 'back up' that can be operated during a flood event should the adjacent flap valve fail to close.

**(c) Surface Water Runoff**

Mapping illustrating the areas at risk from surface water flooding are contained in the SFRA 2. This contains information on the extent, depth and velocity of surface water flooding and the associated flood hazard.

Both the Environment Agency and RMBC require Sustainable Drainage (SUDS) techniques to be incorporated within new development. This can be achieved in many ways, a few examples of which can be found in the following table.

SUD's Technique	Description
Pervious surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil.
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
Filter drain	Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist with drainage, to store and conduct water. They may also permit infiltration.
Filter strips	Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
Swales	Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
Basins, Ponds and Wetlands	Areas that may be utilised for surface runoff storage.
Infiltration devices	Sub surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
Bio retention areas	Vegetated areas designed to collect and treat water before

SUD's Technique	Description
	discharge via a piped system or infiltration to the ground.
Pipes and accessories	A series of conduits and their accessories normally laid underground that convey surface water to a suitable location for treatment retention and/or disposal. (Although sustainable, these techniques should be considered where other SUDS techniques are not practicable).

**Table 2 – SUDS Techniques**

Of particular importance is that surface water drainage systems from new development sites should not increase the runoff rates into the receiving watercourse. Therefore, the following constraints must be applied to all new development:

- *Development on all sites will be required to minimise the risk of flooding, which could occur as a consequence of the development, both to the new development and to other off site land. This includes flooding from any watercourse, surface water runoff created by the development, local overland flow which could occur due to overflow or blockage of any drainage facility, or ground water flooding;*
- *The disposal of surface water must not have any adverse effect on neighbouring or downstream land;*
- *New development on 'brownfield' sites should have their outfall discharge flow restricted to 70% of the pre-development value. This figure may be reduced to 50% if there is deemed to be an existing serious flooding problem downstream from the development.*
- *For any part of the site that is designated 'greenfield', discharge from it should be restricted to a rate of 5 litres/second per hectare;*
- *The above limits apply irrespective of whether the proposed discharge is to a sewer or watercourse. However, where a new surface water discharge is to a watercourse, and it was previously to a sewer, then the new development will be treated as 'greenfield';*
- *Where storage of excess water is necessary, then the Developer should generally allow for a 3.3% AEP (1 in 30 annual chance) design storm for any onsite facility. This may be increased up to a 1% AEP (1 in 100 annual chance) design storm if the storage is offsite, is an on-line watercourse or is in a location deemed to be susceptible to flooding. The Developer must also undertake an assessment of overland flow routes for a 1% AEP (1 in 100 annual chance) event;*
- *Consideration should also be given to the impacts of climate change on the 1% AEP (1 in 100 annual chance) event;*
- *For large impervious car park areas and service/delivery yards, oil/petrol interceptors must be installed; and*
- *Connections to the public sewer system must be agreed with Yorkshire Water.*

The above constraints would have to be taken into account for any development within the area covered by this design guidance. These constraints are best dealt with by consulting with RMBC's Land Drainage team at an early stage in the development of proposals for the site, rather than after the submission of any planning application.

- *SFRA 2 contains detailed mapping of the areas prone to flooding from surface water;*
- *Developers need to determine the location of any drainage paths on or adjacent to their land and provide appropriate mitigation from the flood risks that are present;*
- *Any outfalls to the river must be investigated by the Developer and works provided to ensure the outfalls do not form a route for water to bypass flood defence structures;*
- *SUD's techniques should be used to control surface water runoff where possible; and*
- *RMBC Land Drainage team have a stringent set of development control constraints that must be taken into account by Developers.*

### **3.1.6 Riverside access and river edge treatments**

As set out in Chapter 2.2, the urban renaissance aspirations and public realm strategy require the riverside to be improved, in terms of environmental quality and access in particular. The principal way of achieving this is through appropriate development on riverside sites that, for example:

- *Set buildings back from the river edge so that it looks out onto the river;*
- *Have open spaces that are available for public usage along the river edge, with public footpaths and walkways being a key feature;*
- *Implementing and maintaining appropriate landscaping along these accesses to supplement existing river corridor vegetation; and*
- *Incorporating 'destination points' along the river frontage at appropriate locations.*

### **3.1.7 Adaptation and Resilience to Flooding**

#### **(a) Adaptation to flooding**

Any designs for flood risk management options should account for anticipated increase in flood levels due to future climate change. It is therefore crucial that defences are designed and constructed in a manner that they can be raised in the future to adapt to any changes in flows caused by the impacts of climate change.

Similarly and just as important is that flood resilience is incorporated into the design of any development behind flood defence structures.

SFRA 2 assesses the flood risk specifically along the river corridor. It contains mapping that identifies depths of flooding within the floodplain and will help Developers understand the risks that they need to take account of within the development site layouts.

#### **(b) Resilience to flooding**

It should be recognised that there is always a residual risk that an event that is more severe than the 1% AEP (1 in 100 annual chance) design standard will occur in the future.

The likelihood P of encountering an event equal to or exceeding the event with return period T during a time period N years is given by the following equation:

$$qP = 1 - \{ 1 - ( 1/T ) \}^N$$

For example, there is a 22% chance that a 0.5% AEP (1 in 200 annual chance) event will occur in a 50 year time period or in other words, there is a 78% degree of security against overtopping from this event. It is therefore important that flood resilience measures are incorporated into the design of any development, particularly for building structures, key services and access routes within the development.

Resilience is defined as “sustainable measures that can be incorporated into the building fabric, fixtures and fittings to reduce the impact of floodwater on property”<sup>2</sup>. Building flood resilience measures into properties can provide considerable benefits in a flood event such that the structural integrity is maintained, no permanent damage is caused, and to facilitate cleaning and drying. Flood resilience measures can be readily designed for new developments as they can be planned and meticulously designed into the construction. However, it is more difficult to retrofit flood resilience measures into existing properties.

Guidance on flood resilient design and construction can be found in the ‘Improving the flood performance of new buildings: Flood resilient construction,’ Communities and Local Government, 2007.

These approaches are appropriate for areas where the probability of flooding is low, (for example Flood Zone 1 as defined by PPS 25) or areas where flood risk management or mitigation measures have been put in place.

**Some examples of flood resilience methods are:**

- ***Raising electrical sockets, fuse boxes and other electrical wires to at least 1.5m above ground level to limit being at risk from floodwaters;***
- ***Design doors so that floodgates can be placed across the bottom external doors to hold back floodwaters;***
- ***Fit stainless steel, plastic or solid wood kitchen units rather than chipboard to aid the drying out process and minimise damages;***
- ***Ensure the threshold levels into a property are above the design flood level;***
- ***Boundary walls and fencing can be designed to create flood resistant barriers;***
- ***Use air bricks which have airtight covers that can be easily attached to prevent water entering your property;***
- ***Use lime based plaster on walls and avoid using gypsum plasterboard; and***
- ***Clay ceramic tiles on the ground floor of properties instead of carpets as they are easier to clean and do not soak up floodwaters or debris.***

<sup>2</sup> Improving the flood performance of new buildings: Flood resilient construction’, Communities and Local Government, 2007).

### **3.2 Handover Requirements**

It is necessary to consider who will be responsible for any flood defence structures during the design life of the RRFAS. There are typically documents and records expected to be provided to the party who will have the responsibility (referred to as the Responsible Party) throughout the life of the design project and after completion of the development. Appendix C includes a Best Practice Guide which lists and summarises the variety of documents which can be compiled for handover to the Responsible Party on completion.

This chapter sets out:

- *The requirements for 'Site Specific Flood Risk Assessments' required as part of any planning application;*
- *Expectations of Development Management Teams and the processes that need to be applied to development in river corridor areas for them to be met; and*
- *A summary of the flood risk issues to be addressed by Developers.*

#### 4.1 Site Specific Flood Risk Assessment

One of the key requirements of PPS 25 is the requirement for Developers to submit a Flood Risk Assessment as part of their planning application. Amongst other things, this should demonstrate that:

- *It is appropriate for development to be located within the floodplain, given that there may be other sites not prone to flooding in the vicinity;*
- *The development can be made safe through mitigation measures; and*
- *That the mitigation measures proposed for the development are reasonable.*

With regard to the first point, the RMBC, through the SFRA 2, has established that the principle of developing land within the floodplain throughout the extent of the Rotherham Renaissance Flood Alleviation Scheme (RRFAS) passes a strategic Sequential Test. Each development site must be subject to a site specific Sequential Test and Exception Test (if required). This requires the development proposals to incorporate reasonable measures to mitigate the risks of flooding.

To satisfy the second point, Developers will need to demonstrate that, for their particular site, the development proposals are compliant with this Design Guidance. Compliance will need to be demonstrated through a Site Specific Flood Risk Assessment.

General guidance on the information to be provided in a site specific Flood Risk Assessment is given in PPS 25 and its 'living draft' companion guide. The requirements of these documents should be taken into account by Developers when submitting a planning application. By completing the checklist in the How to Use Guide (Section 2 of the Flood Risk Toolkit), all the issues relevant to the Rotherham Regeneration Area and PPS 25 should be addressed.

Further information about the application of the Sequential Test is provided in the Sequential Approach Guidance (Section 3 of the Flood Risk Toolkit).

The Environment Agency will not object in principle to development in floodplain areas provided that it has been demonstrated that the proposed development can remain safe within the Rotherham Regeneration Area. Flood Risk Assessments will be assessed by the RMBC Development Management Teams and the Environment Agency, in line with their standard processes.

## 4.2 Development Control

'Development Control' is the process through which Local Planning Authorities including RMBC set out certain standards and conditions to ensure that inappropriate development does not take place. Any proposed development will have to go through this process to ensure development is appropriate.

**Developer's should be aware that if their development is deemed by RMBC's Development Management Teams or the Environment Agency to be incompatible with the overall community wide flood alleviation scheme, this may be grounds for a planning application to be refused.**



### 4.3 Expectations of Development Control Teams

Developers must provide information, drawings and documents to the appropriate Development Management Teams at different stages of the project, as illustrated in the table below.

Project Phase	Minimum Expectations of Development Management Teams	Relevant Development Control Team
Outline planning application	<p>A FLOOD RISK ASSESSMENT to demonstrate that the proposed development complies with the requirements of PPS 25 and this Design Guide.</p> <p>Appropriately detailed drawings to illustrate the CONCEPTUAL DESIGN of flood alleviation measures and how these are incorporated into the development proposals.</p> <p>Above to be incorporated with the OUTLINE PLANNING APPLICATION submission for Development Management Team approval.</p>	RMBC (RMBC will consult Environment Agency)
Detailed planning application	<p>A FLOOD RISK ASSESSMENT to demonstrate that the proposed development complies with the requirements of PPS 25 and this Design Guide.</p> <p>Appropriately detailed drawings to illustrate the OUTLINE DESIGN of flood alleviation measures and how these are incorporated into the development proposals.</p> <p>Above to be incorporated with the DETAILED PLANNING APPLICATION submission for Development Management Team approval.</p>	RMBC (RMBC will consult Environment Agency)
Before start of construction	<p>Appropriately detailed drawings to illustrate the DETAILED DESIGN of flood alleviation measures, including Designer’s Risk Assessments and ‘Approval in Principle’ documentation. Information to discharge planning conditions formally submitted to RMBC Development Management Team for approval.</p> <p>Above to be incorporated with application for LAND DRAINAGE CONSENT. If this consent is not required for a development, then the above information should be incorporated with the DETAILED PLANNING APPLICATION submission for Development Control team approval.</p>	RMBC (RMBC will consult Environment Agency)

**Table 3 - Expectations of the Environment Agency and RMBC Development Management Teams**

#### 4.4 Overview of Flood Risk Issues to be Addressed by Developers

Developers must address the flood risk issues identified in the table below to ensure they comply with the design standard set out in this design guidance.

Issues To Be Addressed	Further Information
<p><b>Community Wide Flood Protection</b></p> <ul style="list-style-type: none"> <li>• <i>Level of flood protection</i></li> <li>• <i>Mechanisms of flooding</i></li> </ul>	Chapter 3.1
<p><b>Environment Agency Development Control Constraints</b></p> <ul style="list-style-type: none"> <li>• <i>Development platform and building floor levels</i></li> <li>• <i>Flood defence</i></li> <li>• <i>Compensatory floodplain</i></li> <li>• <i>Impact on nearby land/properties</i></li> <li>• <i>Development layouts</i></li> <li>• <i>Future access requirements</i></li> <li>• <i>Provision of safe access during floods</i></li> <li>• <i>Timing of development occupation</i></li> </ul>	
<p><b>Environment Agency Operational and Maintenance Constraints</b></p> <ul style="list-style-type: none"> <li>• <i>Application of safety in design principles</i></li> <li>• <i>Access adjacent to flood defences</i></li> <li>• <i>Elements to be operated during a flood event</i></li> <li>• <i>Flood release mechanisms</i></li> </ul>	
<p><b>Technical Requirements of Flood Defence Structures</b></p> <ul style="list-style-type: none"> <li>• <i>Extent of flood defences and compatibility with other flood alleviation works within flood cell within which development falls</i></li> <li>• <i>Compatibility of flood defence levels with community wide scheme</i></li> <li>• <i>Incorporation of climate change</i></li> <li>• <i>Application of safety in design principles</i></li> <li>• <i>Consideration of relevant load cases (including overtopping events)</i></li> <li>• <i>Design life</i></li> <li>• <i>Design codes and technical specification</i></li> </ul>	
<p><b>Technical Requirements for Land Raising</b></p> <ul style="list-style-type: none"> <li>• <i>Generally as per 'technical requirements of flood defence structures' but with some Exceptions</i></li> </ul>	
<p><b>Surface Water Drainage Paths, Outfalls and Surface Water Runoff from Development Sites</b></p> <ul style="list-style-type: none"> <li>• <i>Overland drainage paths</i></li> <li>• <i>Method of dealing with bypassing defences via outfalls</i></li> <li>• <i>Incorporation of SUDs techniques</i></li> <li>• <i>Control of surface water runoff rates and volumes</i></li> </ul>	
<p><b>Riverside Access and River Edge Treatments</b></p> <ul style="list-style-type: none"> <li>• <i>Urban renaissance and public realm strategy aspirations</i></li> <li>• <i>Riverside access</i></li> </ul>	
<p><b>Adaptation and Resilience to Flooding</b></p> <ul style="list-style-type: none"> <li>• <i>Adaptation and resilience measures</i></li> </ul>	

Issues To Be Addressed	Further Information
<p><b>Project Records</b></p> <ul style="list-style-type: none"> <li>• <i>Designer's Risk Assessments/Hazard Evaluation and Risk Reduction documentation</i></li> <li>• <i>'As Built' drawings</i></li> <li>• <i>Health and Safety File</i></li> <li>• <i>Operation and Maintenance Manual</i></li> <li>• <i>Design warranties</i></li> </ul>	Appendix C
<p><b>Handover Procedure</b></p> <ul style="list-style-type: none"> <li>• <i>Handover plans/documentation</i></li> <li>• <i>Handover workshop/site tour</i></li> </ul>	

**Table 4 – Flood Risk issues to be addressed by Developers.**

## Appendix A Flood Defence Levels

**This page is intentionally left blank.**

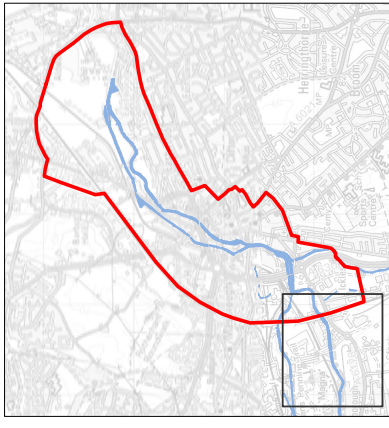
DON BRIDGE REMOVED										
Model Node Reference	River Cross Section Description	1 in 100 Year Peak Water Level (mAOD)	Freeboard Allowance (mm)		Climate Change Allowance (mm)	Flood Defence Level (mAOD)				Reach Flood Defence Level Applicable To
			Left Bank	Right Bank		Left Bank		Right Bank		
						Current	Future	Current	Future	
DON12_6550	Railway Bridge (Upstream Face)	28.94	500	500	600	29.44	30.04	29.44	30.04	DON12_6550 to DON12_6454
DON12_6454	River Section (Downstream of Railway Bridge)	28.69	500	500	600	29.19	29.79	29.19	29.79	DON12_6454 to DON12_6293
DON12_6293	BOC Pipe Bridge	28.65	500	500	600	29.15	29.75	29.15	29.75	DON12_6293 to DON12_6200
DON12_6200	Coronation Bridge (Upstream Face)	28.65	500	500	600	29.15	29.75	29.15	29.75	DON12_6200 to DON12_6123
DON12_6123	DOGSTAR/Transco Pipe Bridge	28.45	500	500	600	28.95	29.55	28.95	29.55	DON12_6123 to DON12_6081
DON12_6081	Bessemer Way Bridge (Upstream Face)	28.45	500	500	600	28.95	29.55	28.95	29.55	DON12_6081 to DON12_5924
DON12_5924	Firth Rixson Upstream Access Bridge (Upstream Face)	28.40	500	500	600	28.90	29.50	28.90	29.50	DON12_5924 to DON12_5859
DON12_5859	Firth Rixson Derelict Bridge (Upstream Face)	27.95	500	500	600	28.45	29.05	28.45	29.05	DON12_5859 to DON12_5751
DON12_5751	Firth Rixson Weir	27.94	500	550	600	28.44	29.04	28.49	29.09	DON12_5751 to DON12_5708
DON12_5708	Firth Rixson Main Access Bridge (Upstream Face)	27.56	550	600	600	28.11	28.71	28.16	28.76	DON12_5708 to DON12_5667
DON12_5667	Railway Viaduct (Upstream Face)	27.56	550	600	600	28.11	28.71	28.16	28.76	DON12_5667 to DON12_5602
DON12_5602	River Cross Section (Downstream FR Site)	27.38	550	600	600	27.93	28.53	27.98	28.58	DON12_5602 to DON12_5395
DON12_5395	River Cross Section (Centenary Site)	27.38	550	700	600	27.93	28.53	28.08	28.68	DON12_5395 to DON12_5192
DON12_5192	Disused Bridge Centenary Site (Upstream Face)	26.97	550	550	600	27.52	28.12	27.52	28.12	DON12_5192 to DON12_5069
DON12_5069	River Cross Section Near Riverside Way	26.90	550	550	600	27.45	28.05	27.45	28.05	DON12_5069 to DON12_4952
DON12_4952	Centenary Way Bridge (Upstream Face)	26.76	550	550	600	27.31	27.91	27.31	27.91	DON12_4952 to DON12_4732
DON12_4732	River Cross Section Near End of Don Island	26.60	550	600	700	27.15	27.85	27.20	27.90	DON12_4732 to DON11_4566
DON11_4566	River Cross Section adj. Guest & Chrimes	26.43	600	600	700	27.03	27.73	27.03	27.73	DON11_4566 to DON11_4294
DON11_4294	Main Street Bridge (Upstream Face)	26.25	750	600	700	27.00	27.70	26.85	27.55	DON11_4294 to DON11_4216
DON11_4216	Tesco Road Bridge (Upstream Face)	25.99	750	600	700	26.74	27.44	26.59	27.29	DON11_4216 to DON11_4132
DON11_4132	Rotherham Weir	25.99	800	650	800	26.79	27.59	26.64	27.44	DON11_4132 to DON11_4082
DON11_4082	Tesco Footbridge	25.60	850	700	800	26.45	27.25	26.30	27.10	DON11_4082 to DON11_3935
DON11_3935	Chantry Bridge (Upstream Face)	25.41	700	700	700	26.11	26.81	26.11	26.81	DON11_3935 to DON11_3906
DON11_3906	Footbridge next to Our Lady's Chapel	25.41	650	650	700	26.06	26.76	26.06	26.76	DON11_3906 to DON11_3676
DON11_3676	Footbridge	24.78	650	650	700	25.43	26.13	25.43	26.13	DON11_3676 to DON11_3648
DON11_3648	Crinolene Bridge (Upstream Face)	24.78	550	550	700	25.33	26.03	25.33	26.03	DON11_3648 to DON11_3514
DON11_3514	River Cross Section adjacent to Underwood Meat Company	24.35	550	550	700	24.90	25.60	24.90	25.60	DON11_3514 to DON11_3280
DON11_3280	River Cross Section adjacent to Aizlewood Build Base	24.11	700	500	700	24.81	25.51	24.61	25.31	DON11_3280 to DON11_3111
DON11_3111	Pipe Bridge (immediately upstream of Don Bridge)	23.87	500	500	700	24.37	25.07	24.37	25.07	DON11_3111 to DON11_3054
DON11_3054	Graffon Bridge (Upstream Face)	23.82	500	500	700	24.32	25.02	24.32	25.02	DON11_3054 to DON11_2952
DON11_2952	River Cross Section	23.81	500	500	700	24.31	25.01	24.31	25.01	DON11_2952 to DON11_2752
DON11_2752	River Cross Section	23.69	500	500	700	24.19	24.89	24.19	24.89	DON11_2752 to DON11_2533
DON11_2533	River Cross Section	23.60	500	500	700	24.10	24.80	24.10	24.80	DON11_2533 to DON11_2299

Note: For locations of river cross sections, refer to Figures A.1, A.2 and A.3.

**FIGURE A1**

**Legend**

- Rotherham Regeneration Area
- Watercourse
- Model cross section reference
- C = Current flood defence level (i.e includes freeboard)
- F = Future flood defence level (i.e includes freeboard and climate change)



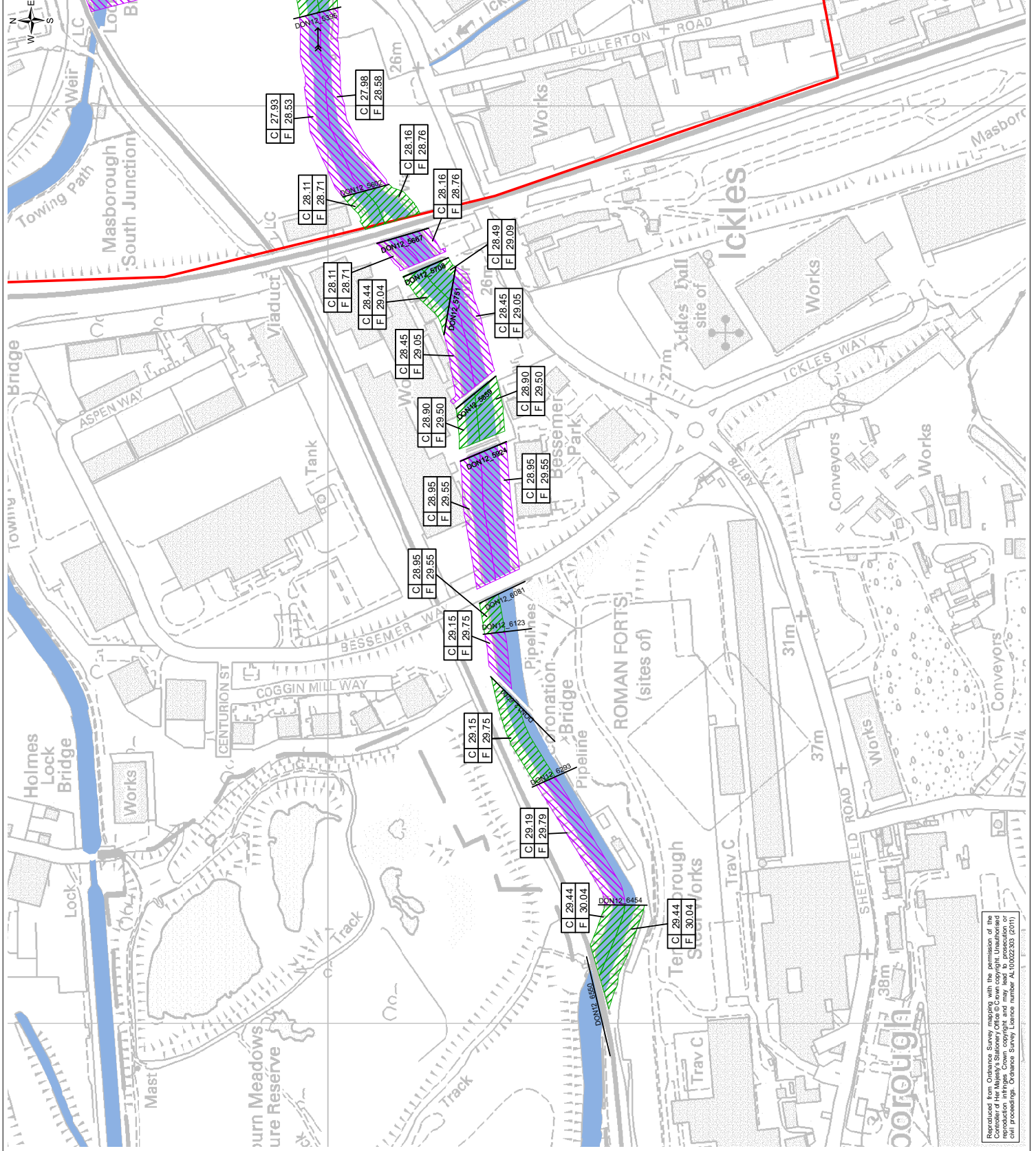
Rev	Date	Purpose of revision	AA	FL	HG	ID
0	APR 2011	Initial Issue				
			Drawn	Checked	Revised	Approved

**JACOBS**  
 1 City Walk, Leeds, LS11 5DQ, UK  
 Tel: +44(0)113 242 877 Fax: +44(0)113 389 1389  
 www.jacobs.com

**MAR**  
 Client: Rotherham Metropolitan Borough Council  
 Project: Rotherham SFRA 2

Drawing Status	FINAL
Scale @A3	1:4,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA2_A1.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.  
 P:\B0000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA2\B1486900\_SFRA2\_A1.mxd

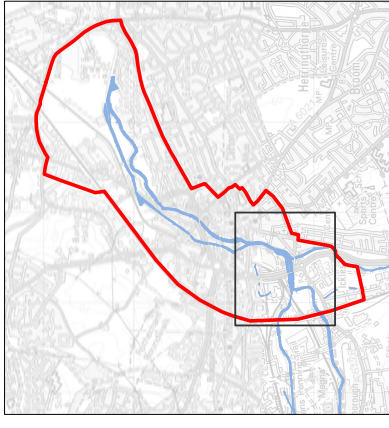


Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright and may lead to prosecution of civil proceedings. Ordnance Survey Licence number AL10002303 (2011)

# FIGURE A2

## Legend

- Rotherham Regeneration Area
- Watercourse
- Model cross section reference
- C = Current flood defence level (i.e includes freeboard)
- F = Future flood defence level (i.e includes freeboard and climate change)



Rev	Date	Drawn	Checked	Revised	App'd	AA	FL	HG	ID
0	JPR, 2011								

**JACOBS**  
 1 City Walk, Leeds, LS11 5DQ, UK  
 Tel: +44(0)113 242 677 Fax: +44(0)113 389 1389  
 www.jacobs.com

Client  
**MAR**  
 Rotherham Metropolitan Borough Council  
 Bailey House, Rotherham Road,  
 Rotherham, S60 1TD

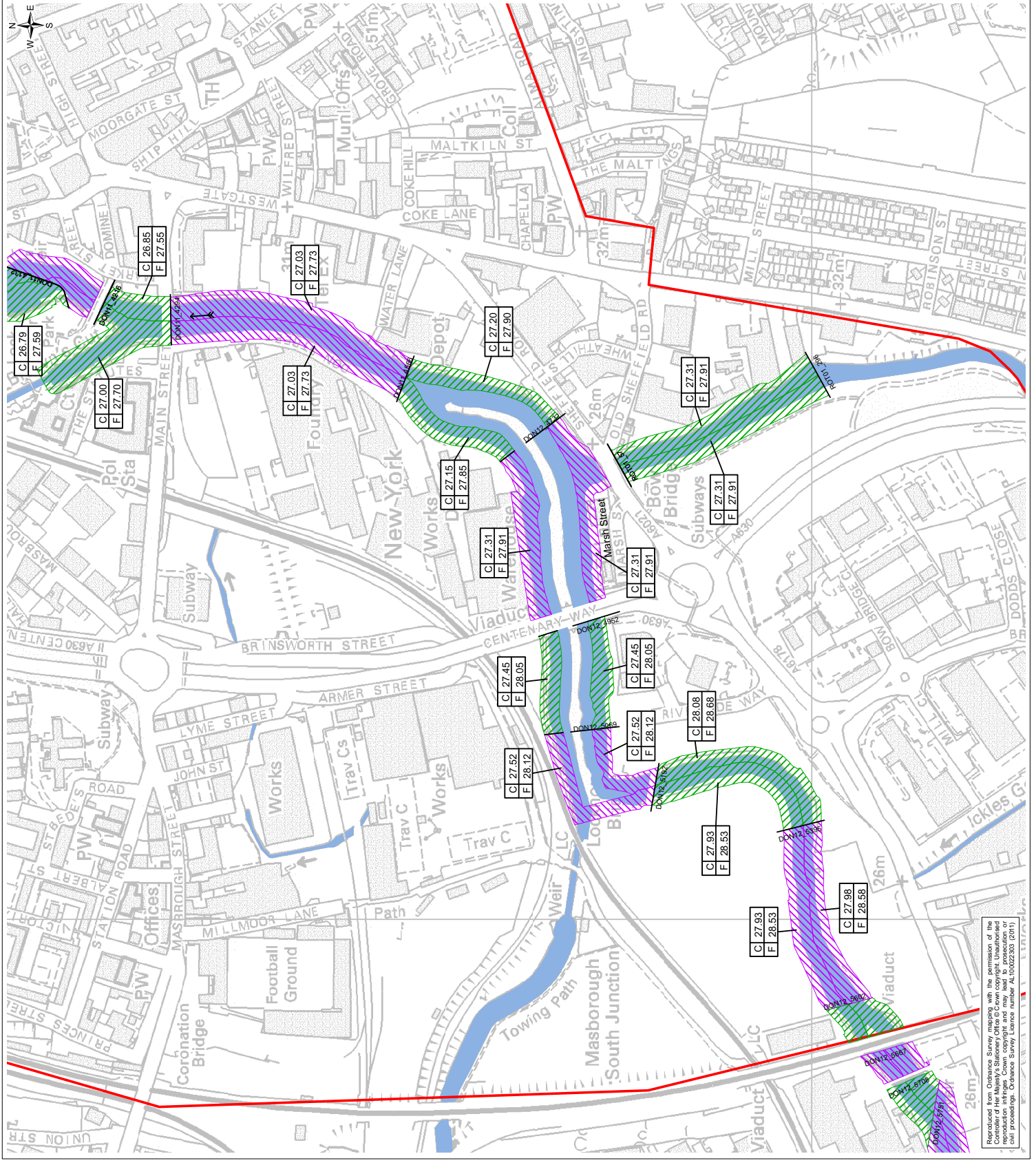
Project  
 ROTHERHAM SFRA 2

Drawing Title  
 MODEL CROSS SECTIONS

Drawing Status	FINAL
Scale @ A3	1:4,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA2_A2.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

P:\B0000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA2\B1486900\_SFRA2\_A2.mxd



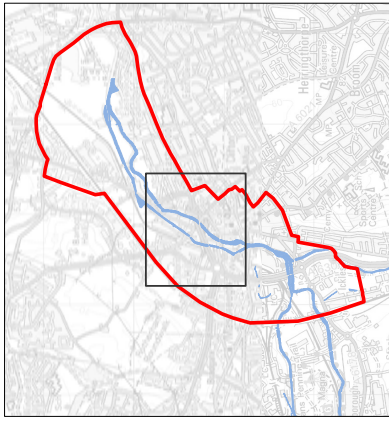
Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown copyright and may lead to prosecution or civil proceedings. Ordnance Survey Licence number AL10022303 (2011)



**FIGURE A3**

**Legend**

- Rotherham Regeneration Area
- Watercourse
- Model cross section reference
- C = Current flood defence level (i.e includes freeboard)
- F = Future flood defence level (i.e includes freeboard and climate change)



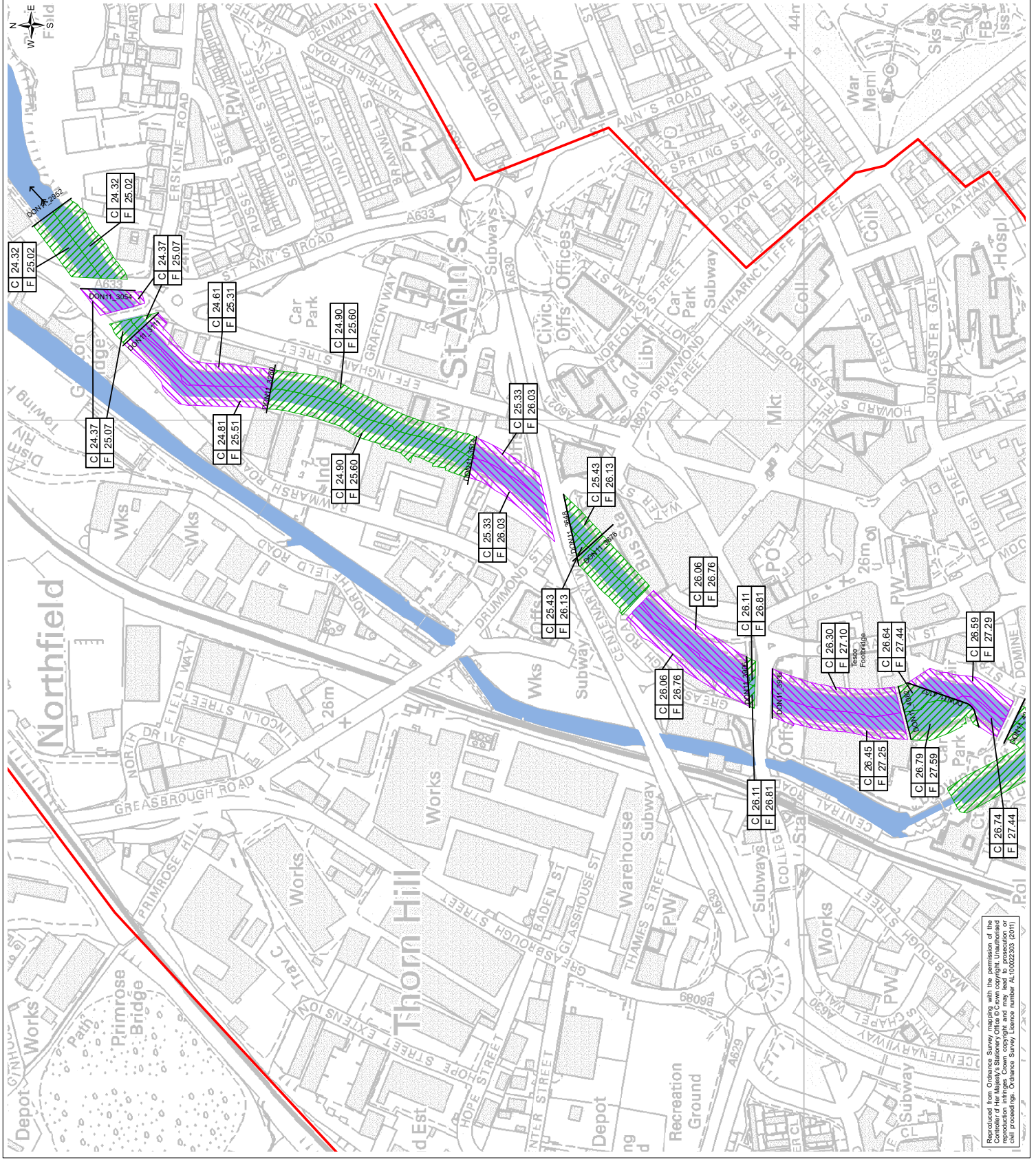
Rev	Date	Drawn	Checked	Revised	App'd	ID
0	14/04/2011					

**JACOBS**  
 1 City Walk, Leeds, LS11 5DQ, UK  
 Tel: +44(0)113 242 877 Fax: +44(0)113 389 1389  
 www.jacobs.com

**MAR**  
 Client: Rotherham Metropolitan Borough Council  
 Project: ROTHERHAM SFRA 2

Drawing Title	MODEL CROSS SECTIONS
Drawing Status	FINAL
Scale @ A3	1:4,000
Jacobs No.	B1486900
Client No.	
Drawing No.	B1486900_SFRA2_A3.mxd

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.  
 P:\B0000000\B0486900 - TRFAS Phase 2\GIS\output\SFRA2\B1486900\_SFRA2\_A3.mxd



Reproduced from Ordnance Survey mapping with the permission of the Ordnance Survey. Crown copyright and may lead to prosecution of civil proceedings. Ordnance Survey Licence number AL100022303 (2011)

**Appendix B Safety in Design RAG List**

**This page is intentionally left blank**

**Purpose of the Red, Amber, Green (RAG) list.** To encourage the use of best practice techniques in the construction of projects so as to minimise health, safety and environmental risk during construction, use and demolition.

**Procedure** All designs issued for construction will be formally reviewed against the RAG list by the designers’ technical reviewer during final design review.

The sign off statement together with in most cases a buildability statement will be included in the pre construction information and therefore made available to the contractor.

Buildability statements will outline the assumptions the designer has made as regards construction techniques including access arrangements.

In the construction phase, the CDM-C will ensure that significant design changes are referred back to designer, reviewed against the RAG list approved as necessary.

**! Important** It does not replace the requirement for or override requirements resulting from environmental impact assessment or similar environmental assessment processes.

**RED LIST**

**Red List Items are NOT banned. But are undesirable. This procedure creates a hold point where they are to be used as follows:**

**Where a red list item is proposed, approval by the Project Director, is required before the design is issued for construction.**

**The Designers Project Director will in writing approve the design, as being the most appropriate with no lower risk alternatives given the constraints involved.**

1. Detailed design/construction without a buried services/structures survey.
2. Designs likely to impose high vibration processes during operation or maintenance.
3. Designs likely to impose frequent or repeated manual handling of materials weighing more than 20kgs.
4. Operations likely to impose significant muscular skeletal risk during operation or maintenance.
5. Designs imposing Access/Egress arrangements requiring special controls in construction for example use of fall arrest.

6. Designs or detailing of structural elements (steel, concrete, timber etc) which can not accommodate systems to prevent falls from height.
7. Designs imposing Access/Egress arrangements which present unusual risks during use or maintenance, including to legitimate use by the public, bank gradients making grass cutting possible only with special equipment or likely to create fall risks to those crossing or walking upon them.
8. Creation of a confined space.
9. Designs for the provision of services in any location without making special provisions for access, i.e. at height or within a confined space, (requiring future access for maintenance etc).
10. Processes likely to give rise to large quantities of dust, ie dry cutting.
11. Designs which are likely to cause contaminated discharges directly into controlled water or land.
12. Designs which include manholes/inspection covers in heavily trafficked areas.
13. Designs that require the contractor to remove Asbestos Contaminated Material
14. Designs which do not allow for the segregation of members of the public in construction.
15. Designs which do not allow sufficient space for segregated traffic.
16. Any design requiring a crane lift, without proper consideration of how the lift will be made
17. Use of tropical hardwoods.
18. Designs which involve in-situ concrete pours within the watercourse.
19. Site layouts where there is insufficient space to manage plant, materials and waste efficiently and effectively or where there is a risk of flooding with associated pollution risk.

**AMBER LIST**

**Amber list items are NOT banned but represent techniques which, where possible, should be substituted for lower risk alternatives. Often this will not be possible.**

**Where an amber list item is proposed, justification and sign off is required by Project Design Manager (different design organisations will have different names for this role).**

**Sign off by the project manager/project executive is NOT required.**

1. Designs likely to require tube and fitting scaffold systems (as opposed to much lighter system scaffolds or other access systems with reduced manual handling implications).
2. Designs requiring the use of toxic or harmful chemicals including those damaging to the environment.
3. Use of solvent based paints and coatings.
4. Designs that require chasing out of concrete/brick/ block work.
5. Designs that rely on traffic cones to protect personnel from errant vehicles.
6. Site access which imposes significant risk to the public, for example on corners, near bridges, junctions etc.
7. Structures which require on site welding.
8. Designs which require entry into an existing confined space
9. Designs likely to impose high vibration exposures upon constructors.
10. Any design which does not include, either with the drawings or within the PCI, a buildability statement setting out the basic assumptions the designer has made as to how the contractor will effect constructing.
11. Designs likely to require high ongoing maintenance, for example greater than two cuts of grassed areas per year.
12. Designs which involve wet working (use of grouts, concrete etc) use in close proximity to watercourses or sensitive groundwater.
13. Activities that will require/involve significant dewatering and discharge into watercourses with associated silt management issues.
14. Designs which require 'in-channel' working with plant and other equipment.
15. Programmes that involve 'in-channel' working e.g. piling in or near spawning areas during spawning seasons.
16. Designs that will result in vibration adjacent to listed structures.

17. Designs which require excavation in areas of invasive species e.g. Japanese Knotweed.
18. Designs that specify or necessitate diving to be used as part of the construction method.

### GREEN LIST

**Green items include examples of best practice which we would encourage. They require no sign off.**

1. The Pre construction plan should include a buildability statement describing the methods of construction and where appropriate site access arrangements where these considerations have affected or formed design assumptions.
2. Where temporary works are required to support existing structures during construction, the locations, and relevant information such as expected loads shall be given.
3. Consider adequate access for construction vehicles to minimise reversing requirements and contact with over head services.
4. Thoughtful location of mechanical and /or electrical equipment for safe maintenance including the use of remote greasing points to avoid the need for access into confined spaces or areas with moving machinery.
5. Designs which maximise the use of off site manufactured units, for example as opposed to in situ concrete pours.
6. Provision for the early installation of permanent means of access and edge protection.
7. Design into the scheme safe stopping/parking places for vehicles that will carry out known maintenance operations.
8. Encourage the use of mechanical means for all manual handling operations.
9. Designers should identify where electrical services, due to age or other factors may be in an unsatisfactory condition so that early references can be made to the service owner for repair or diversion.
10. Site investigations commissioned during design should reduce to a minimum the number of unknown features within the construction zone.
11. Designs should seek to eliminate or minimise risk of ongoing exposure to asbestos.
12. Where designs incorporate, or require access to existing confined spaces, access and egress shall be improved as necessary for safety

during construction and maintenance.

13. Design to reduce adverse impact on neighbouring properties for example due to noise and dust.
14. Consider features which will enable future flexibility of M&E or civils structures so as to take advantage of future technological improvements or hydraulic models.
15. Design to show emergency site traffic routes.
16. Designs which eliminate or minimise the need for wet side construction or maintenance.
17. Designs that give early consideration to site set ups which consider health, safety and environmental risks, avoid site compounds on the wet side of a defence where there is a risk of flooding, make use of existing hard standings and buildings and take advantage of mains electricity, water and sewerage.
18. Designs that have documentary evidence demonstrating that they consider all environmental risks in the immediate and surrounding areas of the works and that use alternatives to reduce/design out the environmental risk.
19. Designs which promote opportunities for enhancement of the environment including BAP habitat creation/enhancement and SSSI remediation or water level management planning.
20. Sustainable designs which:
  - a) avoid or reduce the demand on virgin resources
  - b) minimise waste generation e.g. avoid temporary works such as haul routes that will consequently generate waste
  - c) maximise the reuse of materials generated on the project, e.g. local cut and fill, with materials balance being the objective
  - d) allow and encourage the use of recycled aggregates and other recycled/green materials and products (provided the specification suits the needs)
  - e) have reduced carbon footprints, e.g. by local resourcing of materials and staff, and minimal demands on all materials, but in particular concrete, aggregate and steel
  - f) integrate the project with other projects in the vicinity to maximise reuse of waste
21. Designs which include renewable energies in the operational phase of the scheme
22. Designs which improve access for specialist users (e.g. recreational canoeing), disabled person access or open space amenity facilities for the local community



23. Project programming takes account of relevant environmental windows for the works including the need to obtain and the duration of environment permits
24. Environmental risks are included in SHE boxes on design drawings
25. Selection of plant considers environmental aspects (optimum plant chosen to suit design) e.g. biodegradable hydraulic oil, fuel efficiency etc
26. Considered and planned for the treatment/removal of invasive species sufficiently in advance of construction to minimise disruption and constraints on-site
27. Designs which establish vibration monitoring ahead of construction to set a baseline and which minimise vibration on existing structures
28. Designs that avoid, or minimise as far as possible, extensive tree or hedge removal or work under canopies and over root protection zones
29. Designs that avoid or minimise impact on public access to footpaths and amenity areas for extended periods
30. Designs that improve (where appropriate) or at least do not obstruct the safe, natural movement of wildlife
31. Designs that consider and plan for the conservation of soil for reuse on the project
32. Designs that produce site hazard plans to be issued to the construction team.
33. Designs that take into account the use of scaffold staging for stone masonry, brick and block laying works.

**Appendix C Best Practice Guide**



## C1 Handover Requirements

Given the long term nature of the RRFAS, it is necessary to consider who will be responsible for any flood defence structures throughout their life. This chapter refers to the deliverables that a Developer must produce for any party who will have responsibility (referred to as the responsible party) throughout the life of the design project and after completion of the development.

### C1.1 Documentation Requirements

During and on completion of construction, Developers will be required to supply a number of records of the flood defence works that they have constructed. As a minimum these must include:

- *Designer's Risk Assessments/Hazard Evaluation and Risk Reduction documentation;*
- *'As Built' drawings;*
- *Health and Safety File;*
- *Operational and Maintenance Manual; and*
- *Design warranties.*

The contents of the above will need to be acceptable to the responsible party if they are to adopt the scheme and be responsible for its future operation and maintenance. An indication of the type of information that will be required by the responsible party is given below.

#### (a) Designer's Risk Assessments/Hazard Evaluation and Risk Reduction documentation

This documentation must be compliant with the requirements of the CDM Regulations. As a minimum, they should include information on the construction, maintenance/operational and demolition phases of the project.

#### (b) As Built Drawings

The Developer must prepare 'as-built' drawings for all flood defence works relevant to their development in DXF format to suit a version of AutoCAD. Hardcopy and PDF formats shall also be supplied. Electronic copies must be supplied on a CD.

In addition to the details of the flood defences constructed, drawings must include works below finished ground level such as:

- *Service crossings;*
- *Areas where weak ground has been replaced;*
- *Location of diverted services;*
- *Obstructions to piling;*
- *Location of existing walls and culverts, whether left in place or not;*
- *Location of outfalls from surface water drainage systems;*
- *Location and nature of any changes in construction detail for works below ground; and*
- *Previously unidentified services.*

**(c) Health and Safety File**

The typical contents of a Health and Safety File will be:

- *General description;*
- *Project files/other documents;*
- *Design criteria;*
- *Equipment specification;*
- *As constructed records;*
- *Materials used;*
- *Public utilities and services;*
- *Ground investigation information;*
- *Access, land ownership and rights of way;*
- *Operating procedures;*
- *Operating manuals;*
- *Maintenance procedures;*
- *Maintenance manuals;*
- *Methods used in construction;*
- *Confined spaces;*
- *Electrical safety;*
- *COSHH; and*
- *Information relevant to demolition.*

**(d) Operational and Maintenance Manual**

The Operational and Maintenance Manual shall highlight all the future operational and maintenance activities along with their associated programmes and frequency of occurrence. The exact content and format is to be approved by the responsible party, but shall include detailed method statements on how the activities are to be carried out and highlight any Health and Safety issues. The Operational and Maintenance Manual shall be separate to, but may make reference to, the Health and Safety File.

The typical contents of an Operational and Maintenance Manual will be:

- *Introduction;*
- *Scheme Background;*
- *Flooding Information;*
- *Components of the Scheme; and*
- *Design Criteria;*

- *Public Utilities and Services;*
- *Access Locations;*
- *Ongoing Inspection Requirements;*
- *Inspection Requirements during Flood Events;*
- *Operating Requirements during Flood Events; and*
- *Information Relevant to Demolition.*

Typical Appendices of an Operational and Maintenance Manual include:

- *Figures;*
- *List of Other Relevant Documents and Project Files;*
- *As Built Information for Operational Elements;*
- *Designers Risk Assessments;*
- *Location of Services;*
- *Standard Inspection Forms;*
- *Operational Risk Assessments; and*
- *Operational Procedures.*

In addition to the above, Developers should provide an overview of the operational requirements during a flood event at the start of the document. It is envisaged that this will be no more than two pages long and should be in a format that can be used by trained operatives. An example is shown at the end of this Appendix.

#### **(e) Design warranties**

Developers will need to provide design warranties, the format of which will need to be agreed with the responsible party.

**During construction, Developers will be required to supply a number of records of the flood defence works that they have constructed. As a minimum these must include:**

- ***Designer’s Risk Assessments;***
- ***‘As Built’ drawings;***
- ***Health and Safety File;***
- ***Operational and Maintenance Manual; and***
- ***Design warranties.***

#### **C1.2 Handover Procedure**

Provided that the project records described above are to a satisfactory standard, the responsible party will maintain and operate the flood defence aspects of the scheme. All other areas, including landscaping adjacent to flood defences, will need to be managed by Developers.

To ensure that the responsible party’s operational staff are fully conversant with the scheme before handover, a structured handover process is required. This must include the Operations and Maintenance Manual, a handover workshop and must include the training of the responsible party’s staff in all operational activities.

Developers will need to submit a handover plan to the responsible party at least eight weeks prior to the anticipated completion date for flood defence works. This will need to comprise:

- *Provision of the Operations and Maintenance Manual;*
- *Provision of the Health and Safety File information; and*
- *Signed-off As Built drawings.*

A handover workshop/site tour shall be arranged to be held at a minimum of two weeks prior to anticipated completion. This will need to include:

- *A familiarisation tour of the scheme;*
- *Training in the operation of all mechanical and electrical plant for operations staff;*
- *An overview of the information held in the Health and Safety File, the Operations and Maintenance Manual;*
- *Any unusual or innovative elements of the scheme described by reference to the As Built drawings; and*
- *Additional training will be required for specialist staff for any mechanical, electrical and ICA equipment.*

## C2

Example Overview of Operational Requirements for TRFAS  
Phase 1A

The following is an extract from the Operational and Maintenance Manual for the first phase of TRFAS. It therefore contains some cross references to documentation that does not form part of the Flood Risk Toolkit.

### C2.1 Flooding Information

The scheme protects a number of commercial properties, major industrial facilities at Firth Rixson, a railway line and the local road network. The latter includes the only accesses to properties off Sheffield Road

***A figure was included to show the scheme and the extents of the flooded area***

The defences are designed to provide protection up to a 1% AEP (1 in 100 annual chance) event. For this event, river levels are likely to rise from their normal levels to their peak levels in around 24 hours, the peak of the flood will last around 1.5 days and river levels will return to their normal levels after several days.

***Plans showing the location of defences, the access routes to them and the components requiring operation during flood events were included.***

Key operational actions are summarised below and the location of further information is summarised in part 1.7 of this overview document.

#### 1.2 Immediate Actions for Centenary Riverside Wetland

Centenary Riverside is designed to operate as a wetland and it is envisaged that flooding will occur several times per year. The riverside bund of the wetland is only 0.5m above normal river level and so this area will be the first location to flood.

On reaching the trigger levels for Centenary Riverside wetland, the following actions are required:

- *Check that no members of the public are trapped within the wetland area;*
- *Close and lock a barrier to prevent access to the wetland area; and*
- *Ensure signs to state that access is restricted due to flooding are clearly visible.*

The above is a three person operation.

#### 1.3 Immediate Actions for Firth Rixson

The sill of the lowest floodgate will be reached when water levels rise from their normal levels by around 2.5m.



On reaching the trigger level for the floodgates the following must be closed:

- *2 floodgates on the north side of Firth Rixson's stockyard access bridge; and*
- *2 floodgates on the south side of Firth Rixson's stockyard access bridge.*

The above is a three person operation.

#### **1.4 Immediate Actions for Other Areas**

Check that there are no members of the public trapped on the riverward side of the defence. Formal footpaths are located between Phoenix Park and Centenary Riverside. Other areas include informal footpaths and fishing platforms.

This is a 3 man operation.

#### **1.5 Less Urgent Actions**

The following actions must be undertaken before the flood event reaches its peak:

- *Opening of 2 penstocks to the flood release mechanisms located at the eastern boundary of Firth Rixson;*
- *Opening of 2 penstocks to the flood release mechanism located immediately to the east of the Phoenix Park Site.*

This is a two person operation.

#### **1.6 Inspection Requirements**

The following require inspection during a flood event:

- *Checks that there is no leakage at potential weak points such as joints, floodgates, outfalls and flood release mechanisms;*
- *Checks that there are no signs of distress / movement within flood defence structures;*
- *Checks that the components of the scheme that require operation, as detailed above, are working correctly;*
- *Monitoring of water levels in the Ickles Goit storage area to check that they are not likely to overtop the sheet piled walls on the south side of Sheffield Road; and*
- *Checks that no floodwater enters the Marsh Street subway as a 'back door' route for flooding of the Phase 1A area.*

### 1.7 Further Information

The table below summarises the location of more detailed information regarding the above operation and inspection requirements:

	Further Information
Overview drawings for the scheme.	N/A for this Design Guidance.
Flooding mechanisms and timescales.	N/A for this Design Guidance.
Predicted extents of flooding if defences not operated.	N/A for this Design Guidance.
Components of the scheme.	N/A for this Design Guidance.
Access routes to flood defences	N/A for this Design Guidance.
Operational requirements during flood events.	N/A for this Design Guidance.
Inspection requirements during flood events	N/A for this Design Guidance.