



Kettering and Wellingborough

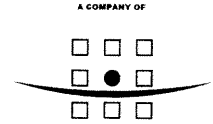
Level 1 Strategic Flood Risk Assessment Update

Kettering Borough Council and The Borough Council
of Wellingborough

February 2011

Final Report

9V9114



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EXECUTIVE SUMMARY

Introduction

A Stage 2 Strategic Flood Risk Assessment (SFRA) was produced in 2005 for Kettering Borough Council (KBC) and the Borough Council of Wellingborough (BCW), hereafter referred to as the Councils, in compliance with Planning Policy Guidance Note 25: Development and Flood Risk (PPG 25).

PPG 25 has since been replaced by Planning Policy Statement 25: Development and Flood Risk (PPS 25). In light of this the Councils commissioned Royal Haskoning in March 2010 to prepare an updated Level 1 SFRA to satisfy the requirements of PPS 25. The SFRA is to provide an overview of flood risk in the two Boroughs, giving due consideration to all sources of flood risk and to the implications of climate change, to inform development plans. This study has been carried out in consultation with the Councils, the Environment Agency, Northamptonshire County Council and Anglian Water.

Why carry out a Strategic Flood Risk Assessment (SFRA)?

Flooding can result not only in costly damage to property, but can also pose a risk to life and livelihood. It is essential that future development is planned carefully, steering it away from areas that are most at risk from flooding, and ensuring that it does not exacerbate existing known flooding problems.

Planning Policy Statement (PPS) 25: Development and Flood Risk has been developed to underpin decisions relating to future development (including urban regeneration) within areas that are subject to flood risk. In simple terms, PPS 25 requires local planning authorities to review the variation in flood risk across their district, and to steer vulnerable development (e.g. housing) towards areas of lowest risk. Where this cannot be achieved and development is to be permitted in areas that may be subject to some degree of flood risk, PPS 25 requires Kettering Borough Council and the Borough of Wellingborough Council to demonstrate that there are sustainable mitigation solutions available that will ensure that the risk to property and life is minimized (throughout the lifetime of the development) should flooding occur.

The Strategic Flood Risk Assessment (SFRA) is the first step in this process, and it provides the building blocks upon which the Council's planning and development control decisions will be made.

Study Area

The Boroughs of Kettering and Wellingborough form part of the North Northamptonshire Local Development Framework (LDF), along with the Corby and East Northamptonshire Councils and are located within the Milton Keynes and South Midlands growth area as promoted by the Government through its Sustainable Communities Plan.

Kettering Borough covers an area of approximately 233km² situated in the eastern half of Northamptonshire. It lies approximately 70 miles from London and Birmingham. The main settlements within the Borough are Kettering, Burton Latimer, Broughton, Rothwell and Desborough. The rest of the Borough is mostly rural.

Kettering Borough falls mostly across the River Nene catchment, although its northern tip, to the north of Desborough falls within the River Welland catchment. The main watercourse in the Borough is the River Ise, a tributary of the River Nene, which first flows in a west to east direction before turning south at Geddington. The River Ise then crosses Kettering, before meeting the Slade Brook, one of its main tributaries. The River Welland forms the northern boundary of the Borough.

The Borough of Wellingborough covers an area of approximately 163km² situated also in the eastern half of Northamptonshire. It lies about 65 miles from both London and Birmingham. The main settlements within the Borough are Wellingborough, Irchester, Finedon, Earls Barton, Wollaston and Bozeat. The rest of the Borough is mostly rural.

The Borough of Wellingborough falls entirely within the River Nene catchment. The River Nene crosses the Borough in a south west to north east direction. The River Ise meets the River Nene at Wellingborough, whilst a number of smaller watercourses, such as the Grendon Brook and the Wollaston Brook, meet the River Nene upstream of Wellingborough.

Outcomes of the Level 1 SFRA

The Boroughs of Kettering and Wellingborough are likely to undergo significant expansion as part of the growth proposals. Areas of new development will be centred on the larger towns of Kettering and Wellingborough, with further development in smaller settlements.

This Level 1 SFRA update has considered all sources of flooding based on information gained through consultation with the Environment Agency, Anglian Water, Northamptonshire County Council, Kettering Borough Council and the Borough Council of Wellingborough in line with the requirements PPS 25. The updated Level 1 SFRA is thus compliant with PPS 25 and will inform land allocation and future flood risk management needs within the Boroughs.

Fluvial flood risk in the Boroughs has historically been the dominant source of flood risk, with significant flooding occurring in March 1947, Easter 1998 and July 2007. Flood risk zones along the main river corridors have been mapped, including the functional floodplain, as per PPS 25. In urbanised areas such as Kettering and Wellingborough, watercourses are heavily culverted rendering the risk of blockage high. Also, a number of raised defences have been identified in Wellingborough. It is not clear whether these are formal engineered flood defences but breaching of the defences is not a concern as there are no areas benefiting from them. With climate change, fluvial flood risk will increase.

Surface water flooding has also been identified as a key constraint on development. A number of instances of surface water flooding have been reported, most of them occurring in the larger settlements of Kettering and Wellingborough. New developments will therefore need to address surface water management, ensuring that, at the very least, runoff from new development is not increased and, if possible, is reduced. This will be achieved through careful design of the site lay-out and drainage system, giving due consideration to the implementation of SuDS solutions where appropriate. Detailed site

investigation and infiltration tests will be needed to clarify the permeability of the soil and design infiltration systems.

Within the River Nene Corridor, joint-working between the Environment Agency, The River Nene Wildlife Trust and Anglian Water should be promoted to maximise opportunities for a green corridor and deliver benefits for flood risk reduction, water quality, amenity and habitat improvement.

The risk of groundwater flooding has generally been deemed low although use should be made of local, site-specific information in the preparation of FRAs to ensure this source of flood risk is appropriately addressed.

Finally, there are three former water supply reservoirs in the catchment which are the responsibility of Northamptonshire County Council. These reservoirs fall within the Reservoirs Act 1975 as amended by the Flood and Water Management Act 2010 and may pose a residual flood risk to local communities. Flood risk from these reservoirs should be incorporated within site-specific FRAs where relevant. This is in addition to the requirements for considering residual risks from FSRs.

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GLOSSARY

Annual Exceedance Probability (AEP)

The estimated probability of a flood of given magnitude occurring or being exceeded in any year. Expressed as, for example, 1 in 100 chance or 1 per cent.

Appraisal

The process of defining objectives, examining options and evaluating costs, benefits, risks, opportunities and uncertainties before a decision is made.

Aquifer

A geological stratum (or rock layer) which bears water.

Attenuation

In relation to flooding, the impact of the floodplain on the shape of a flood hydrograph (reducing flood peak and increase flood duration) due to a combination of storage and resistance. Flood attenuation provided by 'natural storage' has increasingly been considered as a useful complement to conventional flood defences in certain situations, e.g. flood attenuation areas that can be used to cope with overflow when river levels rise. By allowing floodwaters on to these open spaces, downstream properties can be better protected.

Brownfield Site

Any land or site having been previously developed.

Catchment

A surface water catchment is the total area that drains into a river. A groundwater catchment is the total area that contributes to the groundwater component of the river flow.

Catchment Flood Management Plan (CFMP)

Catchment Flood Management Plans (CFMPs) give an overview of the flood risk across each river catchment and estuary. They recommend ways of managing those risks now and over the next 50-100 years.

CFMPs consider all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea, (coastal flooding), which is covered in Shoreline Management Plans. They also take into account the likely impacts of climate change, the effects of how we use and manage the land, and how areas could be developed to meet our present day needs without compromising the ability of future generations to meet their own needs.

CFMPs will be used by the Environment Agency and their partners to plan and agree the most effective way to manage flood risk in the future.

Climate Change

Long term variations in global temperature and weather patterns both natural and as a result of human activity, primarily greenhouse gas emissions.

Critical Drainage Area

An area within Flood Zone 1 which has critical drainage problems and which has been notified... [to]...the local planning authority by the Environment Agency.

Culvert

A covered channel or pipeline which is used to continue a watercourse or drainage path under an artificial obstruction.

Development

The carrying out of building, engineering, mining or other operations in, on, over or under land or the making of any material change in the use of any buildings or other land.

DG5 Register

Register held by water companies which records the number of properties reported to have been affected by flooding both internally and/or externally due to hydraulic inadequacy, insufficient capacity or failure of the public sewerage system. The register does not, however, record the number of properties considered to be at risk from external or internal flooding.

Digital Elevation Model (DEM)

A digital elevation model is a representation of the topography of an area and gives the elevation of the upper surface whether it is the ground, vegetation or a building.

Digital Terrain Model (DTM)

A digital terrain model is a representation of the ground surface with buildings and vegetation removed. With airborne techniques automated filters have been developed which can detect buildings and remove them and fill the gap with interpolated data.

Drift Geology

In geology, drift is transported rock debris overlying the solid bedrock. The transport mechanisms can include rivers and glaciers. Glacial drift is a general term for the coarsely graded sediments of glacial origin. In the UK the term drift is commonly used to describe any deposits of quaternary age.

Environment Agency

Non-departmental public body responsible for the delivery of government policy relating to the environment and flood risk management in England and Wales.

Flood Alleviation Scheme

A scheme designed to reduce the risk of flooding at a specific location.

Flood Defence

A structure (or system of structures) for the alleviation of flooding from rivers or the sea.

Flood Estimation Handbook (FEH)

Flood Estimation Handbook (FEH) provides the current methodologies for estimation of flood flows for the UK.

Floodplain

Any area of land over which water flows or is stored during a flood event or would flow but for the presence of flood defences.

Flood Map

The Flood Map shows areas across England and Wales that could be affected by flooding from rivers or the sea. It is the Environment Agency's public face map for floodplain information. It shows the flood extents, which ignore defences, the location of raised defences, and the area benefiting from defences. Available on the Environment Agency's website, it also provides information on the likelihood of flooding to general areas of land. Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency.

Flood Risk

The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption).

Flood Risk Assessment

A study to assess the risk of a site or area flooding, and to assess the impact that any changes or development in the site or area will have on flood risk. Flood Risk Assessments are required under PPS 25.

Flood Risk Management

The activity of modifying the frequency or consequences of flooding to an appropriate level and monitoring to ensure that flood risks remain at the proposed level. This should take account of other water level management requirements, and opportunities and constraints. It is not just the application of physical flood defence measures.

Flood Risk Management Measures

Structural and non-structural interventions that modify flooding and flood risk either through changing the frequency of flooding, or by changing the extent and consequences of flooding, or by reducing the vulnerability of those exposed to flood risks. Measures, in isolation or in combinations of more than one measure, are the means by which a catchment policy is implemented.

Flood Risk Problem Areas

Areas identified as being at significant risk of flooding.

Flood Storage

The temporary storage of excess runoff or river flow in ponds, basins, reservoirs or on the floodplain during a flood event.

Floodline Warnings Direct (FWD)

The Environment Agency's flood warning dissemination system. Floodline Warnings Direct is an internet based telecommunications system which disseminates flood warnings using a variety of media channels, i.e. telephone, fax, sms and email.

Fluvial

Pertaining to a watercourse (river or stream).

Flood Zone 1 Low Probability

PPS 25 Flood Zone, assessed as land having less than 0.1% AEP (1 in 1000 annual probability) of river or sea flooding in any year, ignoring the presence of defences.

Flood Zone 2 Medium Probability

PPS 25 Flood Zone, assessed land having between a 1% and 0.1% AEP (1 in 100 and 1 in 1000 annual probability) of river flooding or between 0.5% and 0.1% AEP (1 in 200 and 1 in 1000 annual probability) of sea flooding in any year, ignoring the presence of defences.

Flood Zone 3a High Probability

PPS 25 Flood Zone, assessed as land having a 1% AEP (1 in 100 annual probability) or greater of river flooding or a 0.5% AEP (1 in 200 annual probability) or greater of flooding from the sea in any year, ignoring the presence of defences.

Flood Zone 3b Functional Floodplain

PPS 25 Flood Zone, where water has to flow or be stored in times of flood. This is not rigidly defined by probability parameters, however the starting point is land that has an annual probability of 5% AEP (1 in 20) or greater, or is designed as a flood storage area.

Greenfield runoff rate

The rate of runoff that would occur from the site in its undeveloped state.

Geographical Information System (GIS)

A GIS is a computer-based system for capturing, storing, checking, integrating, manipulating, analysing and displaying spatially-referenced data.

Groundwater

Water occurring below ground in natural formations (typically rocks, gravels and sands).

Groundwater flooding

Flooding caused by groundwater escaping from the ground when the water table rises to or above ground level.

Historic Flood Map

The Historic Flood Map shows the mapped extents of known historical flooding.

Hydrograph

Hydro- meaning water, and –graph meaning chart.

- a record through time of discharge (flow) in a river, or
- a record through time of water level in an aquifer, measured in a well.

Hydraulic Model

Estimates the water level in a river for a given flow.

Hydrological Model

Estimates the flow in a river arising from a given amount of rainfall falling into the catchment. Such models typically account for factors such as catchment area, topography, soils, geology and land use.

Inundation

The covering with water – especially flood waters.

Land Use

Various designations of activities, developments, cropping types, etc for which how land is used.

Land Management

Various forms of activities relating to agricultural, forestry, etc practice.

LiDAR

Light Detection and Ranging (LiDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground.

Local Development Framework (LDF)

Consists of a number of documents which together form the spatial strategy for development and the use of land

Local Planning Authority (LPA)

Body responsible for planning and controlling development, through the planning system.

Main River

All watercourses shown as such on the statutory main river maps held by the Environment Agency and the Department of Environment, Food and Rural Affairs, and can include any structure or appliance for controlling or regulating the flow of water into, in or out of the channel. The Environment Agency has permissive powers to carry out works of maintenance and improvement on these rivers.

Maintained Channel

Undefended watercourse that has a maintenance regime for flood risk management including undefended artificial channels. The regime does not need to be undertaken annually.

Mitigation Measure

A generic term to refer to an element of development which may be used to manage flood risk to the development, or avoid an increase in flood risk elsewhere.

National Flood and Coastal Defence Database (NFCDD)

NFCDD is a database of all flood and coastal defences, available to all Operating Authorities in England and Wales. The development of the National Flood and Coastal Defence Database (NFCDD) is a requirement under the Defra High Level Targets for flood and coastal defence operating authorities. The Environment Agency is leading the development but is working in partnership with local authorities and internal drainage boards to ensure the successful delivery of the database.

Natural Channel

Undefended watercourse that does not have a flood risk management maintenance regime of any sort. Natural channels are most likely to be in remote rural areas.

Ordinary Watercourse

A watercourse that does not form part of a main river.

Ordnance Datum Newlyn

Ordnance Datum Newlyn (ODN) is a traditional vertical coordinate system, consisting of a tide gauge datum with initial point at Newlyn, Cornwall and a Terrestrial Reference Frame observed by spirit levelling between 200 fundamental benchmarks across Britain. Each benchmark has an orthometric height only (not ellipsoid height or accurate horizontal position). This coordinate system is important because it is used to describe vertical positions of features on British maps (for example, spot heights and contours) in terms of height above mean sea level. The word Datum in the title refers, strictly speaking, to the tide gauge initial point only, not to the national levelled benchmarks.

PPG 25

Planning Policy Statement 25: Development and Flood Risk, Office of the Deputy Prime Minister (ODPM), 2001. This has been superseded by PPS 25 (see below).

PPS 25

Planning Policy Statement 25: Development and Flood Risk, Department of Communities & Local Government, 2010 (updates and superseded the 2006 publication).

PPS 25 Practice Guide

Planning Policy Statement 25: Development and Flood Risk - Practice Guide, Department of Communities & Local Government, Updated December 2009.

Pre-feasibility Study

A pre-feasibility study is a preliminary study to determine if a feasibility study or project appraisal is warranted.

Regional Spatial Strategy (RSS)

The replacement for Regional Planning Guidance.

Risk Assessment

Considerations of the risks inherent in a project, leading to the development of actions to control, mitigate or accept them.

Runoff

Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable or saturated, or if the rainfall exceeds the infiltration capacity of the soil.

Scenario

A possible future situation, which can influence either catchment flood processes or flood responses, and therefore the success of flood risk management policies/measures. Scenarios will usually comprise combinations of the following: urban development (both in the catchment and river corridor); change in land use and land management practice (including future environmental designations); or climate change.

Strategic Flood Risk Assessment (SFRA)

A broad scale assessment of flood risk carried out by a unitary authority or district council. Such documents are drafted so that proposed developments can be quickly appraised to Planning Policy Statement.

Surface Water Flooding

In this context, Surface Water Flooding describes flooding from sewers, drains, small watercourses and ditches that occurs as a result of heavy rainfall.

Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are techniques designed to control surface water runoff before it enters the watercourse. They are designed to mimic natural drainage processes, along with treating the water to reduce the amount of pollutants getting into the watercourse. They can be located as close as possible to where the rainwater falls and provide varying degrees of treatment for the surface water, using the natural processes of sedimentation, filtration, adsorption and biological degradation.

Time to Peak (T_p)

The time, in hours, between the centroid of a rainfall event and the peak of the resulting flood wave at a particular location. A short time to peak generally indicates a 'flashy' catchment where floods occur rapidly after rainfall. Longer times to peak are characteristic of lowland catchments or those with attenuating water bodies.

ABBREVIATIONS

AEP	Annual Event Probability
BCW	Borough Council of Wellingborough
CFMP	Catchment Flood Management Plan
DEM	Digital Elevation Model
DTM	Digital Terrain Model
DPD	Development Plan Document
FCERM-AG	Flood and Coastal Erosion Risk Management Appraisal Guidance
FEH	Flood Estimation Handbook
FRM	Flood Risk Management
FSR	Flood Storage Reservoir
FWAG	Farming & Wildlife Advisory Group
FWD	Floodline Warnings Direct
GIS	Geographical Information System
KBC	Kettering Borough Council
LDF	Local Development Framework
LCA	Landscape Character Area
NFCDD	National Flood and Coastal Defence Database
NNDC	North Northants Development Company
PPG 25	Planning Policy Guidance 25: Development and Flood Risk
PPS 25	Planning Policy Statement 25: Development and Flood Risk
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment
SoP	Standard of protection

SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
T_p	Time to Peak

1 INTRODUCTION

1.1 Background

A Stage 2 Strategic Flood Risk Assessment¹ (SFRA) was produced in 2005 for Kettering Borough Council (KBC) and the Borough Council of Wellingborough (BCW), hereafter referred to as the Councils, in compliance with Planning Policy Guidance Note 25: Development and Flood Risk² (PPG 25).

PPG 25 has since been replaced by Planning Policy Statement 25: Development and Flood Risk³ (PPS 25). PPS 25 builds on the principles set out in PPG 25 which include:

- the need to consider flooding at all stages of the planning process;
- the need to avoid inappropriate development in areas at risk of flooding;
- the use of a risk-based sequential approach, to direct development away from areas at highest risk; and
- having safe development for sustainable communities.

However, PPS 25 includes some new areas, which are:

- a more strategic approach;
- a stronger guidance on flood risk assessment (Annex E);
- a clarified Sequential Test (Annex D);
- a new Exception Test (Annex D); and
- a clearer policy on climate change (Annex B).

In addition PPS 25 offers more detailed guidance on Managing Surface Water (Annex F), and Managing Residual Flood Risk (Annex G).

The aim of PPS 25 is to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is exceptionally necessary in such areas, it aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

PPS 25 requires local authorities to apply a risk-based sequential approach as part of the identification of land for development in areas at risk of flooding. The purpose of the sequential approach is to ensure that areas of low risk are developed in preference to areas of higher risk, within this, ensuring that the developments that are most vulnerable to flood risk are located at the lowest risk areas. The application of the sequential approach needs to be underpinned by an appropriate assessment of flood risk. The sequential approach process then uses this information to avoid the highest flood risk areas and where this is not possible, take opportunities to substitute higher vulnerable land uses in higher flood risk areas for lower vulnerable uses in lower flood risk areas, or mitigate the risk of flooding; in that order.

¹ Kettering and Wellingborough Strategic Flood Risk Assessment Stage 2 Report, Royal Haskoning, May 2005

² Planning Policy Guidance 25: Development and Flood Risk, Office of the Deputy Prime Minister, July 2001

³ Planning Policy Statement 25: Development and Flood Risk, Department for Communities and Local Government, Revised March 2010

The Sequential Test is an important aspect of the sequential approach which is required at the local planning authority (LPA) level. It is a test to show that land allocation has been made in the lowest possible flood zone (as defined in Table D.1 of PPS 25) that is available within the relevant geographical area for the type of development being proposed.

The SFRA is at the core of the PPS 25 approach. It provides the essential information on flood risk, taking climate change into account, that allows the LPA to understand the risk across its area so that the Sequential Test can be properly applied. All local planning authorities (LPAs) are required to carry out a SFRA in preparation of their Local Development Documents (LDDs) to enable sustainability appraisals, land allocation and development control policies to be informed by an understanding of the catchment-wide flooding issues that affect the area.

PPS 25 recommends a staged process for the development of SFRAs to enable the detail of the assessment to be related to the risk posed by new development. A Level 1 SFRA, principally a desk-based study, is required to provide the LPA with flood risk information to apply the Sequential Test. Where it is clear that proposed development and infrastructure is not able to be accommodated in accordance with the sequential test, taking account of the flood vulnerability category of the intended use (as outlined in Tables D.2 and D.3 of PPS 25), then a more detailed Level 2 SFRA is required to facilitate the application of the Exception Test (as outlined in paragraph D.9 of PPS 25).

In the context of the proposed development plans for Kettering Town Centre, it has been necessary to bring forward the preparation of a Level 2 SFRA in order to better understand flood risk, now and in the future, and to inform the preparation of Local Development Documents (LDD). The Level 2 SFRA for Kettering Town Centre⁴ was prepared in April 2010 and precedes this document. Where relevant, key findings from the Level 2 SFRA are acknowledged.

The Councils have then commissioned Royal Haskoning to prepare an updated Level 1 SFRA to satisfy the requirements of PPS 25. The SFRA is to provide an overview of flood risk in the two Boroughs, giving due consideration to all sources of flood risk and to the implications of climate change, to inform development plans. This study has been carried out in consultation with the Councils, the Environment Agency, Northamptonshire County Council and Anglian Water.

1.2 Study Area

The Boroughs of Kettering and Wellingborough are presented in **Figure 1**. These two Boroughs form part of the North Northamptonshire Local Development Framework (LDF), along with the Corby and East Northamptonshire Councils and are located within the Milton Keynes and South Midlands growth area as promoted by the Government through its Sustainable Communities Plan⁵.

⁴ Kettering Strategic Flood Risk Assessment, Level 2, Royal Haskoning, April 2010

⁵ Sustainable Communities: Building for the Future, Office of the Deputy Prime Minister, 2003

Kettering Borough covers an area of approximately 233km² situated in the eastern half of Northamptonshire. It lies approximately 70 miles from London and Birmingham. The main settlements within the Borough are Kettering, Burton Latimer, Broughton, Rothwell and Desborough. The rest of the Borough is mostly rural.

Kettering Borough falls mostly across the River Nene catchment, although its northern tip, to the north of Desborough falls within the River Welland catchment. The main watercourse in the Borough is the River Ise, a tributary of the River Nene, which first flows in a west to east direction before turning south at Geddington. The River Ise then crosses Kettering, before meeting the Slade Brook, one of its main tributaries. The River Welland forms the northern boundary of the Borough.

The Borough of Wellingborough covers an area of approximately 163km² situated also in the eastern half of Northamptonshire. It lies about 65 miles from both London and Birmingham. The main settlements within the Borough are Wellingborough, Irchester, Finedon, Earls Barton, Wollaston and Bozeat. The rest of the Borough is mostly rural.

The Borough of Wellingborough falls entirely within the River Nene catchment. The River Nene crosses the Borough in a south west to north east direction. The River Ise meets the River Nene at Wellingborough, whilst a number of smaller watercourses, such as the Grendon Brook and the Wollaston Brook, meet the River Nene upstream of Wellingborough.

Development plans have identified indicative housing requirements of 13,100 for the Kettering Borough over the period 2001-2021, with 2,353 houses respectively completed between 2001 and 2006. For the Borough of Wellingborough, the indicative housing requirement is 12,800 over the period 2001-2021, with 1,521 houses completed between 2001 and 2006. These figures are currently being reviewed and this is likely to lead to a revision of the amount of housing required.

1.3 Objectives

The general aims of PPS 25 are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest flood risk. Where new development is exceptionally necessary in such areas, PPS 25 aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall. The mechanisms for the effective implementation of these principles are referred to as the 'Sequential Test' and the 'Exception Test'.

The SFRA is at the core of the PPS 25 risk-based approach. It is a strategic assessment of flood risk which all Local Planning Authorities (LPA) are required to carry out in preparation of their Local Development Documents (LDDs) to enable sustainability appraisals, land allocation and development control policies are informed by an understanding of the catchment-wide flooding issues affecting the area and the implications of climate change. SFRAs therefore form a key part of the evidence base to help inform the allocation of development through the preparation of LDDs. PPS 25 recommends a staged approach to the development of SFRAs to enable the detail of the assessment to be commensurate to the risk posed by new development.

A Level 1 SFRA is principally a desk-based study required to provide the LPA with flood risk information to apply the Sequential Test. Where it is clear that proposed development and infrastructure cannot be accommodated in accordance with the Sequential Test, taking account of the flood vulnerability of the intended use, then a more detailed Level 2 SFRA is required to facilitate the application of the Exception Test. This SFRA will confirm the relevance and desirability of PPS 25 to Kettering and Wellingborough, and if appropriate, recommend areas which need to be addressed by locally-specific policy.

At the planning application stage, an appropriate site-specific flood risk assessment (FRA) will be required for all development proposals of 1 hectare or greater in Flood Zone 1 and for all proposals for new development located in Flood Zones 2 and 3 to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed now and taking climate change into account. The site-specific FRA should build on the information included in the local SFRA.

Planning applications for development proposals of 1 hectare or greater in Flood Zone 1 and all proposals for new development located in Flood Zones 2 and 3 should be accompanied by a site-specific FRA (see Annex E of PPS 25).

2 DATA COLLECTION AND REVIEW

2.1 Overview

In order to inform the production of this SFRA, all data relative to flood risk and proposed development plans has been collated and reviewed in accordance with Royal Haskoning's Quality Management System to assess its suitability for the study.

Data has been obtained from the Councils, the Environment Agency, and Anglian Water. This data includes:

- Growth aspirations for the Boroughs;
- Topographic and geological information in the Boroughs;
- Existing flood risk management plans, strategies and studies;
- Local development plans and local aspirations for growth;
- Anecdotal flooding information, considering all sources of flooding;
- Existing flood defences and other flood alleviation measures in the Boroughs;
- Flood warning areas and hydrometric gauges; and
- Existing hydraulic models and flood risk mapping covering watercourses in the Boroughs and including the Environment Agency's Flood Map.

Details of the datasets, including their source, spatial coverage and suitability are presented in the following sections.

2.2 Topography and Geology

2.2.1 Topography

LiDAR data has been obtained for this study. It covers the majority of the two Boroughs although the coverage is incomplete. The extent of LiDAR coverage and the topography within the Boroughs is presented in **Figure 2**. The LiDAR spatial resolution is 2m with an accepted vertical accuracy of ± 20 cm.

Ground levels in the Boroughs range from 150mAOD to 40mAOD. Ground levels are highest to the north of Kettering, gradually falling towards the south as the River Ise flows into the River Nene. The Slade Brook is the principal tributary to the River Ise in the Kettering Borough. Other watercourses such as the Harrowden Brook and the Swanspool Brook meet the River Ise further south in Wellingborough before the confluence with the River Nene. North of Desborough, ground levels also fall towards the River Welland which forms the northern boundary of the Kettering Borough. The River Jordan flows northwards from Braybrooke towards Market Harborough and is one of the tributaries of the River Welland. To the north of Kettering, Harper's Brook flows westwards, outside of the Kettering Borough's boundary before joining the River Nene downstream of Wellingborough.

Ground levels at the southern end of the Wellingborough Borough reach 100mAOD and a number of minor tributaries such as the Grendon Brook, the Wollaston Brook and the Knuston Brook flow northwards into the River Nene.

2.2.2 Geology

The bedrock geology in North Northamptonshire is complex. In general, the bedrock of central-eastern England becomes progressively younger towards the south-east, changing from Triassic to Jurassic and Cretaceous rocks. Within the North Northamptonshire area, this south-easterly trend is overlain by the effects of fluvial erosion, meaning that older rocks (e.g. Inferior Oolite and Upper Lias) are found in the river valleys while the upstream catchments consist of younger rocks such as Oxford Clay, Cornbrash and Great Oolite. The bedrock is in some places overlain by superficial deposits from the more recent Quaternary period. In most locations, these deposits consist of till: unsorted sediments deposited in glacial episodes, including clays, sands, gravel and boulders.

The River Nene, the River Ise and the Slade Brook and their surrounding valley comprise a mixture of upper Lias clays and mudstones, with nodular limestone geological formations that underlie the relatively steep topography of the Northampton sand formations.

The bedrock geology of the Boroughs is presented in **Figure 3**.

The area around the River Ise contains large areas of loam over sandstone. Along the River Ise and River Nene corridors, there are also alluvium deposits and river terraces. There are also a number of areas underlain by clayey material, to the west of Wellingborough, to the east of Kettering and to the south of the River Nene.

The permeability of each bedrock and superficial deposit depends on sediment properties such as grain size and porosity. Clays have a low permeability, while gravels and limestones have a high permeability.

The soil geology of the Boroughs is presented in **Figure 4**.

2.3 Flood Risk Management Plans, Strategies and Studies

2.3.1 Catchment Flood Management Plans

Catchment Flood Management Plans aim to promote a sustainable approach to managing flood risk within the catchment over the next 100 years, in light of predicted rising sea levels and increasing storminess, by providing a set of policies to inform planning and key decision-makers. CFMPs are to help the Environment Agency and its partners to make the right investment decisions for the future and to prepare for the anticipated impacts of climate change. Indeed, over the next 100 years, it is expected that sea levels in East Anglia will rise by approximately 1m and rainfall, peak flow and flood volumes in all watercourses will increase by 20%.

Based on a high level understanding of sources and consequences of flooding, both now and in the future, CFMPs determine whether flood risk should be reduced or kept at its existing level, or can even be allowed to increase if that benefits other areas or functions. CFMPs also identify the strategy level studies that are required to implement the chosen policy.

As part of the CFMP process, catchments have been divided into policy units, for each of which a preferred flood risk management policy has been identified. The policies are the following:

- Policy 1: No active intervention (including flood warning and maintenance). continue to monitor and advise;
- Policy 2: Reduce current levels of flood risk management;
- Policy 3: Continue with existing or alternative actions to manage flood risk at the current level;
- Policy 4: Take further action to sustain flood risk now/and in the future;
- Policy 5: Take further action to reduce flood risk; and
- Policy 6: Take actions with others to store water or manage runoff in locations that provide overall risk reduction or environmental benefits locally or elsewhere in the catchment.

The River Nene CFMP was published by the Environment Agency in December 2009⁶, with the catchment being sub-divided into sixteen policy units. The preferred policy for both the towns of Kettering and Wellingborough is Policy 4: Take further action to sustain flood risk now/and in the future. The preferred policy for the River Ise corridor between Kettering and Wellingborough, which includes the western edge of Kettering, is Policy 6: Take actions with others to store water or manage runoff in locations that provide overall risk reduction or environmental benefits locally or elsewhere in the catchment. Finally, in the rest of the Nene catchment within Kettering Borough the preferred policy is Policy 2: Reduce current levels of flood risk management.

The CFMP policies within the Boroughs are presented in **Figure 5**.

The River Nene CFMP includes an Action Plan which is to help the Environment Agency and its partners to deliver successfully its preferred policies.

The Action Plan for Kettering recommends the following actions:

- to develop a Flood Storage Study to investigate creating/developing storage on the River Nene corridor policy unit;
- to develop a System Asset Management Plan to investigate how the current level of flood risk management throughout all systems in this policy unit can be continued;
- to develop a Flood Forecasting and Warning delivery plan to maintain the current level of flood forecasting/warning service;
- to develop a Flood Awareness Plan to encourage people to sign up to and respond to flood warnings as well as using self-help methods to protect their properties;
- to develop an Emergency Response Plan for the five electricity sub-stations, a management site, the A14 at Kettering and the Midland Mainline at risk of flooding;
- to put in place policies within the Local Development Framework for no inappropriate development in the floodplain following the principles set out in PPS 25;
- to put in place policies within the Local Development Framework to link flood risk management planning with regeneration and redevelopment of commercial sites; and

⁶ River Nene Catchment Flood Management Plan, Summary Report, December 2009

- to implement the recommendations from the North Northants Water Cycle Strategy for the increased risk to the drainage system from future development proposed for Kettering.

The Action Plan for Wellingborough recommends the following actions:

- to develop a Flood Storage Study to investigate creating/developing storage on the River Nene corridor policy unit;
- to develop a System Asset Management Plan to investigate how the current level of flood risk management throughout all systems in this policy unit can be continued;
- to develop a Flood Forecasting and Warning delivery plan to maintain the current level of flood forecasting/warning service;
- to develop a Flood Awareness Plan to encourage people to sign up to and respond to flood warnings as well as using self-help methods to protect their properties;
- to develop an Emergency Response Plan for the five electricity sub-stations, a metal recycling site, IPPC site, the Midland Mainline, A45, A510, A5128, A5193, an ambulance station and a school at risk of flooding;
- to put in place policies within the Local Development Framework for no inappropriate development in the floodplain following the principles set out in PPS 25;
- to put in place policies within the Local Development Framework to link flood risk management planning with regeneration and redevelopment of commercial sites; and
- to implement the recommendations from the North Northants WCS for the increased risk to the drainage system from future development proposed for Kettering.

The Action Plan for the River Nene corridor, including the River Ise corridor, recommends the following actions:

- to develop a Flood Storage Study to investigate creating/developing storage on the River Nene corridor policy unit;
- to develop a System Asset Management Plan to investigate where and how the current level of flood risk management throughout all systems in this policy unit can be reduced where storage cannot be carried out;
- to develop a Flood Forecasting and Warning delivery plan to maintain the current level of flood forecasting/warning service;
- to develop an Emergency Response Plan for the three Sewage Treatment Works, A45, A6, A14, A509, A605 and railway line at Burton Latimer at risk of flooding;
- to put in place policies within the Local Development Framework for no development in this area deemed natural floodplain; and
- to put in place policies within the Local Development Framework to link flood risk management planning with regeneration and redevelopment of commercial sites.

The River Welland CFMP was also published by the Environment Agency in December 2009⁷, with the catchment being sub-divided into nine policy units. Within Kettering Borough, the River Jordan corridor falls within Policy 3: Continue with existing or alternative actions to manage flood risk at the current level. The River Welland corridor

⁷ River Welland Catchment Flood Management Plan, Summary Report, December 2009

and the remainder of the Welland sub-catchment fall within Policy 2: Reduce current levels of flood risk management.

The River Welland CFMP also includes an Action Plan. The Action Plan for the River Welland corridor (specific to the area covered by the Kettering Borough) recommends the following actions:

- to develop a System Asset Management Plan to phase out flood risk maintenance activities on all systems within this policy unit;
- to develop a Flood Forecasting and Warning delivery plan to maintain the current level of flood forecasting/warning service; and
- to put in place policies within the Local Development Framework for no inappropriate development in the floodplain following the principles set out in PPS 25.

The Action Plan for the River Jordan corridor (specific to the area covered by the Kettering Borough) recommends the following actions:

- to develop a System Asset Management Plan to investigate how the current level of flood risk management throughout all systems in this policy unit can be continued;
- to develop a System Asset Management Plan to continue maintenance and inspection of Braybrooke FSR;
- to support and have continued input to the SFRA for no inappropriate development in the floodplain using guidance from PPS 25.

The River Nene CFMP highlights the importance of looking at opportunities for flood storage along the River Nene floodplain in order to prevent an increase of flood risk to the main urban centres of Kettering and Wellingborough. Other measures within these urban centres might be necessary if upstream floodplain storage cannot be developed in time or if insufficient storage is available to provide the protection needed for development.

2.3.2 North Northants Flood Risk Management Study

The North Northamptonshire Flood Risk Management Study was published in June 2007. Its aim was to create an overall flood risk management strategy within North Northamptonshire by bringing together existing flood risk information for each of the four councils (i.e. Corby, Kettering, Wellingborough and East Northamptonshire).

The North Northamptonshire Flood Risk Management Study contains useful information on growth proposals and flood risk in the Boroughs to inform this updated Level 1 SFRA. The key recommendations from the report are:

- Implementation of strategic flood risk management measures in advance or in parallel with the proposed developments with the intent of obtaining appropriate financial contributions from the prospective developers through Section 106 Agreements including for long-term management;
- Continuing to seek opportunities using a partnership approach to reduce flood risk within North Northamptonshire, avoiding the temptation just to manage flood risk within individual administrative areas;
- Provision of a combination of source control and strategic SuDS measures within individual development sites where the opportunities for catchment-wide strategic measures are limited;
- Incorporation of sufficient capacity in strategic flood management measures allowing for planned growth and future climate change;

- Avoidance of a piecemeal approach to managing runoff from smaller individual sites whilst providing strategic and local green corridors to incorporate SuDS for managing surface water runoff from developments;
- Restoration of the river floodplains as the land becomes available for redevelopment through set back options and creation of green space;
- Identification of the locations that are known to have surface water flooding problems from sewers and overland flow routes and exploring possible solutions for them through new development proposals; and
- Recognition of accommodating imminent development currently planned in North Northamptonshire ahead of the final Core Strategy.

These recommendations stress the importance of planning for flood defence in parallel with development proposals, to involve developers in the delivery of flood defence infrastructure and to manage flood risk holistically within the Boroughs.

2.3.3 North Northamptonshire Detailed Water Cycle Strategy

The North Northants Detailed Water Cycle Strategy (WCS) was commissioned by North Northants Development Company and has been delivered in partnership with North Northants Joint Planning Unit, Anglian Water and the Environment Agency.

The purpose of the North Northants Detailed WCS is to identify the water services infrastructure requirements to support the levels of growth identified within the North Northants Core Spatial Strategy and to provide a framework for the ongoing detailed technical work and delivery programme needed to achieve these requirements.

In total the North Northants WCS is divided into six technical sections, covering the key aspects of the urban water cycle in relation to planned growth. They are as follows:

- Planning and Development;
- Flood Risk Investigation Report;
- Water Resources;
- Water Supply Infrastructure;
- Wastewater and Water Quality; and
- Ecological Appraisal.

The information presented in the WCS has been reviewed in the context of the PPS 25 requirements for SFRA and key pieces of information have been drawn to inform the production of this updated Level 1 SFRA.

The North Northants Detailed WCS Flood Risk Investigation Report concluded that the towns of Kettering and Wellingborough might benefit from Surface Water Management Plans (SWMPs). The report also considered strategic flood risk management solutions to offset increased runoff from new developments for a number of watercourses. With regards to the Boroughs of Kettering and Wellingborough, the relevant points can be drawn out:

- Storage on the Slade Brook upstream of the railway culvert in Kettering should be pursued as the preferred option and a design study should be commissioned to assess in more detail the required volumes and costs of the facility;
- Further investigations should be made by developers and the Environment Agency to explore opportunities to reduce flood levels on the Harrowden Brook by enhancing the Harrowden Road FSR;

- Assessing the operation and standard of protection offered by the Wilby Bridge FSR on the Swanspool Brook and assess options for improvement; and
- Strategic flood storage may be possible on the Alledge Brook to offset potential development on to the east of Kettering.

Once again, these elements indicate potential flood risk management infrastructure to be implemented to allow development to come forward.

2.3.4 Kettering Town Centre Level 2 SFRA

The Kettering Town Centre Level 2 SFRA published in April 2010 has concluded that Kettering Town Centre contains localised areas that are prone to flooding from a range of sources including rivers, sewers and surface water. The dominant sources of flooding are from the Slade Brook which runs through the centre of Kettering, and also from surface water flooding relating to inadequate drainage systems.

The SFRA identified that, in order to meet PPS 25 requirements of allocating safe development where the likelihood of flooding at the development and consequences of flooding are acceptable for vulnerability of the development, there are options available to mitigate flood risk. The Level 2 SFRA in particular recommended that a whole catchment approach would be the most sustainable solution, not only to mitigate against flooding, but also to reduce flooding elsewhere as a result of new development.

The Level 2 SFRA explored the requirements for flood storage at a suitable site upstream of Kettering on the Slade Brook and assessed the impacts this would have on flood risk throughout the town centre.

The SFRA also demonstrated that there is an opportunity for implementation of strategic SuDS along the Slade Brook Corridor to reduce runoff from potential development sites and recommended that a SWMP be developed for Kettering Town Centre.

2.4 Local Development Plans

2.4.1 Background

The Government's Sustainable Communities Plan launched in 2003 identified the Milton Keynes South Midlands (MKSM) area as one of four growth areas for the greater south-east. Following this, a Sub-Regional Strategy for the area covering Northamptonshire, Milton Keynes, Aylesbury Vale and Bedfordshire was prepared. It was subsequently incorporated within the Regional Spatial Strategy for the East Midlands (RSS8)⁸, which was adopted in March 2005 and later revoked by government in July 2010.

With regards to the management of river systems, RSS8 included Policy 34 on Regional Priorities for Strategic River Corridors. This policy addressed specifically the River Nene and its tributaries, stating that *“Development Plans, future Local Development Frameworks, and other strategies of local authorities and other agencies should seek to protect and enhance the natural and cultural environment of the region’s strategic river*

⁸ Regional Spatial Strategy for the East Midlands (RSS8), Government Office For The East Midlands, March 2005

corridors of the Nene, Trent, Soar, Welland, Witham, Derwent and Dove, along with their tributaries, and rivers which contribute to river corridors of a strategic nature in adjoining regions.”

With the revocation of RSS8, this policy has been lost.

2.4.2 North Northamptonshire Core Spatial Strategy

Corby, Kettering, Wellingborough and East Northamptonshire Councils, together with Northamptonshire County Council, have worked through a joint planning committee, known as the North Northamptonshire Joint Planning Unit (JPU), to create the overall town planning strategy for the area. This is known as the North Northamptonshire Core Spatial Strategy (CSS)⁹, adopted in June 2008, and is a key part of the Local Development Framework for North Northamptonshire.

The CSS sets the level of growth for the area until 2021. The CSS identifies indicative housing requirements of 13,100 for the Kettering Borough over the period 2001-2021, with 2,353 houses respectively completed between 2001 and 2006. For the Borough of Wellingborough, the housing requirement is 12,800 over the period 2001-2021, with 1,521 houses completed between 2001 and 2006. The CSS acknowledges that if infrastructure constraints cannot be resolved or suitable interim solutions found, the housing trajectory and rates of growth will need to be reviewed. The CSS is currently being reviewed and this is likely to lead to a revision of the amount of housing that is required.

The CSS provides a framework within which the component parts of North Northamptonshire can work closely together to secure more investment and a greater range of facilities and services than they could do by working alone. It is based on increasing the self-sufficiency of individual settlements but also developing, where possible, a different focus for each in support of complementary working rather than wasteful competition. In this way North Northamptonshire as a whole can become stronger and more self sufficient, competing more effectively with other areas and stemming losses of people and spending.

Policy 13 from the CSS sets out the principles for sustainable development in North Northamptonshire. With particular reference to dealing with flood risk it states that *“Development should meet the needs of residents and businesses without compromising the ability of future generations to enjoy the same quality of life that the present generation aspires to. Development should not cause a risk to (and where possible enhance) the quality of the underlying groundwater or surface water, or increase the risk of flooding on the site or elsewhere, and where possible incorporate Sustainable Drainage Systems (SuDS) and lead to a reduction in flood risk.”*

This policy, which looks to achieve sustainable flood risk management, reflects the aspirations of PPS 25. The quality of life of future generations will be preserved by, amongst other things, planning today for the anticipated effects of climate change such as increased weather storminess and rising sea levels and by ensuring that new

⁹ North Northamptonshire Core Spatial Strategy, North Northamptonshire Joint Planning Unit, Adopted June 2008

development at the very least does not contribute to an increase and, where possible, contributes to an overall reduction. This policy also integrates the need for a better management of the overall water cycle to preserve water quality and achieve enhancements. This policy should be retained and where possible built upon to reflect the loss of Policy 34 on Regional Priorities for Strategic River Corridors in RSS8.

Within the River Nene Corridor, joint-working between the Environment Agency, The River Nene Wildlife Trust and Anglian Water should be promoted to maximise opportunities for a green corridor and deliver benefits for flood risk reduction, water quality, amenity and habitat improvement.

The Northamptonshire Minerals and Waste Development Framework¹⁰ was adopted in May 2010 and forms part of the CSS. The Minerals and Waste Development Framework replaces the Minerals and Waste Local Plan.

The PPS 25 sequential approach has been applied to the waste and minerals sites considered to be deliverable. Flood risk was one of a number of factors to be considered. Some sites that may have been more acceptable in terms of being in a lower flood risk zone had other impacts/factors that prevented them being found to be 'reasonably available' and being taken forward as allocations. This is particularly relevant for the river versus glacial mineral sites where quality and quantity of the resource reduced the suitability of some glacial sites in favour of river sites that are in Flood Zone 3. In addition, some waste sites in a lower zone were determined to be unsuitable to accommodate the development for example due to land use conflicts, environmental impacts, or their ability to serve growth areas. Hence the assessment has taken into account a more holistic view of the overall planning acceptability in determining whether the site is 'reasonably available'.

Minerals and Waste sites provide both opportunities and constraints to flood risk management. For example minerals sites in and on the edge of the floodplain provide opportunities for making space for water via low level restoration.

2.4.3 Strategic Housing Land Availability Assessment for North Northamptonshire

The Strategic Housing Land Availability Assessment (SHLAA) for North Northamptonshire considers the potential supply of housing for a range of settlements in North Northamptonshire over a 20-year period from the base date of April 2008. The planning authorities will use the SHLAA as a starting point for their consideration of which sites to bring forward as allocations in the site-specific Development Plan Documents.

The SHLAA is a technical study of housing potential, working on the best available information at a point in time and assesses sites which were forwarded as having development potential. It is not the case that every site assessed through the SHLAA will or should be developed. The SHLAA forms part of the Local Development Framework evidence base, along with a range of other technical studies. It does not in any way prejudice decisions to be taken by individual district/borough planning

¹⁰ Northamptonshire Minerals and Waste Development Framework, Core Strategy, Northamptonshire County Council, Adopted May 2010

authorities, in relation to preferred directions of growth, site identification in Development Plan Documents or the determination of planning applications. The planning authorities will use the SHLAA as a starting point for their consideration of which sites to bring forward as allocations in the site specific DPDs. Considerable further work will be required in order to ensure that the identification of sites in such Plans is based on sound and up to date information.

The potential development sites in the Kettering Borough are presented in **Figure 1**. These include:

- sites which are proposed for development in emerging LDF Development Plan Documents such as the Kettering Town Centre Area Action Plan and Rothwell and Desborough Urban Extensions Area Action Plan;
- East Kettering which has outline consent for development as a Sustainable Urban Extension; and
- sites which were put forward for assessment in the SHLAA as having development potential.

Figure 1, which encompasses both Boroughs, shows the potential development sites in the Kettering Borough in the same colour. Some of the figures produced for this updated Level 1 SFRA report focus more specifically on the Kettering Borough and in this case the sites proposed for development are colour-coded.

Further details on the proposals are included in **Appendix A**.

2.4.4 Wellingborough Site Specific Proposals Development Plan - Preferred Options

The Wellingborough Site Specific Proposals Development Plan Document – Preferred Options was approved for consultation in October 2010. Consultation ended on December 31st 2010. The proposals included in this document include allocations for housing, employment and other land uses as well as policies to assist in the determination of planning applications.

The proposals for the Borough of Wellingborough are presented in **Figure 1** and further details on the proposals are included in **Appendix B**. It should be noted that although these are the preferred options, this may change following consultation.

Figure 1, which encompasses both Boroughs, shows the potential development sites in the Kettering Borough in the same colour. Some of the figures produced for this report focus more specifically on the Borough of Wellingborough and in this case the sites proposed for development are colour-coded.

2.4.5 Wellingborough Town Centre Area Action Plan

The Wellingborough Town Centre Area Action Plan was adopted in July 2009. This plan guides development in the town centre up to 2021. The proposals are presented in **Figure 1** and further details on the proposals are included in **Appendix B**.

2.5 Historic Flooding

The Boroughs of Kettering and Wellingborough have a long history of flooding. The earliest flood event on record dates back to February 1940. A number of fluvial flood events have been experienced from the watercourses in the Boroughs. Flooding has also occurred as a consequence of surface water.

The River Nene CFMP provides a detailed overview of historic flooding across the catchment and has formed the basis of the information included herein. This has also been supplemented with more detailed information, especially for more recent flood events, and evidence provided by the councils and Anglian Water.

2.5.1 River flooding

The three most significant flood events on record in the Boroughs occurred in March 1947, Easter 1998 and June 2007.

In March 1947, a combination of heavy rain on a frozen catchment followed by rapid snowmelt resulted in substantial flooding on the River Nene between Northampton and Wellingborough. Flooding from the River Ise, Swanspool Brook and the Harrowden Brook occurred in Wellingborough.

In Easter 1998, large areas along the River Nene and the River Ise were flooded due to heavy rainfall. Flooding affected similar areas to the 1947 flood, but also further upstream of Peterborough and downstream of Northampton. This incident had severe consequences with fatalities in Northampton and extensive damage to property in several towns along the River Nene.

In June 2007, intense rainfall (over 65mm in three hours at one gauge) fell on the predominantly urbanised Slade Brook catchment leading to rapid surface runoff. In Slade Brook, river levels rose by over two metres in one hour. The intensity of the rainfall meant that drainage systems were completely overwhelmed, flooding 29 properties in Kettering along the Slade Brook. High flows from Slade Brook also caused levels to rise on the River Ise flooding an industrial building and roads in Kettering.

Other, less severe, flood events have affected the Boroughs such as in June 1981, when properties in Wilby and in Braybrooke were affected. The River Jordan also flooded the village of Braybrooke in 1968, 1980 and 1983 according to the North Northamptonshire Flood Risk Management Study.

Discussions held by the Borough Council of Wellingborough have also revealed local flooding problems in the Croyland Ward of Wellingborough due to bad maintenance of the nearby Swanspool Brook.

Figures 6a and **6b** present graphically the history of flooding across the Kettering Borough and the Borough of Wellingborough respectively.

2.5.2 Surface water flooding

The towns of Kettering and Wellingborough as well as other villages within the Boroughs have been subject to a number of instances of surface water flooding.

Instances of surface water flooding in the Boroughs

In August 2004, sewer surcharging led to the inundation of five properties in Kettering.

The June 2007 floods along the Slade Brook were partially caused by the drainage systems being overwhelmed by the intense runoff. As well as the Pytchley Lodge Rd flooding, other parts of Kettering were affected at the time such as the Little Chef and Travel Lodge and some residential parts of Kettering.

The North Northants WCS highlights limited sewer capacity at Severn Way in Kettering where the sewer carries flow from Rothwell and Desborough as well as on the Swanspool Brook sewer serving the west of Wellingborough. There is also anecdotal evidence that surface water flooding due to under capacity drainage has occurred at the junction of Meadow Road and Commercial Road in the centre of Kettering, in Cobden Street and in Field Street.

Flooding has also been recorded at the rear of properties on Wallis Road and Waverley Road in Kettering.

Other places where a problem with surface water has been reported include:

- The Golden Lion Pub in Wellingborough (Postcode NN8 1BL);
- Gloucester Place in Wellingborough (Postcode NN8 1AX);
- Irchester Co-Op (Postcode NN29 7AB);
- Holcot Lane in Sywell;
- At Queensway under the bridge near Olympic Way in Wellingborough; and
- Compton Way, Earl's Barton.

In Wellingborough, the property owners at 68 Windsor Road have reported that a spring has appeared in their front garden. This may warrant further investigation but could be due to a locally-leaking water main.

Anglian Water DG5 register

Anglian Water has also been consulted to obtain the sewer flooding records from the DG5 register. The DG5 register is updated annually and lists the areas and properties which have previously experienced an internal or external sewer flooding incident caused by lack of capacity of a sewer (whether foul, combined or surface water). Temporary problems such as blockages, siltation, sewer collapses, and equipment or operational failures are excluded from the register. An entry upon this register will not be removed until the problem has been solved. It should be recognised that reporting is not necessarily complete as some property owners do not report sewer flooding events. In addition, instances of surface water flooding in remote areas are unlikely to be reported.

Anglian Water has subsequently supplied postcodes of places that have been subject to sewer flooding. The listing gives the number of properties which suffered internal flooding, and the number of places subject to external flooding. External flooding includes highways, public open space, open land, parkland, as well as private gardens.

Table 1 lists all of the postcodes where sewer flooding has occurred within the Boroughs of Kettering and Wellingborough. These locations are also shown in **Figures 6a** and **6b**.

Table 1 - DG5 Sewer Flooding Records within the Boroughs of Kettering and Wellingborough

Borough Council	Postcode	External flooding only	Internal flooding only	Both internal and external flooding	Total flooding areas by postcode
Kettering	NN16 9		X		5
Kettering	NN16 8	X			2
Kettering	NN15 6	X			1
Kettering	NN15 7			X	3
Kettering	NN16 9			X	3
Kettering	?		X		?
Kettering	?	X			?
Kettering	NN14 4	X			3
Wellingborough	NN8 1		X		2
Wellingborough	NN8 2		X		2
Wellingborough	NN8 4	X			1

2.5.3 Groundwater flooding

Groundwater flooding occurs when water levels in the ground rise above the surface but groundwater may also cause harm in other ways, by entering basements for example.

The River Nene CFMP indicates that groundwater flooding has been recorded in areas of Kettering at London Road and St Mary's Road. This is the only reported instance of groundwater flooding in the Boroughs. However, the effects of groundwater flooding are often indistinguishable from the effects of fluvial flooding and are not always obviously attributable to groundwater. As a result, the recording of groundwater flooding tends to be inconsistent and unreliable.

2.6 Flood Defences

Flood defences along the watercourses in the Boroughs have been identified within the Boroughs based on the information provided by the Environment Agency and the Councils. The Councils have supplied the GIS information included in the Environment Agency's National Flood and Coastal Defence Database (NCFDD). Formal flood defences comprise raised defences such as embankments and flood walls as well as flood storage reservoirs and flood relief channels.

Other infrastructure acting as flood defence includes structures which have not been specifically designed and built to retain floodwater and which are therefore not maintained for this purpose but which may affect the spread of water in the floodplain. Typically, road and railway embankments sited in the floodplain act as flood defences.

2.6.1 Raised defences

Raised defences within the Boroughs of Kettering and Wellingborough have been identified based on the information included in the NFCDD. The raised defences are shown in **Figure 1** whilst further information, extracted from the NFCDD, is provided in **Appendix C**.

Most of the raised defences identified within the Boroughs are located in or around Wellingborough:

- Along Harrowden Brook;
- Along Swanspool Brook; and
- On the right-hand bank of the River Ise.

It should be noted that the NFCDD includes some privately owned flood defences as raised defences, although from the attributes it appears that some of them may be spoil banks (i.e. local raising of ground levels using excavated materials) rather than properly engineered flood embankments. Such assets have been highlighted in italics in **Appendix C** and are displayed distinctively in **Figure 1**. However, based on the information available, it is apparent that there are no areas protected by substantial lengths of raised defences, and breaching of these defences is not an issue.

2.6.2 Flood relief channel

A flood relief channel was constructed by the Environment Agency in the village of Geddington in June 2001 following the Easter 1998 floods. The flood relief channel provides flood protection to a 1% AEP standard to the village and is also shown in **Figure 1**. This is the only flood relief channel within the Boroughs.

2.6.3 Reservoirs

There are a number of flood storage reservoirs in the Boroughs. **Table 2** summarises the information available on these structures.

Table 2 - Flood storage reservoirs in the Boroughs of Kettering and Wellingborough

Location	Capacity (m ³)	SoP (AEP)	Responsibility	Watercourse
Kettering Leisure Village FSR	unknown	2%	Kettering Borough Council	Slade Brook
Coop FSR Kettering	small unknown	unknown	Private	Slade Brook
Furnace Lane Kettering FSR	small unknown	unknown	Private	Slade Brook
Rothwell FSR	unknown	unknown	Environment Agency	Slade Brook
Bozeat FSR	4,765	2%	Environment Agency	Grendon Brook
Wilby Bridge FSR	unknown	2%	Environment Agency	Swanspool Brook
Great Harrowden FSR	unknown	2%	Environment Agency	Harrowden Brook
Braybrooke FSR	23,485	2%	Environment Agency	River Jordan
Hardwick Road FSR	unknown	unknown	Wellingborough Borough Council	Hatton Brook
Park Farm FSR	unknown	unknown	Wellingborough Borough Council	Hatton Brook
Harrowden Road FSR	unknown	unknown	Wellingborough Borough Council	Harrowden Brook
Park Farm South FSR (double reservoir)	unknown	unknown	Wellingborough Borough Council	Swanspool Brook (Tributary)
Wilby Way Estate FSR	unknown	unknown	Wellingborough Borough Council	Swanspool Brook

There are also three former water supply reservoirs in the catchment, Sywell Reservoir, Thorpe Malsor Reservoir and Cransley Reservoir. These are now being used for recreational purposes and are the responsibility of Northamptonshire County Council. Although their primary purposes are not to provide flood protection, these reservoirs will influence the propagation and floodwater during a flood event.

The flood storage reservoirs and former water supply reservoirs are shown in **Figure 1**.

2.6.4 Other infrastructure acting as flood defence

No attempt has been made to generate a comprehensive record of other infrastructure acting as flood defence in the Boroughs. However, based on the topographic information obtained, OS maps and the Environment Agency's Flood Map, it is apparent that the railway embankment between Kettering and Wellingborough acts as a flood defence.

2.7 Flood Warning and Hydrometric Stations

The Environment Agency measures river levels, river flows and rainfall across England and Wales at strategic locations. Hydrometric stations within the Boroughs of Kettering and Wellingborough are summarised in **Table 3**, with their location being presented in **Figure 1**.

Table 3 - Hydrometric stations within the Boroughs of Kettering and Wellingborough

Location	Type
Barford Bridge	Gauging station on the River Ise
Barford Bridge	Rain gauge
Bozeat	Reservoir level gauge on Bozeat FSR
Bozeat	Rain gauge
Grendon	River level gauge on the Grendon Brook
Hardwater Mill	River level gauge at sluice, River Nene
Harrowden	Flow gauging station on the River Ise
Kettering	Reservoir level on Kettering Leisure Village FSR
Kettering	Flow gauging station on the Slade Brook
Kettering (Exeter Street)	Rain gauge
Burton Latimer	River level gauge on the River Ise
Wellingborough	Rain gauge
Wellingborough	Reservoir level gauge on Great Harrowden FSR, Harrowden Brook
Wellingborough	River level on the River Nene
Wilby	Reservoir level gauge on Wilby Bridge FSR (Swanspool Brook)
Orlingbury	Rain gauge
Dingley TW	Rain gauge

Hydrometric data, combined with flood forecasting models, is used as an input to the Environment Agency's Flood Warning System. Flood Alert and Flood Warning areas within the Boroughs are presented in **Figure 7**.

2.8 Hydraulic Models and Other Flood Risk Mapping Outputs

2.8.1 Environment Agency Flood Map

The Environment Agency's Flood Map considers flood risk from rivers and from the sea only and is available on the Environment Agency's [website](http://www.environment-agency.gov.uk/homeandleisure/floods/default.aspx) (<http://www.environment-agency.gov.uk/homeandleisure/floods/default.aspx>). The Flood Map ignores the presence of formal flood defences. The land is divided into three Flood Zones based on the probability of flooding as defined in Table D.1 of PPS 25. In order of increasing probability (without the presence of flood defences), these are:

- The low probability Flood Zone 1 assessed as the land having a less than 0.1% AEP of river or sea flooding in any one year;
- The medium probability Flood Zone 2 assessed as the land having between a 0.1% and 1% AEP of river flooding or between a 0.1% and 0.5% AEP of sea flooding in any year; and
- The high probability Flood Zone 3 assessed as the land having 1% or greater AEP of river flooding or a 0.5% or greater AEP of sea flooding in any year.

Flood Zone 3b comprises land where water has to flow or be stored in times of flood (Section 3.2.1). In practice, PPS 25 suggests that this can be taken as formal flood storage areas and the land which would flood with an annual probability of 5% as a starting point, although PPS 25 recognises the need to take account of local circumstances and not to define Flood Zone 3b solely on rigid probability parameters.

Only Water-compatible Development and Essential Infrastructure should be permitted within the functional floodplain. However, in accordance with PPS 25 Table D.1, such development or infrastructure is required to ensure the functional floodplain remains operational and safe for users in times of flood, not to impede water flows nor increase flood risk elsewhere and to result in no net loss of floodplain storage.

The Environment Agency has undertaken a national exercise to generate the Flood Map (i.e. Flood Zones 1, 2 and 3) which has been produced from a combination of a national modelling and mapping, more detailed modelling where available as well as historic flood outlines in order to provide a consistent picture of flood risk across England and Wales. These Flood Maps ignore the presence of flood defences. The corresponding GIS shapefiles encompassing the Boroughs of Kettering and Wellingborough have been provided for this study.

Flood Zone 3b has not been derived nationally and no such shapefile has been provided for it.

The Environment Agency is continuously looking to improve its knowledge of the floodplain and updates are made to the Flood Map on a quarterly basis using the output from the latest models and studies.

2.8.2 Fluvial hydraulic models

A number of flood risk studies have been completed for the watercourses in the Nene catchment. As part of these, hydraulic models have been developed to develop an understanding of flooding and map flood risk across the catchment. These hydraulic models have been obtained from the Environment Agency. **Table 4** summarises the key information on these models.

Table 4 - Hydraulic models within the Boroughs of Kettering and Wellingborough

Watercourse	Model Type	Extent of Model
Alledge Brook	1D Hydrodynamic (ISIS)	From Grafton Underwood To Thrapston (Confluence with River Nene)
Ecton Brook	1D Hydrodynamic (ISIS)	From Wellingborough Road (Northampton) To Confluence with River Nene
Grendon Brook	1D Hydrodynamic	From Denton, Yardley Hastings and Bozeat

Watercourse	Model Type	Extent of Model
	(ISIS)	To Confluence with River Nene
Swanspool Brook	1D Hydrodynamic (ISIS)	From Wilby Bridge To Confluence with River Ise
River Ise (inc. Slade Brook)	1D Hydrodynamic (ISIS)	From Clipston To Finedon
Middle Nene	1D Hydrodynamic (ISIS)	From Northampton To Wansford

The models have been supplied with modelling reports, detailing the data used in the development of the model and how the model was constructed. Outputs from the models, including GIS shapefiles of flood extents, have also been obtained for a number of scenarios combining different AEP events and the inclusion or not of flood defences. Further information on the model outputs provided is included in **Appendix D**.

2.8.3 Environment Agency Areas Susceptible to Surface Water Flooding

Following the Pitt Review of the summer 2007 floods in the UK, the Environment Agency commissioned the production of surface water flood risk maps at a national scale to provide an initial indication of areas that may be susceptible to surface water flooding. The maps have been produced using a simplified methodology which excludes underground sewerage and drainage systems and uses a single rainfall event. Three bandings are indicated, highlighted 'less' to 'more' susceptible to surface water flood risk areas.

These maps have been provided for this study.

Surface water flood maps have recently been developed for the UK to identify areas likely to flood following extreme rainfall events. Such have not been made available as part of this study because of the time constraints.

3 FLOOD RISK IN THE BOROUGHES OF KETTERING AND WELLINGBOROUGH

3.1 Overview

Historically, the River Nene and its tributaries have been the dominant source of flood risk to properties and infrastructure with the Boroughs of Kettering and Wellingborough. This is substantiated by the long history of flooding associated with these watercourses over the past decades, as listed in **Section 2.5**.

Flood defence infrastructure has been provided in places to control floodwater and to reduce fluvial flood risk. Flood defence infrastructure comes in a variety of forms, floodwalls, flood embankments, flood relief channels and flood storage reservoirs, and it is important to stress that this infrastructure does not altogether alleviate the risk of flooding.

Residual flood risk will remain if there is a system malfunction and/or if the magnitude of the flood event exceeds the flood event for which the infrastructure has been designed. Regular maintenance of the flood defence assets as well emergency preparedness will help keep this residual risk as low as possible. A key element of emergency preparedness is the maintenance of a flood warning service. PPS 25 states that the receipt and response to warnings of floods is an essential element in the management of the residual risk of flooding. Thus it recognises that flood warning and emergency planning is an important measure for managing flood risk from extreme events.

PPS 25, however, advocates the consideration of all sources of flood risk. This, combined with the recommendations of the Pitt review, has brought surface water flooding to the fore. A number of instances of surface water flooding have been recorded in the study area, particularly within the larger towns of Kettering and Wellingborough. With increasing pressure for development and the looming threat of climate change, surface water flood risk needs to be considered at the strategic planning stage.

Other sources of flooding, such as groundwater and reservoirs, also need to be considered where appropriate as well.

3.2 Fluvial Flooding

PPS 25 seeks to assess the likelihood of fluvial flooding by categorising the land into zones of low, medium and high probability flood risk in order to provide the basis for the application of the Sequential Test and to steer new development towards areas at the lowest probability of flooding.

The flood risk areas correspond to the Flood Zones as defined in PPS 25 (see **Section 2.8**) and have been used to generate the Environment Agency's Flood Map.

The delineation of the flood extents within the Boroughs has been undertaken for both the present-day and with climate change.

3.2.1 Delineation of present-day flood extents without defences

For the delineation of the fluvial flood extents without defences under present-day conditions, use has been made of the shapefiles provided by the Environment Agency for Flood Zones 1, 2 and 3.

Flood extents without defences within the Boroughs of Kettering and Wellingborough are shown in **Figures 8a** and **8b**. They show that several of the potential development sites are currently at risk from fluvial flooding. In the Kettering Borough the following sites are at risk:

- The SHLAA sites to the north of Kettering, near the Borough boundary, from Harper's Brook, partly in Flood Zone 3;
- The SHLAA site the south of Desborough, from the River Ise, partly in Flood Zone 3;
- The SHLAA site at Geddington, on the left-hand bank of the River Ise, partly in Flood Zone 3;
- The SHLAA site north-west of Kettering, from the Slade Brook, partly in Flood Zone 3;
- Some of the Kettering Town Centre AAP sites, from the Slade Brook, partly in Flood Zone 3;
- Some SHLAA sites in Kettering, from the Slade Brook and its tributaries and from the River Ise, partly in Flood Zone 3;
- The East Kettering SUE, from the River Ise and the Alledge Brook, partly in Flood Zone 3; and
- The SHLAA sites to the south of Burton Latimer, from the River Ise and the Latimer Brook, partly in Flood Zone 3.

In the Borough of Wellingborough the following sites are at risk:

- The North SUE, from the River Ise, partly in Flood Zone 3;
- The West SUE, from Harrowden Brook, partly in Flood Zone 3;
- A Town Allocation Housing site in Central Wellingborough, from the Swanspool Brook, partly in Flood Zone 3;
- The Kangaroo Spinney Travellers Site in Wellingborough, from the River Nene, partly in Flood Zone 2; and
- A Preferred Rural Housing Options site in Wollaston, from the Wollaston Brook, partly in Flood Zone 3.

It should be noted and acknowledged that sites which encroach on Flood Zone 3 and Flood Zone 2 generally have large area located in Flood Zone 1. Thus, a sequential approach should be adopted for the site layout, with a view to locating more vulnerable land uses in Flood Zone 1 and less vulnerable uses in the higher flood risk zones. Alternatively, site boundaries could be redefined to avoid areas of high flood risk.

The only exception where there is no possibility of avoiding the higher flood risk zone is some of the proposed Kettering Town Centre AAP development sites along the Slade Brook in Kettering Town Centre, as outlined in the Level 2 Kettering Town Centre SFRA.

3.2.2 Delineation of present-day flood extents with defences

In accordance with PPS 25, discussions were held with the Environment Agency and the Local Authorities with regards to the Functional Floodplain (Flood Zone 3b). It was agreed to use the outputs from the 4% AEP event model with defences where available to define the Functional Floodplain in the Boroughs. This was possible for the Middle Nene, River Ise, Alledge Brook, Grendon Brook and Swanspool Brook. For other watercourses the Functional Floodplain has been taken as Flood Zone 3.

Model outputs for the present-day 1% AEP and 0.1% AEP events with defences were used for the Middle Nene, River Ise, Alledge Brook, Grendon Brook and Swanspool Brook to map flood extents for the 1% AEP and 0.1% AEP events. For other watercourses, Flood Zone 3 and Flood Zone 2 were used respectively as there is no flood defence infrastructure on these watercourses such that flood extents with defences match those without defences.

Present-day flood extents with defences within the Boroughs of Kettering and Wellingborough are shown in **Figures 9a** and **9b**. The flood extents mapped are less than those presented in **Figures 8a** and **8b** respectively (without defences) owing to the influence of flood defence infrastructure, mainly flood storage reservoirs (see **Section 2.6**).

Figures 9a and **9b** show that several of the potential development sites are currently at risk from fluvial flooding even when taking account of flood defence infrastructure. In the Kettering Borough the following sites are at risk:

- The SHLAA sites to the north of Kettering, near the Borough boundary, from Harper's Brook, partly in the Functional Floodplain;
- The SHLAA site the south of Desborough, from the River Ise, partly in the Functional Floodplain;
- The SHLAA site at Geddington, on the left-hand bank of the River Ise, partly in the Functional Floodplain;
- The SHLAA site north-west of Kettering, from the Slade Brook, partly in the Functional Floodplain;
- Some of the Kettering Town Centre AAP sites, from the Slade Brook, partly in the 0.1% AEP flood extent;
- Some SHLAA sites in Kettering, from the Slade Brook and its tributaries and from the River Ise, partly in the Functional Floodplain;
- The East Kettering SUE, from the River Ise and the Alledge Brook, partly in the Functional Floodplain; and
- The SHLAA sites to the south of Burton Latimer, from the River Ise and the Latimer Brook, partly in the Functional Floodplain.

In the Borough of Wellingborough the following sites are at risk:

- The North SUE, from the River Ise, partly in the Functional Floodplain;
- The West SUE, from Harrowden Brook, partly in the Functional Floodplain;
- A Town Allocation Housing site in Central Wellingborough, from the Swanspool Brook, partly in the Functional Floodplain;
- The Kangaroo Spinney Travellers Site in Wellingborough, from the River Nene, partly in Flood Zone 2; and

- A Preferred Rural Housing Options site in Wollaston, from the Wollaston Brook, partly in the Functional Floodplain.

3.2.3 Delineation of future flood extents with defences

The flood extents with defences have also been delineated looking forward into the future, in an attempt to capture the increase in flood risk due to climate change (i.e. with an increase in flood flows by 20%). In line with the recommended national precautionary sensitivity ranges for peak flows included in Table B.2 of PPS 25, this can be thought of as flood extents for the year 2111 (i.e. 100 years from present-day). This has been done using the model outputs for the 1% AEP event with climate change for the Middle Nene, River Ise, Alledge Brook, Grendon Brook and Swanspool Brook. For other watercourses, Flood Zone 2 has been used instead.

The future flood extents for the 1% AEP event, which take account of existing flood defences, are shown in **Figures 10a** and **10b**. They show that several of the potential development sites will be at risk from fluvial flooding in the future due to climate change.

In the Kettering Borough the following sites are at risk:

- The SHLAA sites to the north of Kettering, near the Borough boundary, from Harper's Brook;
- The SHLAA site the south of Desborough, from the River Ise;
- The SHLAA site at Geddington, on the left-hand bank of the River Ise;
- The SHLAA site north-west of Kettering, from the Slade Brook;
- Some of the Kettering Town Centre AAP sites, from the Slade Brook;
- Some SHLAA sites in Kettering, from the Slade Brook and its tributaries and from the River Ise;
- The East Kettering SUE, from the River Ise and the Alledge Brook; and
- The SHLAA sites to the south of Burton Latimer, from the River Ise and the Latimer Brook.

In the Borough of Wellingborough the following sites are at risk:

- The North SUE, from the River Ise;
- The West SUE, from Harrowden Brook;
- A Town Allocation Housing site in Central Wellingborough, from the Swanspool Brook;
- The Kangaroo Spinney Travellers Site in Wellingborough, from the River Nene; and
- A Preferred Rural Housing Options site in Wollaston, from the Wollaston Brook.

3.2.4 Residual flood risk

The delineation of present day flood zones has been made on a purely probabilistic basis, without considering the influence of flood defences or the behaviour of key hydraulic control structures during a flood event. In practice, these assets have the potential to strongly affect the spread of floodwater downriver, hence influencing the consequences associated with the flood event. As such, these structures need to be well understood if a proper risk management strategy is to be implemented.


It is noted that within the Boroughs there are a number of culverts and bridges, particularly in the larger settlements. During a flood event, debris will be conveyed downriver and have the potential to partially, or even fully, obstruct the area available for flow. Consequently, upstream water levels will rise, in some instances very rapidly, and flood risk will be increased. Properties and goods falling outside of the flood zones may be affected. Also, this may leave little time for evacuation and may cause hazardous conditions.

Similarly, a number of raised defences have been identified principally in or around Wellingborough (see **Appendix C** and **Figure 1**) based on the NFCDD. Some of these defences are the responsibility of the Environment Agency, some the responsibility of the Local Authority and others are privately owned and maintained. It is therefore likely that these defences will be subject to a varying standard of maintenance. However, based on the evidence gleaned as part of this report, it is apparent that there are no areas protected by lengths of raised defences, such that breaching of these defences is not a concern.

Guidance on the assessment of flood hazard was published by Defra and the Environment Agency in October 2005^{11 12} which provides a clear framework on how to assess risk to life. In particular, a methodology is proposed to derive a flood hazard rating based on flood depths and flow velocities which is echoed in **Table 5**.




Table 5 - Flood hazard rating (taken from Table 13.1 of FD2320/TR2)

Velocity (m/s)	Depth of flooding (m)											
	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.00	Green	Green	Green	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red
0.10	Green	Green	Green	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red
0.25	Green	Green	Green	Yellow	Orange	Orange	Orange	Orange	Orange	Red	Red	Red
0.50	Green	Green	Green	Orange	Orange	Orange	Orange	Orange	Orange	Red	Red	Red
1.00	Green	Green	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red
1.50	Green	Green	Yellow	Orange	Orange	Orange	Red	Red	Red	Red	Red	Red
2.00	Green	Yellow	Yellow	Orange	Orange	Red	Red	Red	Red	Red	Red	Red
2.50	Green	Yellow	Yellow	Orange	Red	Red	Red	Red	Red	Red	Red	Red
3.00	Green	Yellow	Yellow	Red	Red	Red	Red	Red	Red	Red	Red	Red
3.50	Green	Yellow	Orange	Red	Red	Red	Red	Red	Red	Red	Red	Red
4.00	Green	Yellow	Orange	Red	Red	Red	Red	Red	Red	Red	Red	Red
4.50	Yellow	Yellow	Orange	Red	Red	Red	Red	Red	Red	Red	Red	Red
5.00	Yellow	Yellow	Orange	Red	Red	Red	Red	Red	Red	Red	Red	Red

Key:
 Little or no danger

¹¹ Flood Risk Assessment Guidance for New Development, Phase 2 – Framework and Guidance for Assessing and Managing Flood Risk for New Development, R&D Technical Report FD2320/TR2, October 2005

¹² Flood Risks to People: Phase 2. R&D Technical Report FD231/TR2 Guidance Document, March 2006.

	Danger for some
	Danger for most
	Danger for all

Danger for some includes danger to the most vulnerable children, the elderly and disabled people. Danger for most covers the general public whilst danger for all includes emergency services.

The Level 2 SFRA for Kettering Town Centre has investigated the risks associated with blockage of structures in further details using two-dimensional numerical modelling. The associated flood hazards have been assessed in accordance with the Defra guidance. A methodology has been developed to identify areas where the risk of blockage is the greatest.

There is also a risk of breach associated with reservoirs. This aspect is dealt with within **Section 3.5** of this report.

3.3 Surface Water Flooding

3.3.1 Surface water flood risk maps

Figure 11 shows the risk of surface water flooding within the Boroughs based on the areas susceptible to surface water flooding maps provided by the Environment Agency.

These maps show that there are numerous potential development sites at risk from surface water flooding, particularly those close to the watercourses. The anecdotal evidence collected for surface water flooding incidents (**Figures 6a and 6b**) indicates that surface water flooding has historically been concentrated in the two main towns of Kettering and Wellingborough. This suggests that the development sites that are at greatest potential risk from surface water flooding are those located within these urban centres.

The recently published surface water flood map will provide additional information, which should be considered when preparing site-specific FRA.

3.3.2 Drainage issues within the catchment

Overflowing surface water drains can lead to flooding, either due to under capacity of drainage or failure of a drainage system, such as blocked pipes, mechanical breakdown or operational errors. Gravity drained systems can back up due to an inability to flow into the river because of high river levels occurring in the receiving watercourse. Individually these impacts usually have little consequence for the flood risk across the wider catchment. However, due to their widespread occurrence the local impacts cannot be ignored.

Sewers are typically designed to cater for a storm period up to the 3.33% AEP storm event. Combined sewer systems, in comparison to the separate systems, have more limited capacity and often do not have the capacity to convey all flows during a

significant event with excess flows being discharged into adjacent watercourses via combined sewer overflows. Furthermore, during high flow events, excess flood water can flow out of the combined sewer system at manholes and flood roads and houses in the vicinity. The level of performance of the sewers will be reduced by lack of regular maintenance.

As stated in **Section 2.5**, the North Northamptonshire WCS highlights sewer capacity problems at Severn Way, Kettering where the sewer carries flow from Rothwell and Desborough. Consultation with Anglian Water has indicated that funding is available for a strategic solution between Kettering and Wellingborough as part of the Asset Management Plan 5 (AMP5) from 2010 to 2015. However, construction will not be started until a developer requires connection. The route of the strategic sewer is, at the time of writing, almost finalised and will solve sewer capacity issues in Kettering, Wellingborough and in East Northamptonshire.

The historic flood map (see **Figures 6a** and **6b**) reveals that the instances of sewer flooding are concentrated in the larger settlements of Kettering and Wellingborough. The River Nene CFMP itself suggests that areas of Kettering and Wellingborough are susceptible to surface water flooding as these are large urban areas. The CFMP also acknowledges that in large parts of the catchment between Northampton and Peterborough there is a risk of localised flooding due to the presence of deep clay soils which can impede drainage and cause flooding at the base of slopes.

As part of the Level 2 SFRA for Kettering Town Centre, Royal Haskoning commissioned Clear Environmental Consultants Ltd to provide information relating to the performance of both foul and surface water sewerage systems within Kettering Town Centre, using Anglian Water's existing model outputs and catchment knowledge. The main findings from this study indicate that there are known capacity issues with the trunk foul/combined system within Kettering Town Centre.

It is clear from the above that, given the number of instances of surface water flooding in the larger settlements combined with the increased pressure for development and the looming threat of climate change, localised flood risk arising from inadequate drainage capacity will need to be managed effectively to deliver an overall reduction in flood risk. Surface water flood risk will need to be addressed in the design process of future developments. Developers should utilise best practice measures for reducing the loading on the drainage infrastructure. Development should restrict runoff rates to the pre-development rate. New development on greenfield sites should restrict runoff to the greenfield runoff rates and brownfield sites should be restricted to the pre-development rate with a reduction where possible to provide betterment as recommended by PPS 25.

The Town and Country Planning (General Development Procedure) (Amendment) (No.2) (England) Order 2006 introduced the concept of Critical Drainage Area (CDA) as "an area within Flood Zone 1 which has critical drainage problems and which has been notified... [to]...the local planning authority by the Environment Agency". Critical Drainage Areas are specific areas in Flood Zone 1 only, where runoff can cause problems downstream, and is not necessarily an area where flooding problems may occur. Some of the information included within this section would feed into the process of defining Critical Drainage Areas, although this would usually be the output of a Level

2 SFRA. Critical Drainage Areas would then be assessed in more detail in a Surface Water Management Plan.

3.4 Groundwater Flooding

High groundwater levels, especially if the water table rises above the ground level, can cause flooding. High groundwater levels can affect low-lying areas of land as well as the cellars and basements of properties. It is difficult to predict groundwater flooding. Indeed, groundwater levels are typically influenced by the cumulative rainfall over long periods (e.g. months) rather than by the short, intense events which could cause fluvial or surface water flooding. As a result groundwater flooding can last from a few days to a few weeks.

The only recorded instance of groundwater flooding has been in areas of Kettering at London Road and St Mary's Road. However, groundwater flooding may have been masked by other sources of flooding in certain instances.

The River Nene CFMP has assessed groundwater flooding potential across the catchment, with areas being attributed a high, moderate or low groundwater flooding potential. Within the Boroughs of Kettering and Wellingborough, there is no area with high groundwater flooding potential.

Notwithstanding this, an area of glacial sand and gravel geology has been identified within the Boroughs. Raised water levels within adjacent rivers and streams can raise the water table beneath the surface, resulting in localised groundwater flooding through permeable sand and gravels.

The Environment Agency has advised that there may be spring lines on the river valleys and former mine workings which may lead to groundwater flooding. This should be investigated in further detail as part of the preparation of any site-specific FRA if deemed a source of flood risk.

In accordance with PPS 25, future development will require an appropriate Flood Risk Assessment (FRA) at the planning application stage, commensurate with the level of flood risk posed to the site. The FRA should incorporate a site-based assessment of the potential risk from groundwater flooding to the site, confirming whether groundwater is a source of flood risk.

3.5 Reservoirs

3.5.1 Risks due to reservoirs in the Boroughs

There are eight flood storage reservoirs and three former water supply reservoirs within the Boroughs. Given PPS 25's requirements to consider all sources of flood risk, flood risk from reservoirs need to be taken into account for the Boroughs of Kettering and Wellingborough. Reservoir flooding may occur as a result of the facility being overtopped and/or as a result of a breach developing in the dam wall. The latter can

happen suddenly resulting in rapidly flowing, deep water that can cause significant threat to life and major property damage.

A breach to either Thorpe Malsor reservoir or Cransley reservoir could impact the western side of Kettering and the potential development sites located to the east of the A14 on the western side of Kettering could be at risk.

A breach to Sywell Reservoir would flow directly into the River Nene and could have less severe consequences on properties and infrastructure, although it could lead to a floodwave coming down the River Nene posing a threat to anglers, boaters and other passers-by near the river.

If development is proposed downstream of the reservoirs shown on **Figure 1** and detailed in **Section 2.6.3**, then it is recommended that a site-specific FRA be produced and that this FRA should consider flood risk from a breach of the upstream reservoir.

3.5.2 Reservoir inundation mapping

The Pitt Review into the 2007 summer floods recommended that the Government should produce inundation maps for all large raised reservoirs to show the effects of a dam breach on its downstream catchment. An assessment of all the large reservoirs in England and Wales has shown that some of them could have a bigger impact if water escaped - if they are very large or in a built up area, for example. Based on such factors, some reservoirs have been classed a higher priority than others. The maps have been produced for emergency planning purposes and display a realistic worst case scenario. The maps are available on the Environment Agency's website. (see <http://www.environment-agency.gov.uk/homeandleisure/floods/124783.aspx>)

Of the three reservoirs in the study area, Cransley, Thorpe Malsor and Sywell, only Thorpe Malsor was deemed a high priority and inundation maps have only been produced for this reservoir. These maps have not been obtained during the preparation of this study, as they were prepared for emergency preparedness rather than spatial planning but are available from Environment Agency Area offices. These maps should be taken into consideration for future planning applications relating to sites potentially at risk from reservoir flooding.

The reservoirs need to be managed and maintained in accordance with the Reservoirs Act 1975 as amended by the Flood and Water Management Act 2010.

4 SUSTAINABLE FLOOD RISK MANAGEMENT

4.1 Overview and Principles

Flood risk is a combination of two components: the probability of a particular flood and the consequence of the flood. Flood risk management can reduce the probability of occurrence through the management of land, river systems and flood defences. Management can also reduce the impact through influencing development in flood risk areas, implementing flood warning systems, and developing flood emergency response procedures.

PPS 25 requires local authorities to apply a risk-based sequential approach as part of the identification of land for development in areas at risk of flooding. The purpose of the sequential approach is to ensure that areas of low risk are developed in preference to areas of higher risk and, within this, ensuring that developments most vulnerable to flood risk are located in the lowest flood risk areas. The application of the sequential approach needs to be informed by an appropriate assessment of flood risk. The sequential approach then uses this information to avoid the highest flood risk areas and where this is not possible, take opportunities to substitute higher vulnerable land uses in higher flood risk areas for lower vulnerable uses in lower flood risk areas, control flood risk through flood defences, SuDS and by design, or mitigate the risk of flooding through resilience measures; in that order. This is known as the flood risk management hierarchy.

The Sequential Test is an important aspect of the sequential approach which is required at the local planning authority level. It is a test to show that land allocation has been made in the lowest possible flood zone available within the relevant geographical area for the type of development being proposed. The Sequential Test should be carried out at all stages of the planning process.

If, following the application of the Sequential Test, it is not possible for a development to be located in a zone with a lower probability of flooding then the Exception Test should be applied to assess its suitability for development. The Exception Test makes provision for sites where flood risk is outweighed by wider sustainability considerations and is designed to ensure that the flood risk posed to such sites is managed to an acceptable level, accounting for climate change, without increasing flood risk elsewhere. Therefore, the Exception Test ensures reasoned justifications are provided for any decision to allocate land in areas at high risk. The Exception Test does not always apply for example with less vulnerable uses in Flood Zone 3.

At the planning application stage, an appropriate site-specific FRA will be required to demonstrate how flood risk from all sources to the development itself and flood risk to others will be managed now and taking climate change into account. The site-specific FRA should build on the information included in the local SFRA as well as considering other relevant aspects of the evidence base including the North Northants Water Cycle Strategy and any forthcoming SWMPs. Annex E of PPS 25 states that planning applications for development proposals of 1 hectare or greater in Flood Zone 1 and all proposals for new development located in Flood Zones 2 and 3 should be accompanied by a site-specific FRA. Guidance on the preparation of FRAs is included in **Appendix E**.

4.2 Responsibilities for Flood Risk Management

4.2.1 Environment Agency

The Environment Agency has a supervising role with respect to all aspects of flood risk management in England and Wales. They have the power to manage flood risk from designated Main Rivers and the sea. In doing so, they have powers to maintain and improve watercourses.

These powers are permissive, and do not oblige the Environment Agency to carry out maintenance or new works. A recommendation from the Pitt Review is that the Environment Agency should publish its schedule of works in order to ensure that the maintenance work they perform is recognised by local communities.

4.2.2 Local Authority

Local Authorities have permissive powers for maintaining and improving ordinary watercourses. Ordinary watercourses include every river, stream, ditch, drain, cut, dyke, sluice or passage through which water flows and which does not form part of a main river.

Following the Flood and Water Management Act 2010, local authorities will have the lead role in managing local flood risk from surface water, ground water and ordinary watercourses once the relevant sections have come in to force. There is no timetable for this at the time of writing. In the meantime, Flood Defence consent is required from the Environment Agency for works affecting the flow in an ordinary watercourse and they will continue to comment on surface water drainage proposals.

4.2.3 Landowners and Developers

The ultimate responsibility for maintenance of watercourses and banks lies with the land owner. This includes an obligation to maintain and operate any river control structures owned, such as mills, dams and weirs. Landowners or developers may require flood defence consent from the Environment Agency for any structure in, over, under main rivers or for works adjacent to main rivers.

4.3 Fluvial Flooding

4.3.1 Key principles

The direction for sustainable fluvial flood risk management in the Boroughs is set within the River Nene and River Welland CFMPs, see **Section 2.3**. These indicate that flood risk management measures should focus on the areas where the risk is highest, i.e. the larger settlements of Kettering and Wellingborough, with further action in the Slade Brook/River Ise and Nene Rivers corridors to take action to generate benefits for settlements further downstream.

The approach set out in PPS 25 is in line with the CFMP objectives in that it aims at ensure development proposals are commensurate to the level of risk, as per Table D.3 of PPS 25.

Key recommendations of PPS 25 which will ensure fluvial flood risk is sustainably managed include:

- There should be no net loss of floodplain storage following development and compensation should be provided on a level for level basis;
- Surface water should be managed at the source, such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect;
- The need to manage residual risk, especially for developments in low-lying areas where rapid inundation and hazardous conditions could cause failure of the defence and
- The application of the sequential approach to new developments to reduce the consequences of flooding; and
- The need to allow for climate change (i.e. 20% increase in rainfall and sea level rise).

PPS 25 also introduces the concept of developer contributions to sustainable flood risk management.

Flood risk mapping, see **Figures 8a, 8b, 9a, 9b, 10a and 10b** as presented in **Section 3.2**, should inform the site allocation in DPDs and should be used to locate development in least vulnerable areas through sequential testing.

These figures show that a majority of potential development sites are located in Flood Zone 1. Some of them encroach partially in the higher risk flood zones. Thus, the sequential approach should be adopted at the site level in order to site more vulnerable land uses in less vulnerable flood risk areas (i.e. Flood Zone 1). Alternatively, where large expanses are available in Flood Zone 1 site boundaries could be redefined to avoid areas of high flood risk.

4.3.2 Strategic flood defence infrastructure

As part of the River Nene CFMP (see **Section 2.3.1**), two strategic solutions for flood storage were investigated within the study area. These were located:

- i. Upstream of the railway embankment on the Slade Brook, to the north west of Kettering; and
- ii. On the River Ise, to the west of Finedon.

These solutions have the potential to deliver benefits to Kettering and Wellingborough as well as to other major settlements further downstream on the River Nene.

Flood risk in Wellingborough is primarily from the minor tributaries Swanspool Brook and Harrowden Brook. New development in these catchments should attenuate flows on-site using SuDS measures to prevent any increase in flood risk downstream and where possible result in betterment. Options to improve existing flood storage facilities and add new upstream storage should be investigated by developers. In line with this, the North

Northants WCS highlighted locations where strategic solutions could be implemented. They are as follows:

- enhancing the Harrowden Road FSR;
- assessing the operation and standard of protection offered by the Wilby Bridge FSR on the Swanspool Brook and assess options for improvement; and
- providing strategic flood storage on the Alledge Brook to offset potential development to the east of Kettering.

The location of these strategic flood storage solutions is presented in **Figure 12**.

Further work is needed to appraise these strategic flood defence measures and to confirm if potential development sites require these storage schemes to allow them to come forward.

The Level 2 SFRA for Kettering Town Centre has confirmed that given the nature of flood risk within the Kettering Town Centre development in that area may require the implementation of a storage reservoir on the Slade Brook. The Level 2 SFRA has in particular assessed the volumes to be stored, tested the impact of the flood storage reservoir on flood levels in the Town Centre and provided an estimated construction cost of £2.3m for this scheme.

As discussed previously, contributions from developers towards the implementation of these measures should be sought.

4.4 Surface Water Flooding

The responsibilities for surface water management fall into a number of bodies including Kettering Borough Council and the Borough Council of Wellingborough, Anglian Water, the highways authority (Northampton County Council) and the Environment Agency. The recent introduction of the Flood and Water Management Act 2010 requires the Lead Local Flood Authority (i.e. County Council) to develop, maintain, apply and monitor the strategy for flood risk management, of which the production of a Surface Water Management Plan (SWMP) forms a key part. Management of surface water is therefore a complex issue, best dealt with using a strategic and co-ordinated approach.

SWMPs hence have an important role in developing a co-ordinated strategic approach to the management of surface water drainage and reducing flood risk. It provides a platform for ensuring that climate change does not exacerbate urban flooding.

The Flood and Water Management Act outlines the key purposes of SWMPs as:

- ensuring that allocations within an area are properly supported by adequate surface water management;
- providing a common framework for stakeholders to agree responsibilities for tackling existing drainage problems and preventing future problems;
- where development pressures are high it can be part of a Water Cycle Strategy; and
- demonstrating how capital investment, infrastructure and maintenance can deliver the required surface water management.

SWMPs are required for a number of reasons including:

- to identify locations where there is evidence of existing problems with the drainage infrastructure and therefore a requirement for upgrade to deal with surface water now and into the future;
- to consider the implications of potential large-scale development where surface water may be best managed with a strategic approach, rather than on an individual development scale; and
- to evaluate the potential opportunities to implement a co-ordinated approach by several bodies to plan infrastructure improvements.

The preparation of the SWMP should be specific to the location and nature of the drainage surface water infrastructure and flooding mechanisms. **Table 6** outlines the key elements and anticipated durations for each phase.

Table 6 - Timescales for the Delivery of SWMPs

Phase in the SWMP Process	Approximate Duration (Months)
1. Preparation	2-4
2. Risk Assessment	4-6
3. Options	3-5
4. Implementation and Review	Reviewed on an annual basis

In the context of the Boroughs of Kettering and Wellingborough, anecdotal evidence has shown that surface water problems are concentrated in the bigger urban areas of Kettering and Wellingborough and the expected impacts of climate change will further strain the drainage infrastructure. Thus, consideration should be given to the preparation of SWMPs for Kettering Town Centre as well as for the wider Borough of Wellingborough, in the absence of a Level 2 SFRA, as a priority. The SWMPs should be prepared by the Northamptonshire Flood and Water Management Partnership and the preparation of the SWMP should make use of the surface water flood map.

Until the SWMPs have been prepared, it will not be possible to identify the sites which require improvements to be delivered through the SWMPs. Thus, all development sites which have experienced surface water flooding or where an issue with surface water is known should not be taken forward until the SWMPs have been completed and solutions to deal with surface water have been identified.

4.5 Sustainable Drainage Systems (SuDS)

Traditionally, surface water drainage systems have been designed by means of underground piped systems eventually discharging in watercourses. Moving downstream along this piped network, volumes rapidly increase making flooding problems increasingly likely if the network is undersized. Pipes do not contribute to the natural recharge of groundwater and also contribute to the transport of pollutants from urban areas into watercourses. In some locations surface water and foul sewage is drained by a single sewer pipe known as a combined sewer. These combined systems, in comparison to the separate systems, usually have more limited capacity and often do not have the capacity to convey all flows during a significant event; therefore excess

flows are discharged into adjacent watercourses via combined sewer overflows. Furthermore, during high flow events, excess flood water can flow out of the combined sewer system at manholes and flood roads and houses in the vicinity.

With concerns surrounding the impacts of climate change, the requirements of PPS 25 to reduce flood risk downstream and the aspirations of the Water Framework Directive, a more sustainable approach is required to manage surface water. The effective management of surface water from a new development is a material planning consideration which will influence the proposals.

Local authorities are encouraged to promote the use of Sustainable Drainage Systems (SuDS) for the management of run-off. SuDS aim to mimic natural infiltration processes and to remove pollutants from urban run-off at the source. They comprise a wide range of techniques, including green roofs (see <http://www.environment-agency.gov.uk/business/sectors/91967.aspx>), water butts or rainwater tanks for rainwater harvesting, permeable paving, swales, detention basins, ponds and wetlands. These techniques can be used in combination to make use of available space and landscaping constraints in order to realise the greatest improvement in water quality and reduction in flood risk. In addition SuDS can provide other benefits in terms of habitat creation and provision of amenity value.

The use of green roofs should be for betterment purposes and not to be counted towards the provision of on-site storage for surface water. This is because the hydraulic performance during extreme events is similar to a standard roof.

Whilst the Environment Agency supports rainwater harvesting, it should be provided as betterment on the site and not as a means of surface water attenuation. Rainwater harvesting stores water on site and as such the tanks are not always empty. Accordingly, during a rainfall storm event, it cannot be guaranteed that the tanks are available to provide sufficient attenuation for the storm event.

The drainage arrangements for a new development site should be such that the surface water run off following development is no greater than the greenfield runoff rate. Specific guidance has been published on SuDS¹³ and developers should use it when designing their drainage system. Flood Risk Assessments should in particular contain detailed information on the proposals for addressing surface water management.

Successful implementation of SuDS will require the early consideration of a wide range of issues with regards to their management, long-term adoption and maintenance. The design team and stakeholders should take every opportunity for early discussion and should consider them at the feasibility stage of a development.

As the Lead Local Flood Authority under the Flood and Water Management Act 2010, it is now Northamptonshire County Council's role to approve, adopt and maintain SuDS on new developments.

¹³ The SUDS Manual, CIRIA C697, 2007

Within the River Nene Corridor, joint-working between the Environment Agency, The River Nene Wildlife Trust and Anglian Water should be promoted to maximise opportunities for a green corridor and deliver benefits for flood risk reduction, water quality, amenity and habitat improvement.

The presence of contaminated soils may be a significant constraint when designing SuDS solutions. Within this SFRA, no attempt has been made to gather information regarding the location of potentially contaminated land within the Boroughs but more detailed information would be required at the design stage.

All new development sites have the potential to increase flood risk downstream if surface water is not adequately managed.

Further guidance on SuDS is provided in **Appendix F**.

The Level 2 SFRA for Kettering Town Centre provides more detailed guidance on SuDS techniques relevant to proposed development plans in that area.

4.6 Flood Warning and Emergency Planning

4.6.1 Flood warning

The timely issue, receipt and response to warnings of floods are an essential element in the management of the residual risk of flooding. The Environment Agency is responsible for monitoring flood events and for issuing warnings to people in properties and businesses at risk of flooding.

Flood forecasting requires real time data and forecast model data to provide accurate and timely flood warnings to the public. The Environment Agency's procedures for recommending warnings are activated by triggers for individual river level and flow sites. Once a rain gauge and/or a river level gauge reaches pre-determined levels, catchment conditions are assessed using a combination of soil moisture deficit data, rainfall information from radar and real-time rainfall and river responses. When conditions suggest that a flood is expected, a flood warning is issued and the Environment Agency's flood warning service is activated. This is known as the Flood Warnings Direct (FWD).

Four codes are used, which are:

- Flood Alert, when flooding of low-lying land and roads is possible.
- Flood Warning, when flooding of homes, businesses and main roads is expected.
- Severe Flood Warning, when severe flooding is expected. Under such conditions, there will be significant risk to life and property; and
- Warning no longer in force, when flood alerts or flood warnings are no longer in place.

Upon reaching an action trigger there is a built-in two-hour lead time before the onset of flooding. This lead time allows people to take remedial action in the face of an oncoming flood such as lifting carpets, moving furniture and evacuating buildings.

Properties covered by the Environment Agency's Flood Warning areas should consider signing up to FWD.

There are also other methods of flood warning dissemination which include:

- The Environment Agency's Floodline on 0845 988 1188. It offers callers the option to listen to recorded flood warning information 24 hours a day and to speak to a trained operator for more advice.
- The Environment Agency's [website](http://www.environment-agency.gov.uk/homeandleisure/floods/31618.aspx) contains live warning information (<http://www.environment-agency.gov.uk/homeandleisure/floods/31618.aspx>); and
- The media where flood warnings are issued and broadcasted on TV weather bulletins as well as on radio weather and travel reports. Flood warnings are also displayed on ITV Teletext regional weather pages (page 154) and on the BBC Ceefax (page 419).

4.6.2 Emergency planning and management

The Councils are encouraged to work with the Environment Agency to ensure that as many homeowners as possible are signed up to FWD and that any new properties are made aware of this service. Under the Civil Contingencies Act 2004, the Councils work with Northamptonshire County Council, and other organisations such as the police, fire and ambulance services during severe flood emergencies. The role and responsibilities for emergency planning is set out by legislation following the implementation of the Civil Contingencies Act 2004. The Act defines the term emergency as:

- An event or situation which threatens serious damage to human welfare;
- An event or situation which threatens serious damage to the environment; or
- War, terrorism, which threatens serious damage to security.

During flood events the Environment Agency and Local Authorities are to liaise closely and the Councils will implement a range of contingency plans to detail how local services are to work together to respond to any of incident or disaster. These plans include but are not limited to a Civil Emergency Manual, Flood Plan, and Emergency Communication plan.

Evacuation plans should be in place for those areas at an identified risk of flooding and should take into account that the occupiers are likely to lack local knowledge. The mobility of occupants also needs to be considered. Those proposing developments should take advice from the emergency services when producing an evacuation plan for the development as part of their FRA. Local Resilience Forums should ensure that flood risk is fully considered as part of their activities, including the resilience of emergency infrastructure required to operate during floods.

An assessment of the Flood Zones and location of emergency services, including police, ambulance, fire stations and command centres using the National Property Dataset has revealed that all emergency services are located in Flood Zone 1 as shown on **Figures 8ab** and **8b**. Therefore they will be able to support during emergency flood events.

With regards to reservoir safety, following the preparation of the reservoir inundation maps, emergency planners will be preparing specific plans over the next few years for

those that have been judged to be higher priority reservoirs. Top-tier local authorities will use these maps to manage the development of emergency flood plans with their Local Resilience Forum. These plans will be followed in the event of a dam breach.

In light of the above, all development proposed downstream of the reservoirs shown on **Figure 1** and detailed in **Section 3.5** should consider the residual risk associated with failure of the reservoir in a site-specific FRA. Particular attention should be given to access to and egress from the site.

4.7 Flood Resilience and Resistance

Where efforts to avoid and reduce flood risk have been exhausted, flood risk can be further managed by mitigating the damages caused by flooding on infrastructure and on buildings. This can be achieved by promoting flood resilience and flood resistance measures.

4.7.1 Flood resilience

The concept of flood resilience refers to the ability of a building to recover following inundation. Flood-resilient buildings are designed to reduce the consequences of flooding and facilitate recovery from the effects of flooding sooner than conventional buildings.

Flood resilience may be achieved through the use of water-resistant materials for floors, walls and fixtures or by ensuring electrical controls, cables and appliances are placed at a higher than normal level.

If the lowest floor level is raised above the predicted flood level, consideration must be given to providing access for those with restricted mobility. In considering appropriate resilience measures, it will be necessary to plan for specific circumstances and have a clear understanding of the mechanisms that lead to flooding and the nature of the flood risk. This information will need to be clearly explained in the FRA supporting the planning application.

4.7.2 Flood resistance

The concept of flood resistance refers to the ability of a building to keep floodwater from entering it, even if surrounded by it. Flood-resistant construction prevents the entry of water or minimises the amount of water that may enter a building where there is flooding outside and therefore relies on the operational deployment of flood defences at the property scale. These measures rely on the availability of a reliable flood forecasting and warning system, and well established mobilisation and closure processes.

This form of construction should be used with caution and accompanied by resilience measures, as effective flood exclusion may rely on the effective deployment of elements, such as barriers to doorways.

Buildings may also be damaged by water pressure or debris being transported by flood water. This may breach flood-excluding elements of the building and permit rapid

inundation. Temporary and demountable defences are not normally appropriate for new developments.

Resilient construction is favoured because it can be achieved more consistently and is less likely to encourage occupiers to remain in buildings surrounded by rapidly rising water levels, whereby making access for emergency services difficult and possibly hazardous.

Essential infrastructure which has to be located in flood risk areas should be designed to remain operational when floods occur.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The Boroughs of Kettering and Wellingborough are likely to undergo significant expansion as part of the growth proposals. Areas of new development will be centred on the larger towns of Kettering and Wellingborough, with further development in smaller settlements.

This Level 1 SFRA Update has considered all sources of flooding based on information gained through consultation with the Environment Agency, Anglian Water, Northamptonshire County Council, Kettering Borough Council and the Borough Council of Wellingborough in line with the requirements PPS 25. The Level 1 SFRA Update is thus compliant with PPS 25 and will inform land allocation and future flood risk management needs within the Boroughs.

A Level 2 SFRA for Kettering Town Centre has preceded the Level 1 SFRA Update for Kettering Borough. The Level 2 SFRA has been prepared to inform the preparation of LDDs for the Kettering Town Centre given the high nature of flood risk and potential development in that area. In particular, blockage risk at key hydraulic structures such as culverts and bridges, especially on urbanised watercourses, has been evaluated and where this risk is high further modelling work has been undertaken to identify flood extents and quantify the flood hazard. The Level 2 SFRA has also investigated whether strategic solutions (e.g. flood storage on the Slade Brook upstream of Kettering) are possible to allow development in Kettering Town Centre to come forward.

Flood zone maps have been prepared as part of this Level 1 SFRA Update (see **Figures 8a, 8b, 9a, 9b, 10a** and **10b**). These maps present predicted flood extents under both present-day (with and without defences) and climate change (with defences) scenarios. These maps show that a majority of potential development sites are located in Flood Zone 1. Some of them encroach partially in the higher risk flood zones. Thus, the sequential approach should be adopted at the site level in order to locate more vulnerable land uses in less vulnerable flood risk areas (i.e. Flood Zone 1). This is the first step in applying the sequential approach in the flood risk management hierarchy (Assess, avoid, substitute, control and mitigate). Alternatively, where large expanses are available in Flood Zone 1 site boundaries could be redefined to avoid areas of high flood risk. Should the sequential approach show that development cannot be accommodated in Flood Zone 1 then an Exception Test needs to be applied and therefore a more detailed Level 2 SFRA will need to be carried out. This is likely to be the case only for the Kettering Town centre AAP sites and the Level 2 SFRA for Kettering Town Centre should be used in that instance.

The information presented in this Level 1 SFRA is sufficient to inform the preparation of the LDDs for the Kettering Borough and no Level 2 SFRA is required for the wider Kettering Borough at this stage.

Similarly, the information presented in this Level 1 SFRA is sufficient to inform the preparation of the LDDs for the Borough of Wellingborough and no Level 2 SFRA is required at this stage.

Fluvial flood risk in the Boroughs has historically been the dominant source of flood risk, with significant flooding occurring in March 1947, Easter 1998 and July 2007. Flood risk zones along the main river corridors have been mapped, including the functional floodplain, as per PPS 25. In urbanised areas such as Kettering and Wellingborough, watercourses are heavily culverted rendering the risk of blockage high. Also, a number of raised defences have been identified in Wellingborough. It is not clear whether these are formal engineered flood defences but breaching of the defences is not a concern as there are no areas benefiting from them. With climate change, fluvial flood risk will increase.

Surface water flooding has also been identified as a key constraint on development. A number of instances of surface water flooding have been reported, most of them occurring in the larger settlements of Kettering and Wellingborough. New developments will therefore need to address surface water management, ensuring that, at the very least, runoff from new development is not increased and, if possible, is reduced. This will be achieved through careful design of the site lay-out and drainage system, giving due consideration to the implementation of SuDS solutions where appropriate. Detailed site investigation and infiltration tests will be needed to clarify the permeability of the soil and design infiltration systems.

The risk of groundwater flooding has generally been deemed low although use should be made of local, site-specific information in the preparation of FRAs to ensure this source of flood risk is appropriately addressed.

Finally, there are three former water supply reservoirs in the catchment which are the responsibility of Northamptonshire County Council. These reservoirs fall within the Reservoirs Act 1975 as amended by the Flood and Water Management Act 2010 and may pose a residual flood risk to local communities. Flood risk from these reservoirs should be incorporated within site-specific FRAs where relevant. This is in addition to the requirements for considering residual risks from FSRs.

5.2 Recommendations

5.2.1 Policy recommendations

The flood risk mapping produced by this SFRA should inform allocations in the Development Plan Documents and aid the location of development in the least vulnerable areas. In addition they should form the basis for Sequential Testing and assessment of future proposals for development.

All new development within the Boroughs should contribute to the reduction of surface water flood risk. For greenfield sites, this will be achieved by restricting runoff to the greenfield runoff rates. For brownfield sites, this will be achieved by restricting runoff to the pre-development rate with a reduction where possible to provide betterment as recommended by PPS 25. Management of surface runoff from the proposed development sites should use a combination of site-specific and strategic SuDS measures encouraging source control where possible.

Within the River Nene Corridor, joint-working between the Environment Agency, The River Nene Wildlife Trust and Anglian Water should be promoted to maximise opportunities for a green corridor and deliver benefits for flood risk reduction, water quality, amenity and habitat improvement.

Consultation with the Environment Agency and developers is required to discuss the possibility of implementing strategic flood alleviation measures, such as flood storage reservoirs on the Slade Brook and the River Ise, to reduce fluvial flood risk.

An appropriate site-specific flood risk assessment will be required for development proposals of 1 hectare or greater in Flood Zone 1 and for all proposals for new development located in Flood Zones 2 and 3 to demonstrate how flood risk from all sources of flooding (e.g. fluvial, surface water, groundwater, reservoirs) to the development itself and flood risk to others will be managed now and taking climate change into account. The site-specific FRA should build on the information included in this updated Level 1 SFRA, the surface water flood map as well as consider other relevant aspects of the evidence base including the North Northants Water Cycle Strategy and any forthcoming SWMPs.

Until the SWMPs have been prepared, it will not be possible to identify the sites which require improvements to be delivered through the SWMPs. Thus, all development sites which have experienced surface water flooding or where an issue with surface water is known should not be taken forward until the SWMPs have been completed and solutions to deal with surface water have been identified.

This SFRA relies upon the policy framework set out by PPS 25 to provide adequate protection from flooding and attenuation of surface water. Should PPS 25 be significantly altered, local planning policy will need to put in places across the Boroughs of Kettering and Wellingborough that adopts similar principles and policies. Alternatively, consideration will need to be given to carrying out further SFRA work to evidence a new set of policies to complement any new higher level steer on flood risk management.

5.2.2 Recommendations for further work

Across the Boroughs, further work is needed to appraise strategic flood defence measures and to confirm if potential development sites require flood storage schemes to allow them to come forward. Contributions from developers towards the implementation of these measures should be sought. As a priority, further strategic work on flood risk management should investigate opportunities for climate change adaptation and flood risk reduction through furthering the recommendations of the North Northants Flood Risk Management Strategy.

Options to improve existing flood storage facilities should also be investigated by developers.

Consideration should be given to the preparation of a Surface Water Management Plan (SWMP) for the Kettering Town Centre considering flood risk from existing sewer systems and land surrounding the town, as well as the additional pressures placed due to new development and climate change. This should consider the potential impacts of climate change and be incorporated with the water cycle strategies.

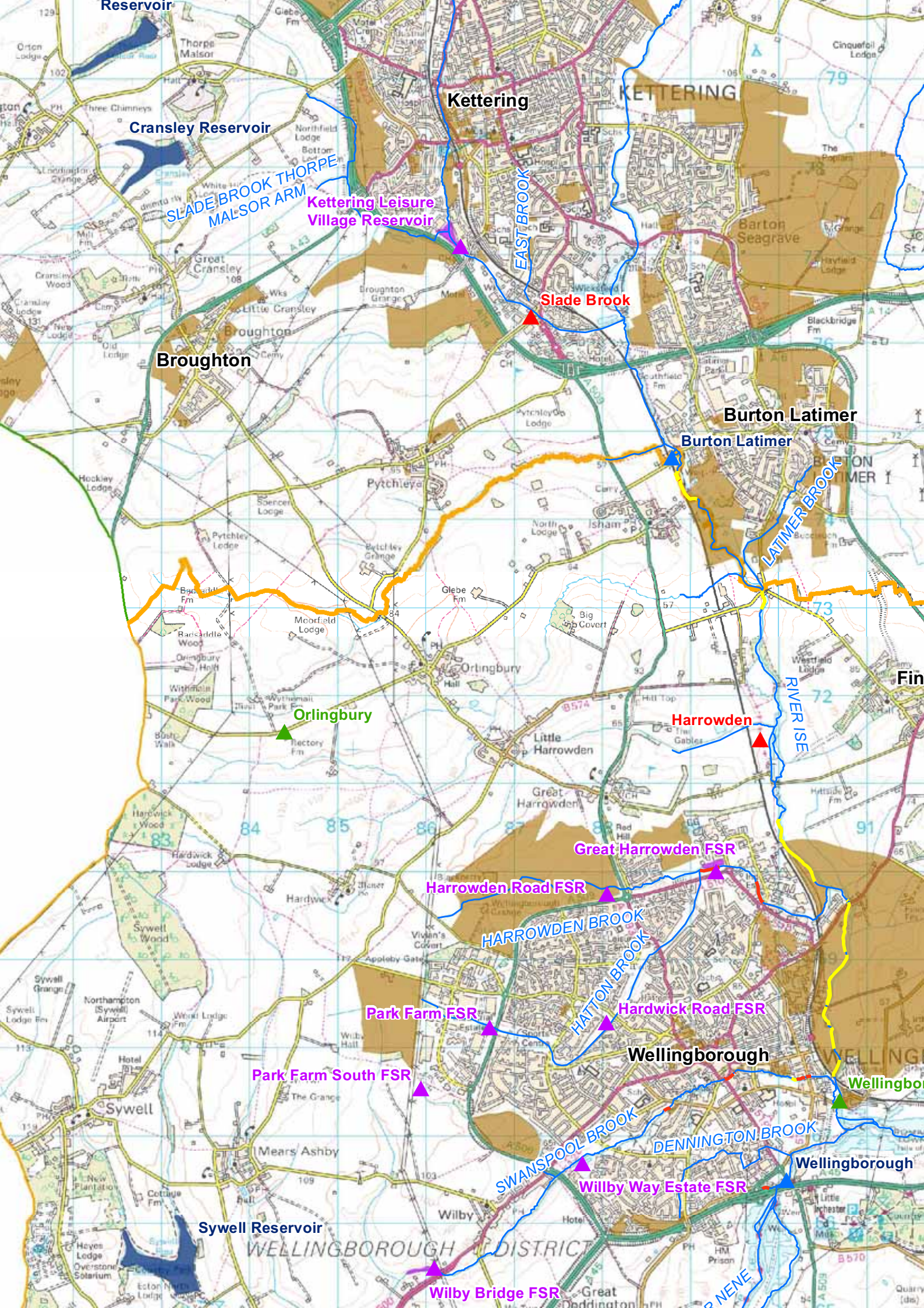
In light of a number of issues with surface water flooding in the Borough, consideration should be given to the preparation of a surface water management plan (SWMP) for the Borough of Wellingborough, considering flood risk from existing sewer systems and land surrounding the town, as well as the additional pressures placed due to new development and climate change. This should consider the potential impacts of climate change and be incorporated with the water cycle strategies. The SWMPs should be prepared by the Northamptonshire Flood and Water Management Partnership and should make use of the surface water flood map.

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Cransley Reservoir

SLADE BROOK THORPE
MALSOR ARM

Kettering Leisure
Village Reservoir

Kettering

KETTERING

EAST BROOK

Slade Brook

Broughton

Burton Latimer

Burton Latimer

LATIMER BROOK

Orlingbury

Harrowden

RIVER ISE

Great Harrowden FSR

Harrowden Road FSR

HARROWDEN BROOK

Park Farm FSR

Hardwick Road FSR

Wellingborough

Park Farm South FSR

Wellingborough

Sywell Reservoir

WELLINGBOROUGH DISTRICT

Wilby Bridge FSR

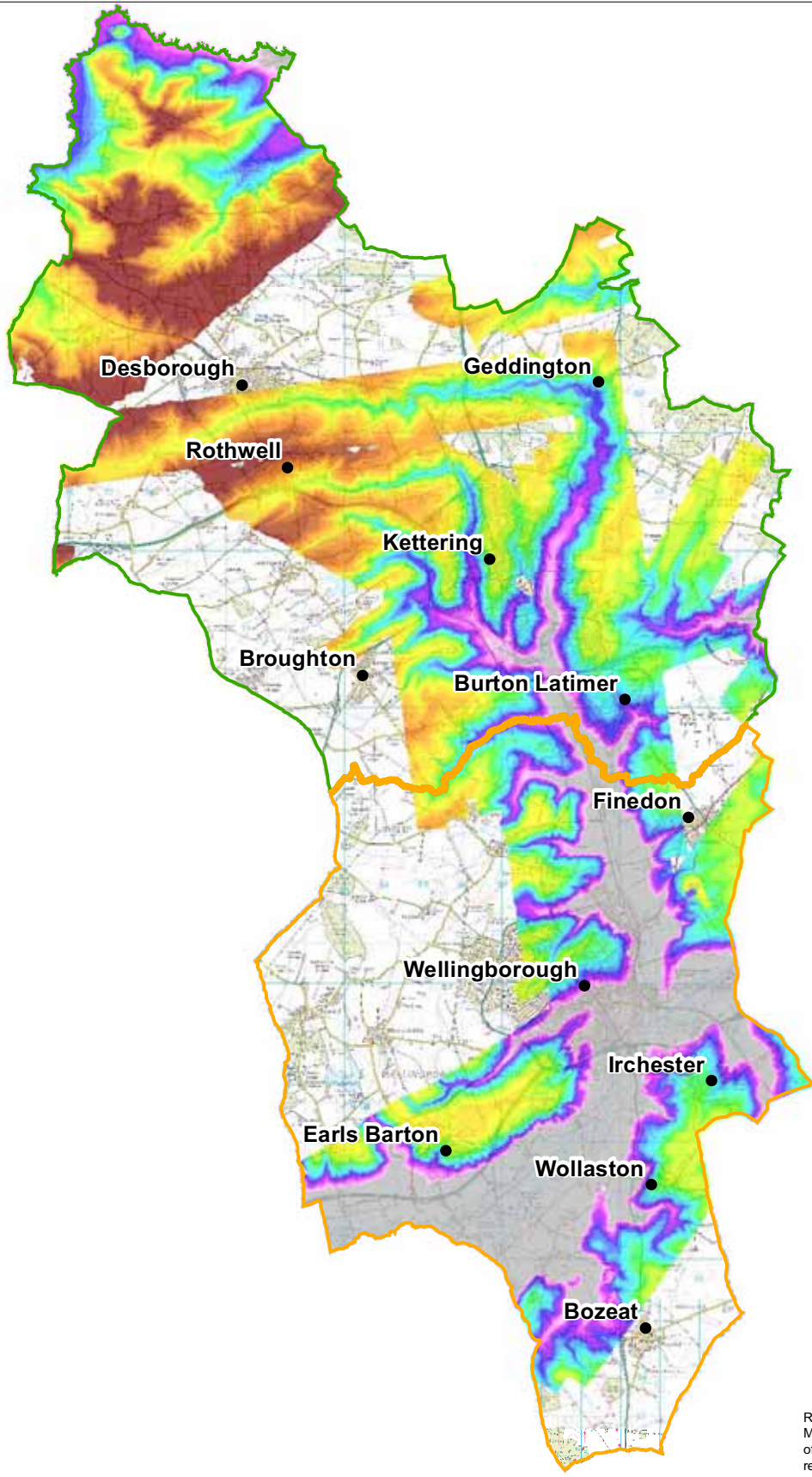
Wilby Way Estate FSR

Wellingborough

SWANSPOOL BROOK



DENNINGTON BROOK

RIVER NENE






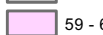





















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Key:

-  Borough of Wellingborough boundary
-  Kettering Borough boundary

LIDAR

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	62.1 - 64		76.1 - 80		105.1 - 110
	64.1 - 65		80.1 - 82		110.1 - 115
	65.1 - 68		82.1 - 84		115.1 - 120
	68.1 - 70		84.1 - 86		120.1 - 125
			86.1 - 88		125.1 - 130
			88.1 - 90		130.1 - 135

Title:

Topography of the Boroughs

Project:

Kettering and Wellingborough Level 1 SFRA Update

Client:

Kettering Borough Council and the Borough Council of Wellingborough

Date:

February 2011

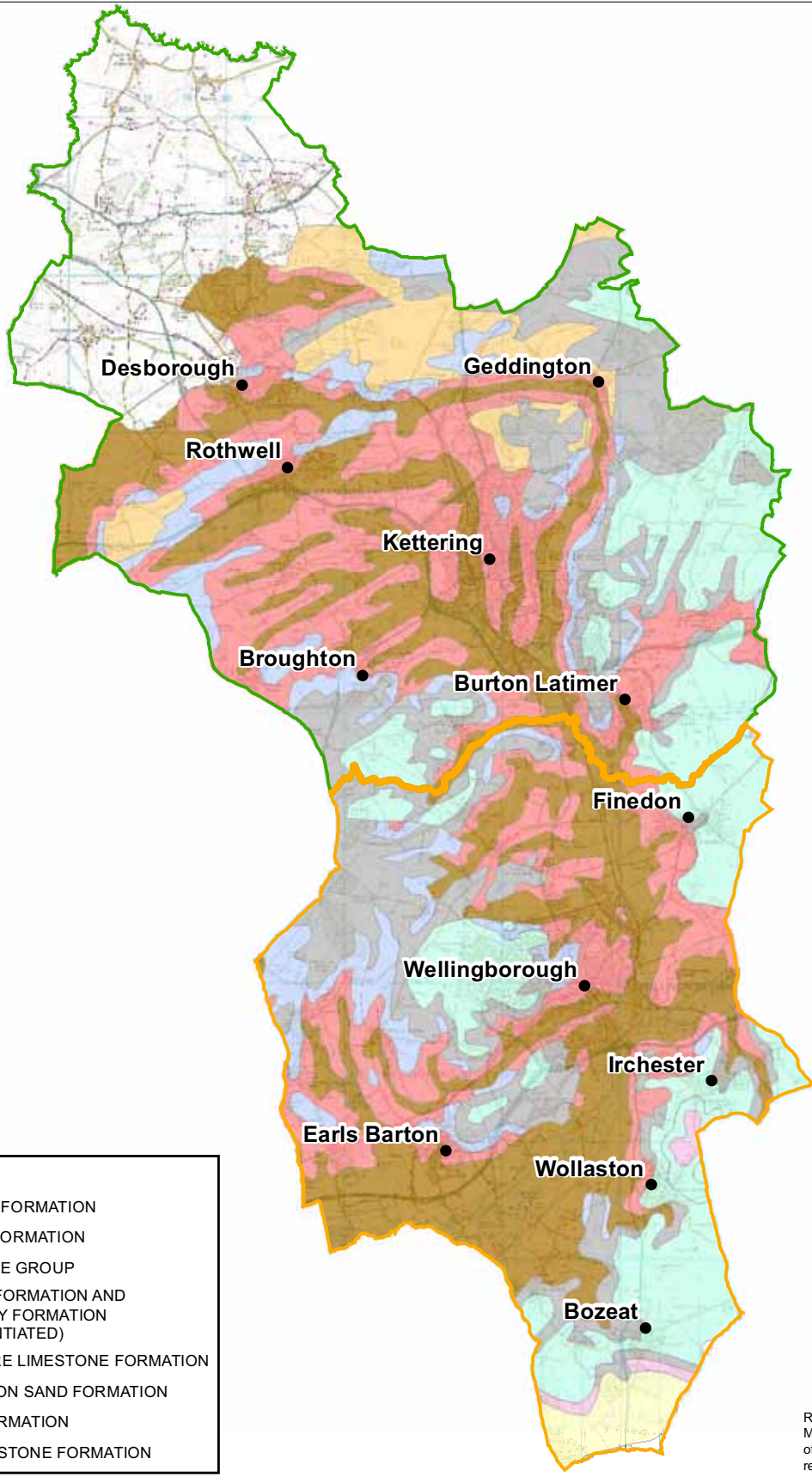
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





Figure:

2







Bedrock geology

-  CORNBRAsh FORMATION
-  GRANTHAM FORMATION
-  GREAT OOLITE GROUP
-  KELLAWAYS FORMATION AND OXFORD CLAY FORMATION (UNDIFFERENTIATED)
-  LINCOLNSHIRE LIMESTONE FORMATION
-  NORTHAMPTON SAND FORMATION
-  RUTLAND FORMATION
-  WHITBY MUDSTONE FORMATION

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- Key:
-  Borough of Wellingborough boundary
 -  Kettering Borough boundary

Title:
Bedrock geology of the Boroughs

Project:
Kettering and Wellingborough Level 1 SFRA Update

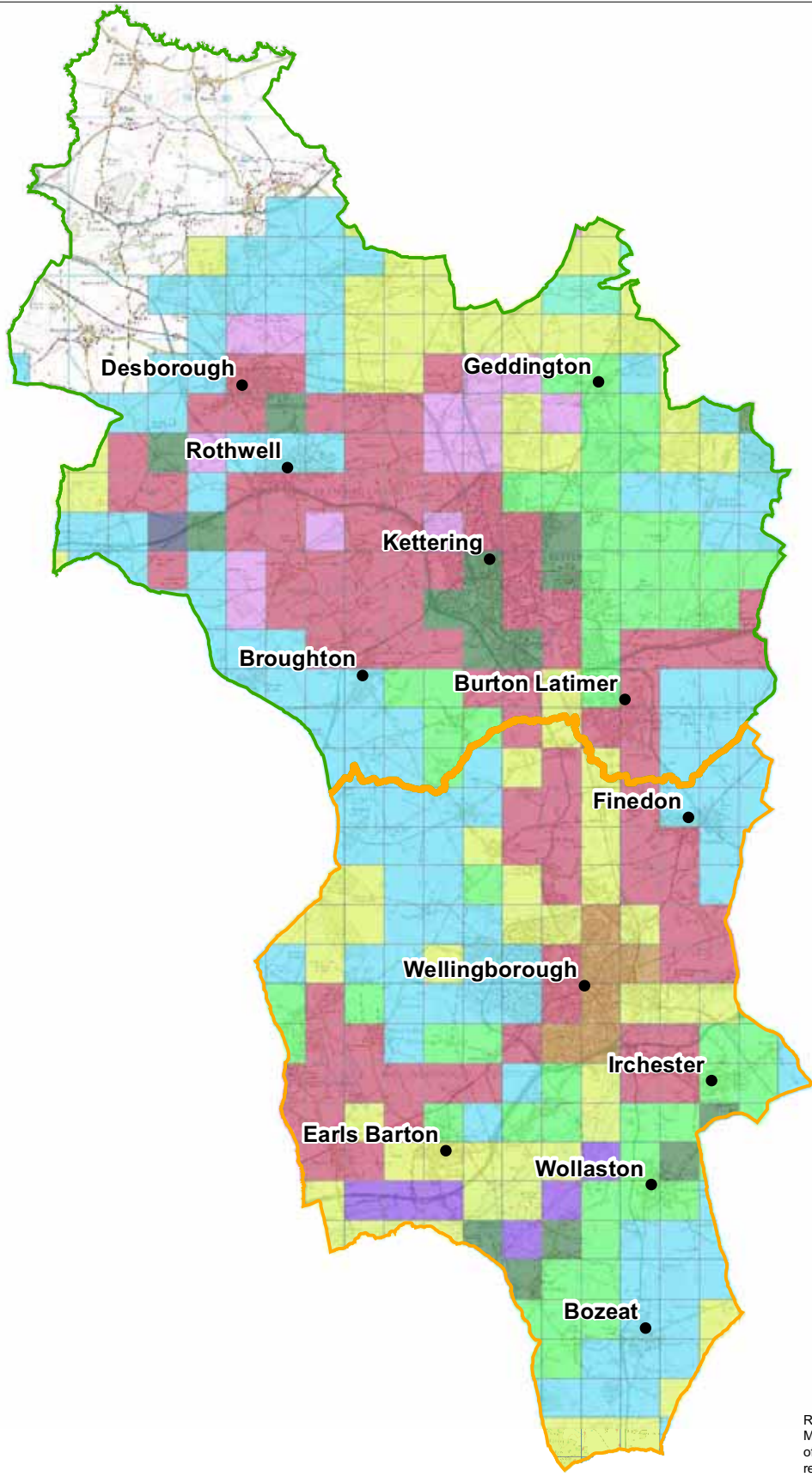
Client:
Kettering Borough Council and the Borough Council of Wellingborough

Date:
February 2011



Scale:
1: 165,000 @ A4

Figure:
3





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Key:  Borough of Wellingborough boundary
 Kettering Borough boundary

Soil geology

- | | |
|--|---|
|  Loam over limestone |  Clayey over limestone |
|  Loam over sandstone |  Deep clay |
|  Restored following ironstone working |  Deep loam |
|  Seasonally wet deep clay |  Deep loam to clay |
|  Shallow clay over limestone |  Loam over gravel |

Title:
Soil geology of the Boroughs

Project:
Kettering and Wellingborough
Level 1 SFRA Update

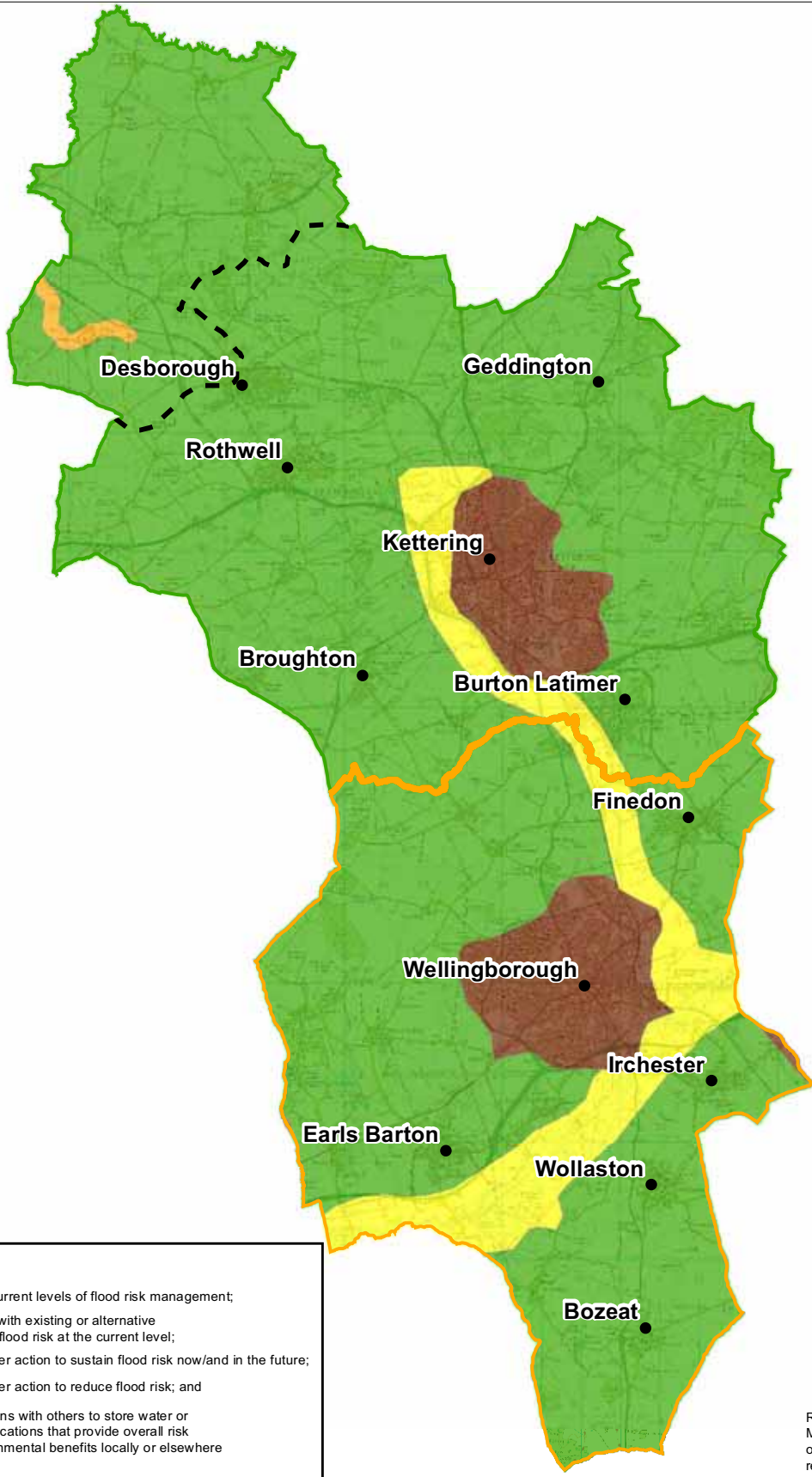
Client:
Kettering Borough Council and the
Borough Council of Wellingborough






Date:
February 2011

Scale:
1: 165,000 @ A4




Figure:
4





- CFMP policies**
-  Policy 2: Reduce current levels of flood risk management;
 -  Policy 3: Continue with existing or alternative actions to manage flood risk at the current level;
 -  Policy 4: Take further action to sustain flood risk now/and in the future;
 -  Policy 5: Take further action to reduce flood risk; and
 -  Policy 6: Take actions with others to store water or manage runoff in locations that provide overall risk reduction or environmental benefits locally or elsewhere in the catchment.

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- Key:
-  Borough of Wellingborough boundary
 -  Kettering Borough boundary
 -  Boundary between the Nene catchment to the south and the Welland catchment to the north

Title:
CFMP policies within the Boroughs

Project:
Kettering and Wellingborough Level 1 SFRA Update

Client:
Kettering Borough Council and the Borough Council of Wellingborough

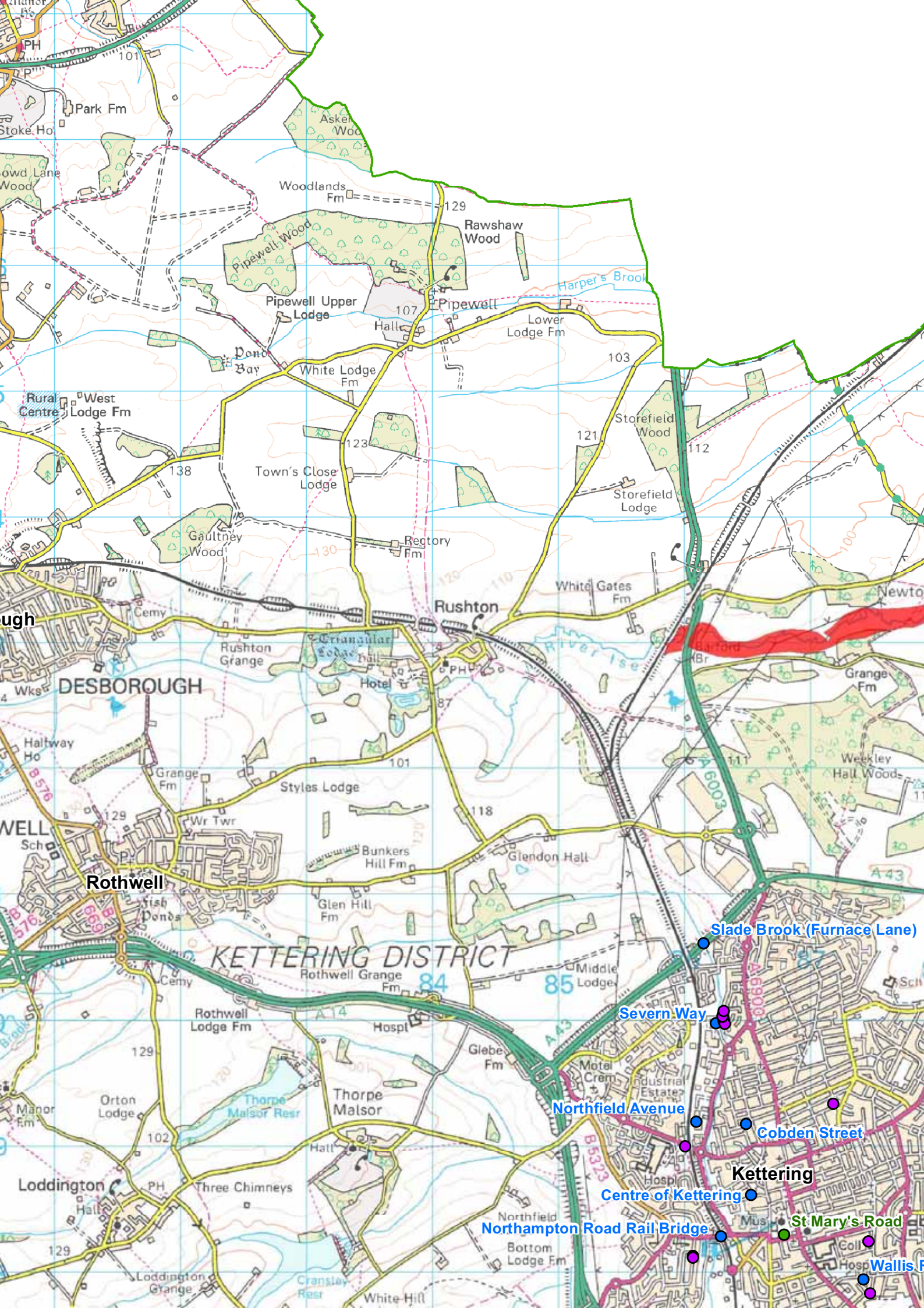
Date:
February 2011

Scale:
1: 165,000 @ A4

Figure:
5



ROYAL HASKONING



PH

101

Park Fm
Stoke Ho

Wood Lane
Wood

Woodlands Fm

Asker Wood

Rawshaw Wood

Pipewell Wood

Pipewell Upper Lodge

Pipewell

Lower Lodge Fm

Harper's Brook

Rural Centre
West Lodge Fm

White Lodge Fm

Town's Close Lodge

Gaultney Wood

Restory Fm

Storefield Wood

Storefield Lodge

ugh

DESBOROUGH

Rushton

Rushton Grange

Grange Hall

Hotel

White Gates Fm

Newto

WELL

Rothwell

KETTERING DISTRICT

Slade Brook (Furnace Lane)

Severn Way

Northfield Avenue

Cobden Street

Kettering

Centre of Kettering

Northampton Road Rail Bridge

St Mary's Road

Wallis F

Loddington

Three Chimneys

Thorpe Malsor

Glebe Fm

Motel Crem

Industrial Estates

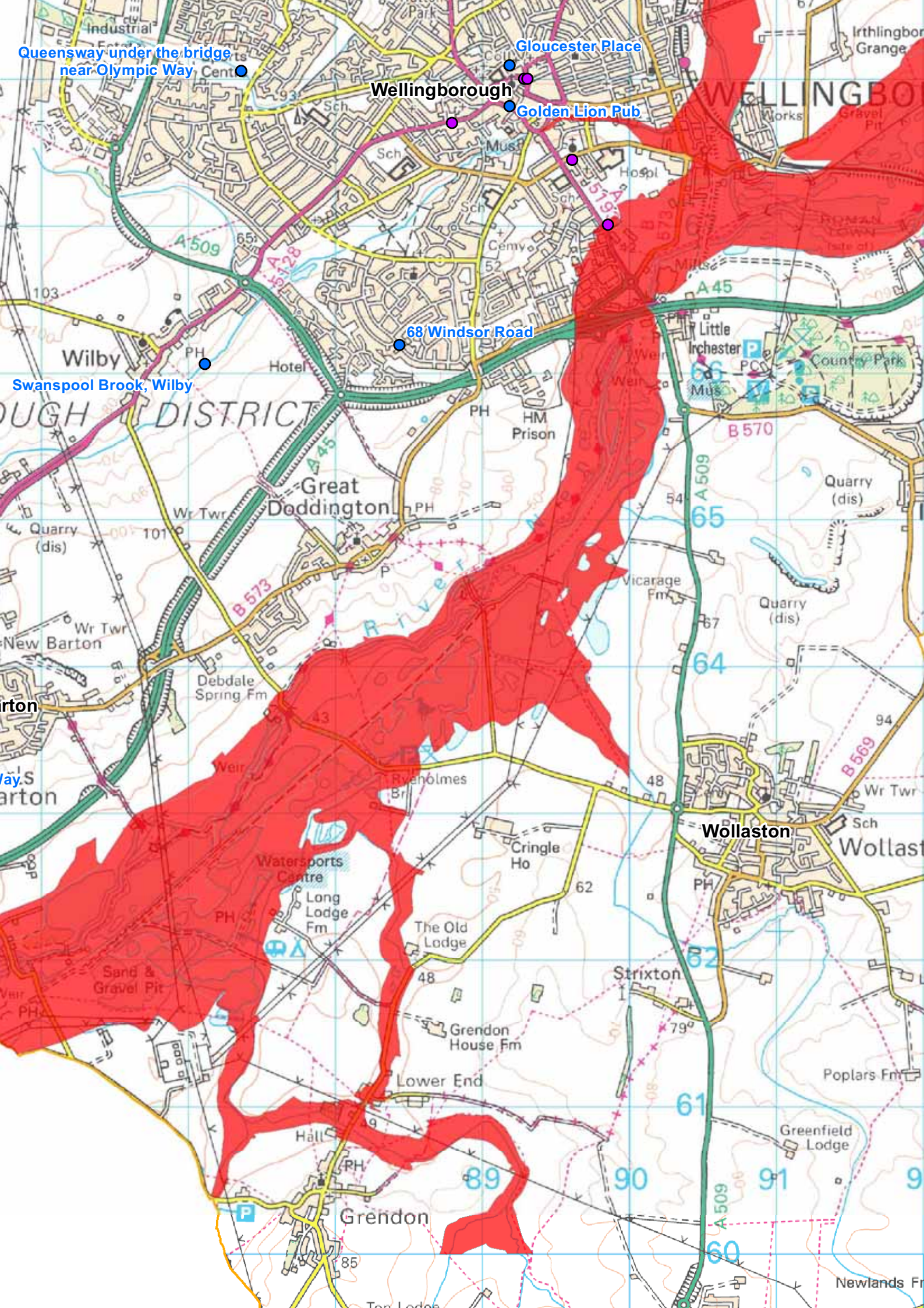
Bottom Lodge Fm

White Hill

Loddington Grange

Cransley Resr

White Hill



Queensway under the bridge
near Olympic Way Cent

Gloucester Place

Wellingborough

Golden Lion Pub

68 Windsor Road

Swanspool Brook, Wilby

WELLINGBOROUGH DISTRICT

Great Doddington

Wollaston

Grendon

Newlands Fr



Kettering

KETTERING

Broughton

Burton Latimer

BURTON LATIMER

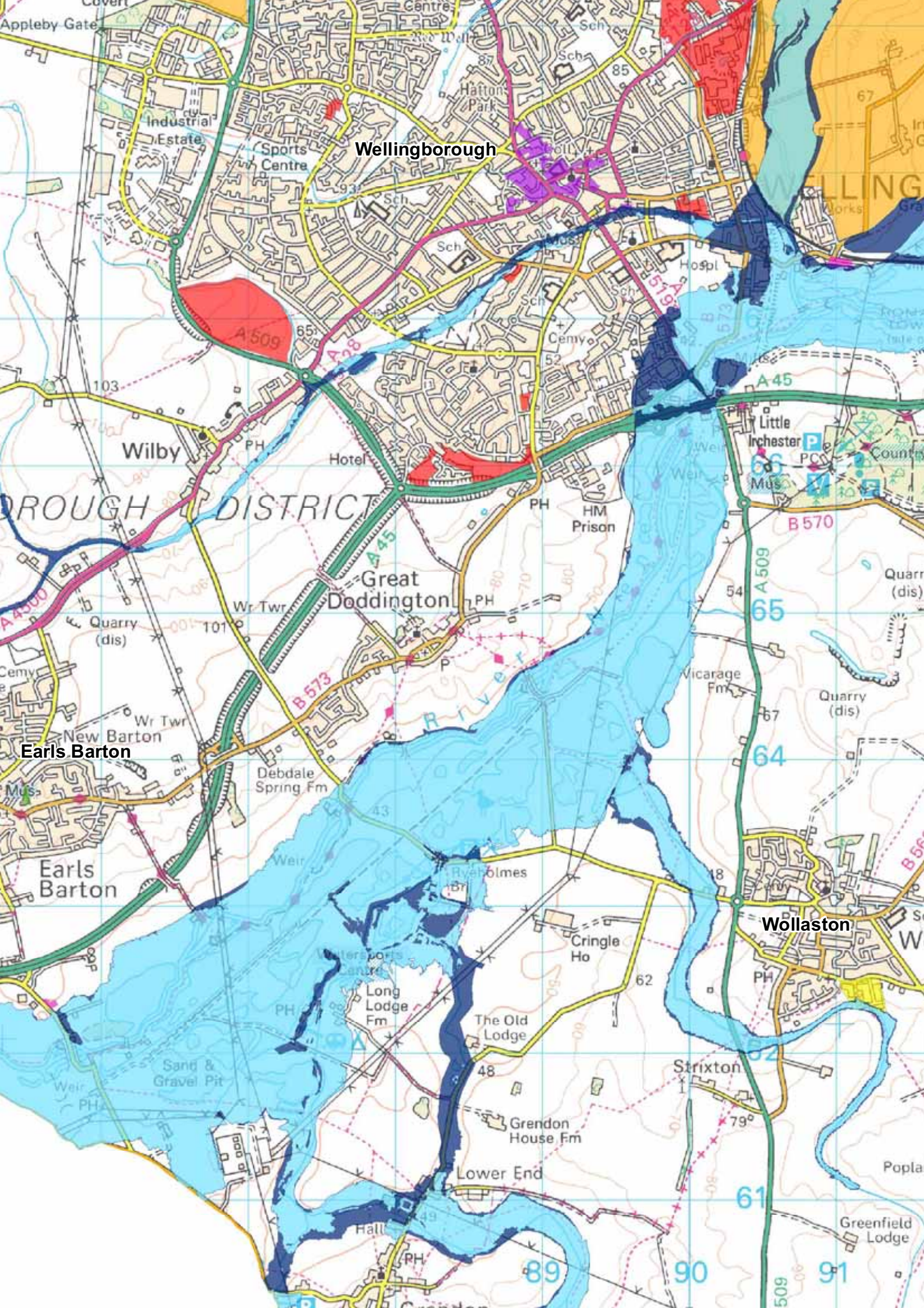
Fineldon

Wellingborough

WELLINGBOROUGH

WELLINGBOROUGH DISTRICT





Wellingborough

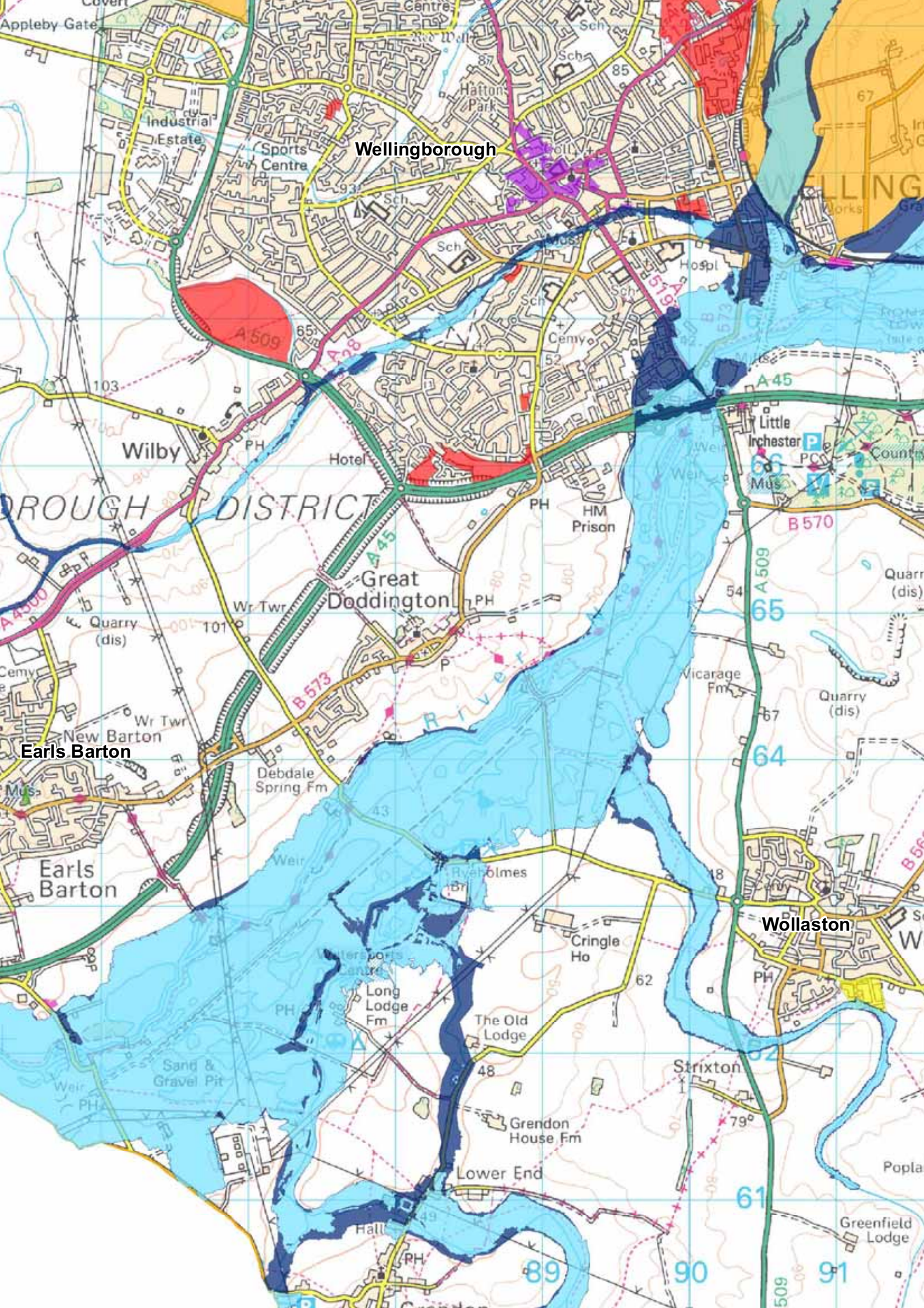
Wilby

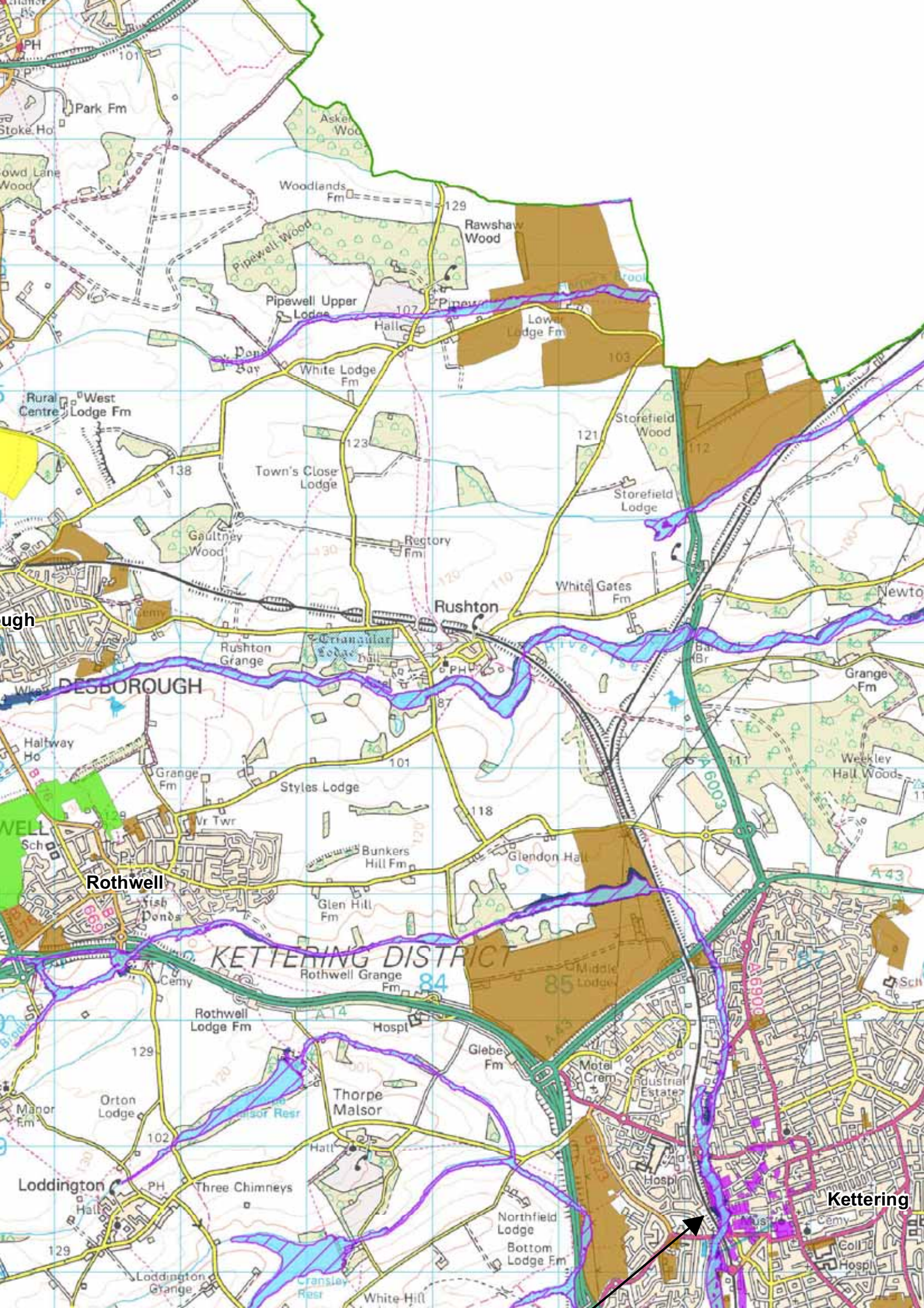
Great Doddington

Earls Barton

Earls Barton

Wollaston





Kettering

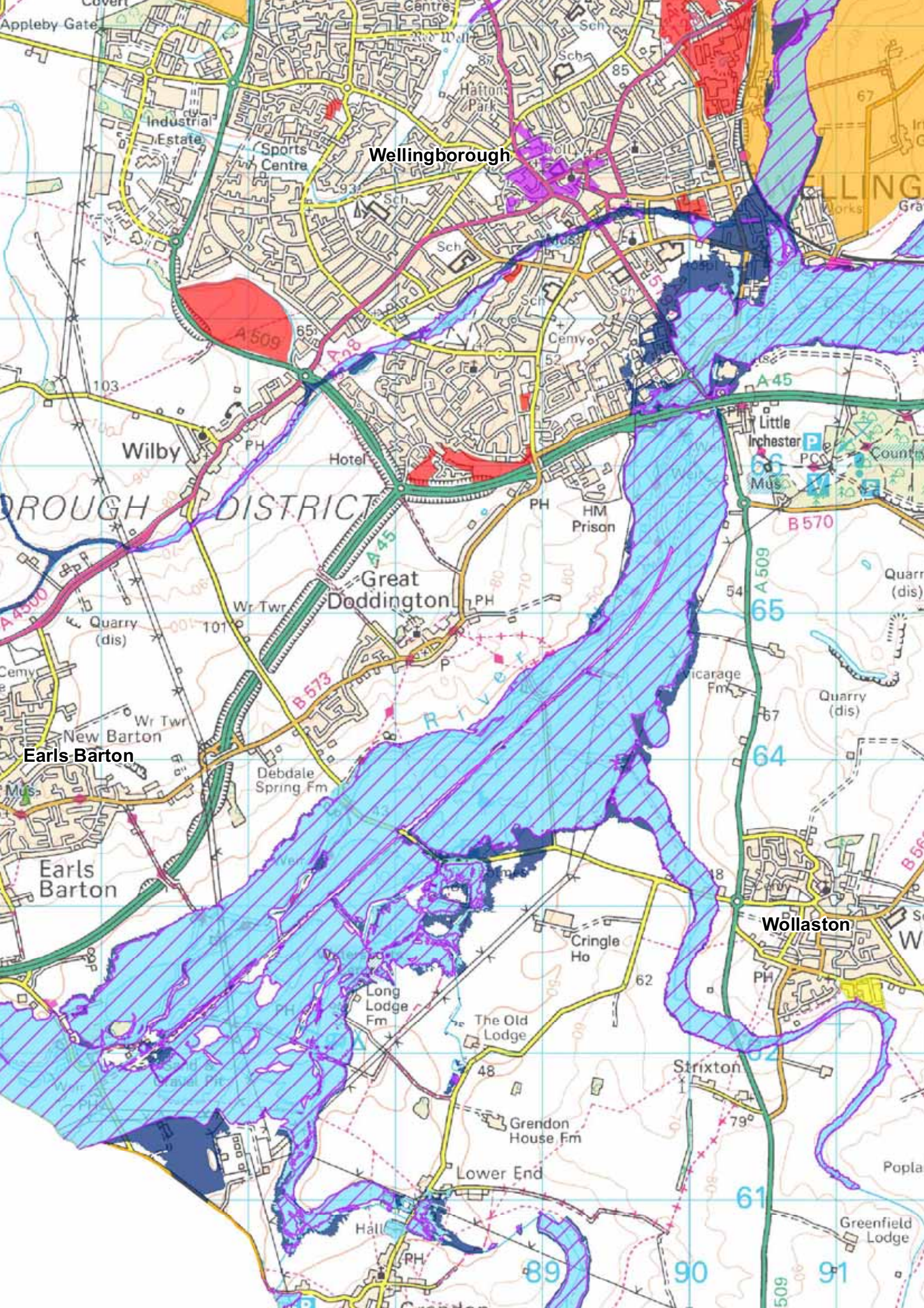


Rothwell

DESBOROUGH

Rushton

KETTERING DISTRICT



Wellingborough

Wilby

Great Doddington

Earls Barton

Wollaston

Appleby Gate

Industrial Estate

Sports Centre

Hatton Park

Little Ilchester

ROUGH DISTRICT

New Barton

Earls Barton

Long Lodge Fm

The Old Lodge

Grendon House Fm

Lower End

Strixton

Hall

Greenfield Lodge

A509

A45

A45

B570

B573

A509

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62

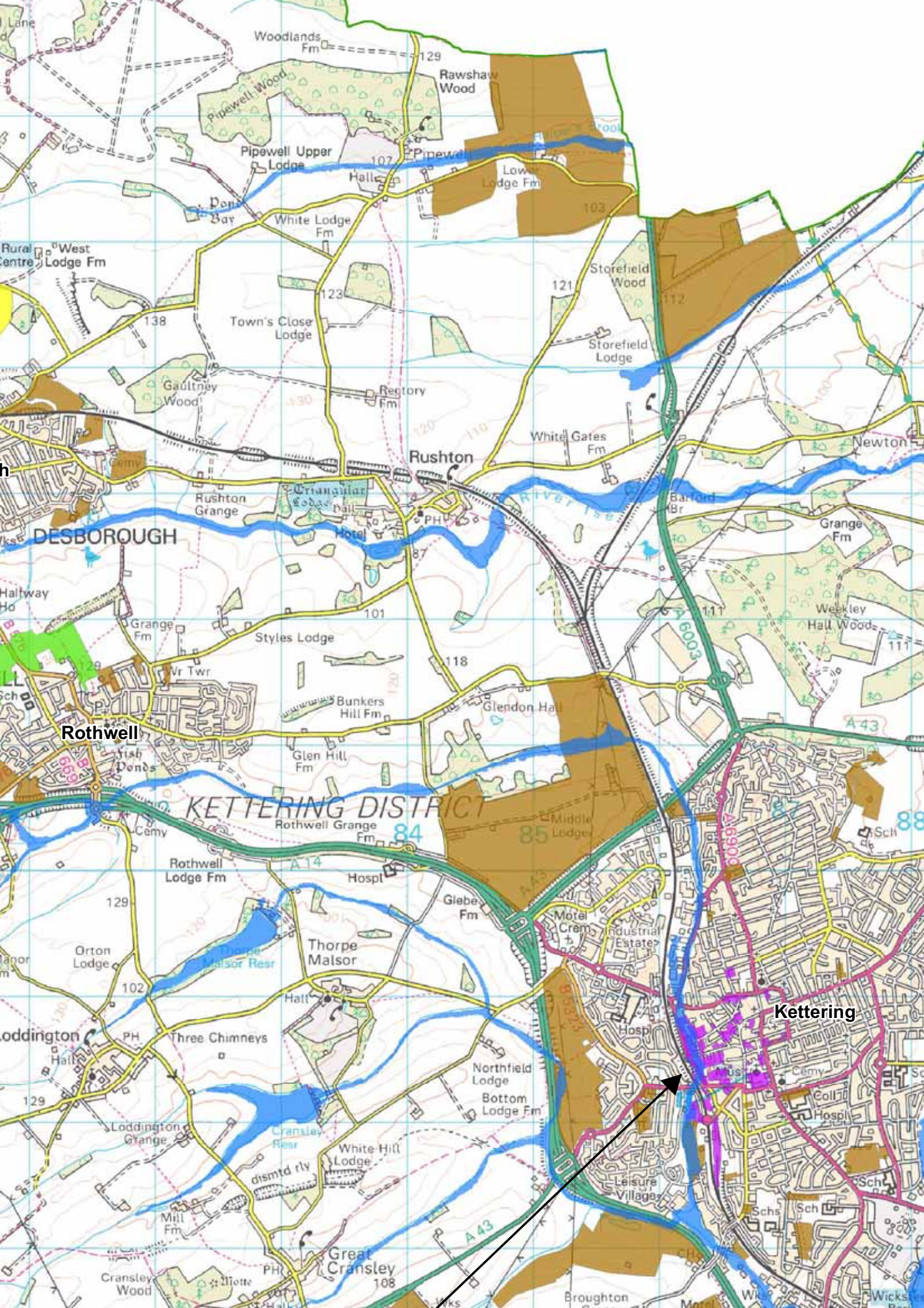
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DESBOROUGH

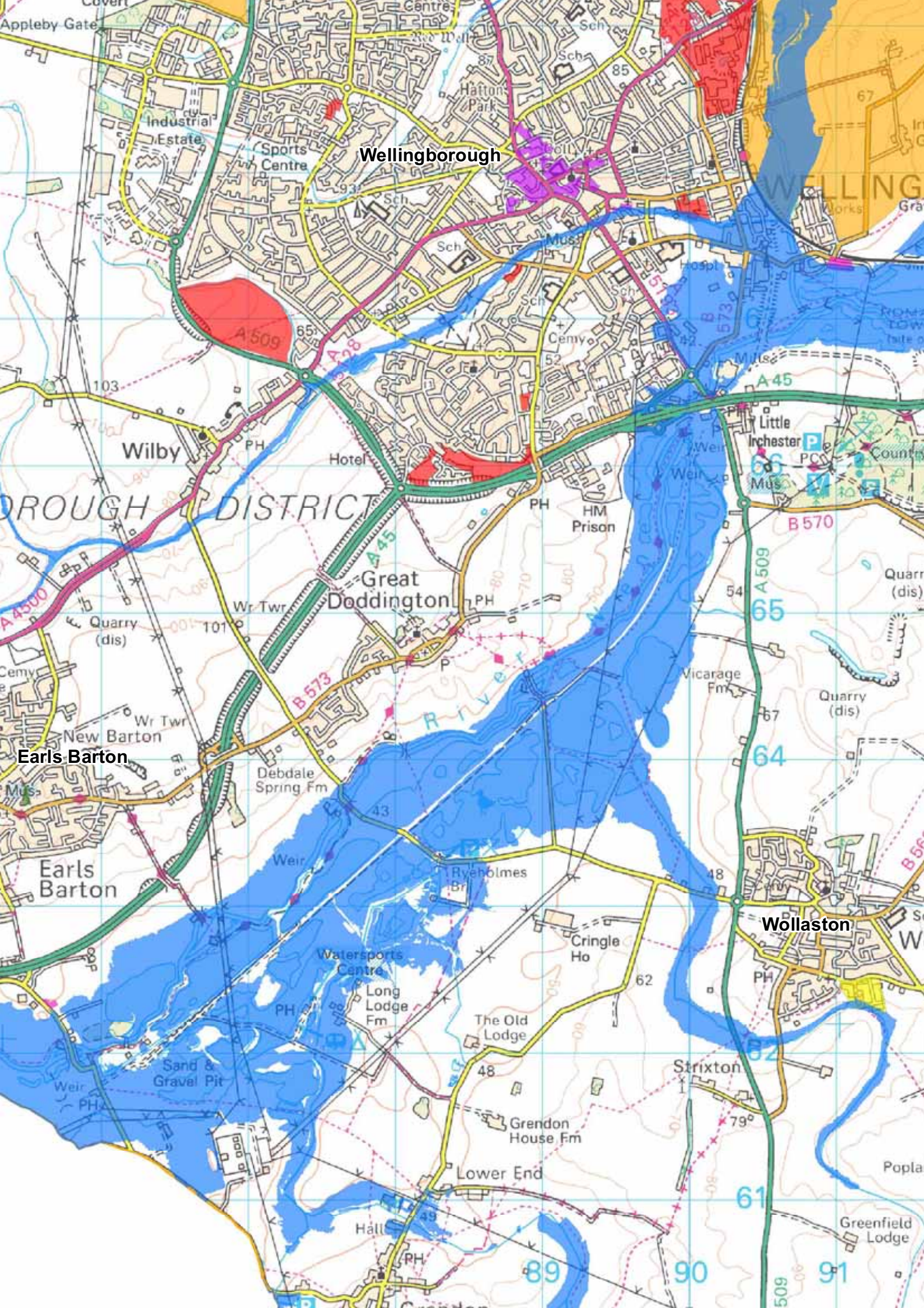
Rothwell

Rushton

KETTERING DISTRICT

Kettering





Wellingborough

Wilby

Great Doddington

Earls Barton

Earls Barton

Wollaston

ROUGH DISTRICT

WELLING

Watersports Centre

Long Lodge Fm

The Old Lodge

Lower End

Grendon House Fm

Hall

Strixton

Greenfield Lodge

Popla

Quarry (dis)

Quarry (dis)

Quarry (dis)

Quarry (dis)

Quarry (dis)

Quarry (dis)

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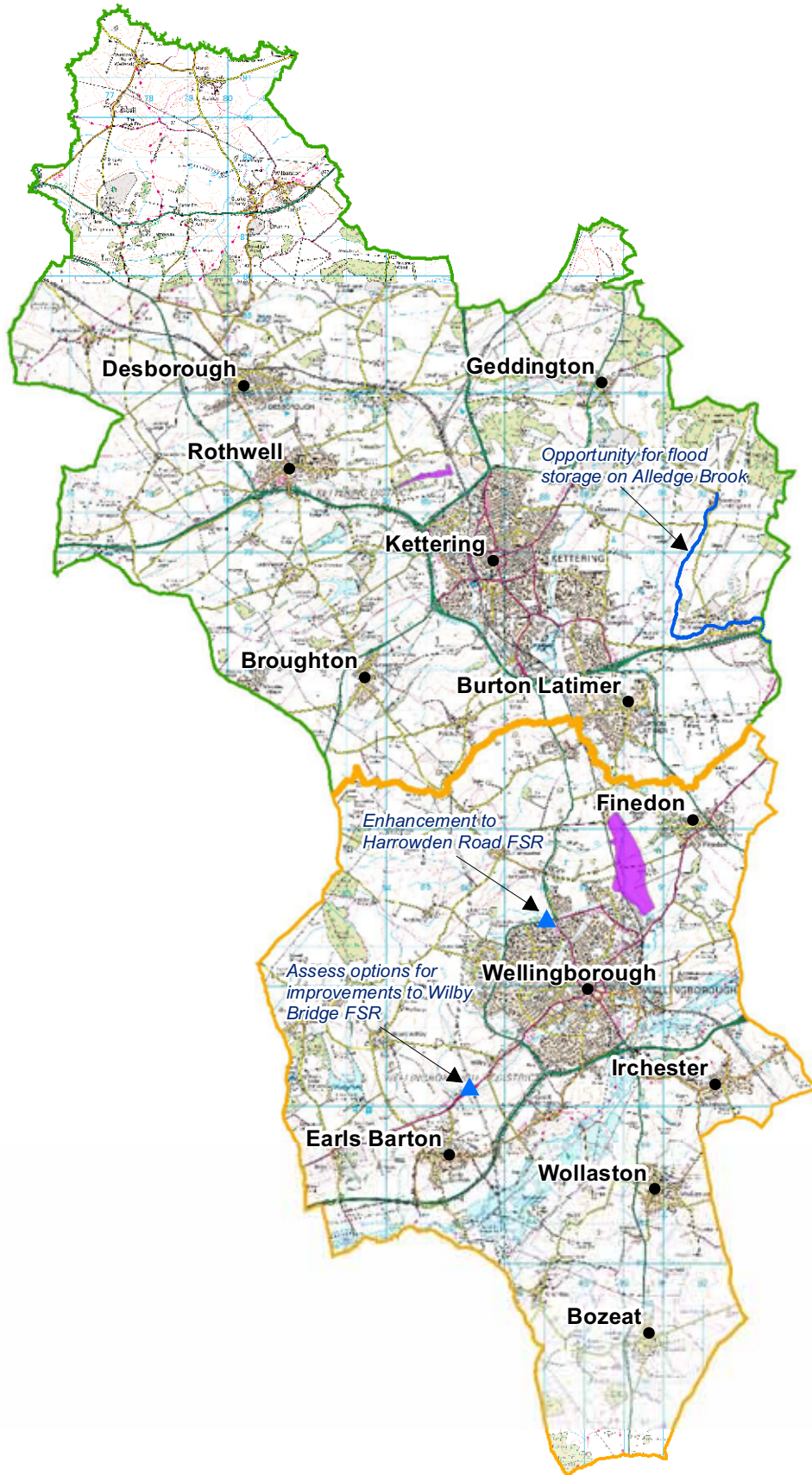
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Key:

-  Borough of Wellingborough boundary
-  Kettering Borough boundary
-  Possible flood storage reservoirs

Title:
Strategic flood defence infrastructure

Project:
Kettering and Wellingborough
Level 1 SFRA Update

Client:
Kettering Borough Council and the
Borough Council of Wellingborough

Date:
February 2011

Scale:
1: 165,000 @ A4

Figure:
12



APPENDICES

Appendix A - Potential Development Sites in Kettering Borough

Potential Development Site	Town	Development Type	Part of Kettering Town Centre AAP?
Kettering East	Kettering	Sustainable Urban Extension	No
Convent Site, Hall Lane	Kettering	SHLAA Category 1 Site	No
Elm Bank, Northampton Road	Kettering	SHLAA Category 1 Site	No
Rockingham Dene site, Furnace Lane	Kettering	SHLAA Category 1 Site	No
66 The Headlands	Kettering	SHLAA Category 1 Site	No
Site very bottom of Furnace 83 Lane by railway bridge	Kettering	SHLAA Category 1 Site	No
Scott Road Garages	Kettering	SHLAA Category 1 Site	No
Silver Acre allotments	Kettering	SHLAA Category 1 Site	No
Kettering Borough Council Municipal Offices, Police Station & Magistrates Court, London Road	Kettering	SHLAA Category 1 Site	Yes
Newlands Phase 1	Kettering	SHLAA Category 1 Site	Yes
Wadcroft,	Kettering	SHLAA Category 1 Site	Yes
Western Quarter Site D	Kettering	SHLAA Category 1 Site	Yes
Western Quarter Site H	Kettering	SHLAA Category 1 Site	Yes
Western Quarter Site I	Kettering	SHLAA Category 1 Site	Yes
Western Quarter Site K	Kettering	SHLAA Category 1 Site	Yes
Western Quarter Site N / Stagecoach Site	Kettering	SHLAA Category 1 Site	Yes
Western Quarter Site O	Kettering	SHLAA Category 1 Site	Yes
Kettering Football Club, Rockingham Road	Kettering	SHLAA Category 1 Site	No
Ferndale Residential Home, 17 Headlands	Kettering	SHLAA Category 1 Site	No
Seddon Packaging & Print LTD, Dryden Street	Kettering	SHLAA Category 1 Site	Yes
Butchers Lane	Pytchley	SHLAA Category 1 Site	No
Land to the east of nos 1 and 3 St. Botolphs Road, Barton Seagrave	Kettering	SHLAA Category 1 Site	No
Land to the Rear of Wed Wells/Off Rochester Close, Barton Seagrave	Kettering	SHLAA Category 1 Site	No
Thurston Drive Extension	Kettering	SHLAA Category 1 Site	No
West Hill (off Northampton Road)	Kettering	SHLAA Category 1 Site	No
Kettering Town Cricket Sports and Social Club, Lake Avenue	Kettering	SHLAA Category 1 Site	No
Kettering Fire Station, Headlands	Kettering	SHLAA Category 1 Site	No
Alternative SUE South East of Corby	Corby	SHLAA Category 2 Site	No
BL Site 10. Alumasc playing fields and adjacent land to south west	Burton Latimer	SHLAA Category 2 Site	No
BL Site 11. Higham Road (Land Adjacent to The Bungalow)	Burton Latimer	SHLAA Category 2 Site	No
BL Site 12.Land adjacent to 51 Finedon Road	Burton Latimer	SHLAA Category 2 Site	No
BL Site 20. Site to the rear of 23 Regent Road)	Burton Latimer	SHLAA Category 2 Site	No
BL Site 21. Land adjacent to Lansom Close / Cranford Road)	Burton Latimer	SHLAA Category 2 Site	No
BL Site 22.Land to the rear of 2 to 20 Bridle Road (gardens)	Burton Latimer	SHLAA Category 2 Site	No
Lawrences Factory, Gladstone Street,	Desborough	SHLAA Category 2 Site	No
Land to the rear of 71 Braybrooke Road	Desborough	SHLAA Category 2 Site	No
Land off Netherfield Road	Kettering	SHLAA Category 2 Site	No
Whiteford Drive	Kettering	SHLAA Category 2 Site	No
Allotments at Windmill Avenue,	Kettering	SHLAA Category 2 Site	No
Western Quarter Site B	Kettering	SHLAA Category 2 Site	Yes
Shotwell Mill Lane (rear gardens of properties on & allotments)	Rothwell	SHLAA Category 2 Site	No
Cooper's Coaches, Desborough Road	Rothwell	SHLAA Category 2 Site	No
Land off Linley Drive,	Rothwell	SHLAA Category 2 Site	No
Land at Harrington Road	Desborough	SHLAA Category 2 Site	No
Land south east of Northampton Road		SHLAA Category 2 Site	No
Land east of railway station	Kettering	SHLAA Category 2 Site	Yes
Land south of Harrington Road	Rothwell	SHLAA Category 2 Site	No
Land off Harborough Road	Desborough	SHLAA Category 2 Site	No
Desborough Site 3, South of Pipewell Road	Desborough	SHLAA Category 2 Site	No
Desborough Site 2, South of Pipewell Road	Desborough	SHLAA Category 2 Site	No
Gate Lane	Broughton	SHLAA Category 2 Site	No
Land to the south of Pioneer Avenue and west of Rothwell Road	Desborough	SHLAA Category 2 Site	No
Land to the north west of Burton Latimer, Hogs Hollow, Hawthorn Road	Burton Latimer	SHLAA Category 2 Site	No
Finedon Road	Burton Latimer	SHLAA Category 2 Site	No
Land west of Polwell Lane	Kettering	SHLAA Category 2 Site	No
Land west of Kettering, east of a14, bounded by Thorpe Land, Gypsy Lane to the North and Northampton Road (A6013) to the South	Kettering	SHLAA Category 2 Site	No
Land at Hospital Hill, off Main Street	Rothwell	SHLAA Category 2 Site	No
Land to the north of Rothwell	Rothwell	SHLAA Category 2 Site	No
Desborough Central, Rothwell Road, (west of B576)	Desborough	SHLAA Category 2 Site	No
Land at Rothwell Town Football Club, Cecil Street	Rothwell	SHLAA Category 2 Site	No
Land between A43 and High Street	Broughton	SHLAA Category 2 Site	No
Land to the east of Watermill Close	Desborough	SHLAA Category 2 Site	No
Site 4 Land South of Great Oakley	Corby	SHLAA Category 2 Site	No
Land to the east and west of Church Street	Broughton	SHLAA Category 2 Site	No
Geddington Sawmill, Grafton Road	Geddington	SHLAA Category 2 Site	No
Brambleside Four - Land to the north-west of Kettering	Kettering	SHLAA Category 2 Site	No
South East of Corby, adjoining the R8 site and the new A43	Corby	SHLAA Category 2 Site	No
Land east of Kettering (situated between submitted outline application KET/2007/0694 for Kettering Sustainable Urban Extension and Kettering Eastern Avenue)	Kettering	SHLAA Category 2 Site	No
Land at Stamford Road	Geddington	SHLAA Category 2 Site	No
Land to the east and west of Cransley Hill	Broughton	SHLAA Category 2 Site	No
Land to the west of Stamford Road (A43)	Geddington	SHLAA Category 2 Site	No
Land adjoining The Orchards. Harrington Road	Desborough	SHLAA Category 2 Site	No
Land to the west of Rothwell, A6	Rothwell	SHLAA Category 2 Site	No
Land at Barton Hall, Barton Road	Kettering	SHLAA Category 2 Site	No
Kettering Rugby Football Club, Waverly Road	Kettering	SHLAA Category 2 Site	No
Land between the A6 and Wold Road	Burton Latimer	SHLAA Category 2 Site	No
Land to the west of Kettering Road	Burton Latimer	SHLAA Category 2 Site	No
Land between Cranford Road and the A6	Burton Latimer	SHLAA Category 2 Site	No
Land to the rear of Station Road and Polewell Road	Burton Latimer	SHLAA Category 2 Site	No
Land to the north of Church Street, Burton Latimer	Burton Latimer	SHLAA Category 2 Site	No

Potential Development Site	Town	Development Type	Part of Kettering Town Centre AAP?
Land to the south east of Finedon Road	Burton Latimer	SHLAA Category 2 Site	No
Land off Cricket Ground, Barton Seagrave	Kettering	SHLAA Category 2 Site	No
Land West of Kettering adjacent A14 and Kettering Golf Club	Kettering	SHLAA Category 2 Site	No
Land adjacent to Mawsley off A43	Mawsley	SHLAA Category 2 Site	No
Cedars Farm, Copelands Road	Desborough	SHLAA Category 2 Site	No
Bridge Road	Desborough	SHLAA Category 2 Site	No
Loatlands school, Harrington Road	Desborough	SHLAA Category 2 Site	No
Eveden Factory 1, Rothwell Road	Desborough	SHLAA Category 2 Site	No
Eveden Factory 2, Rothwell Road	Desborough	SHLAA Category 2 Site	No
BL Site 1. North of Burton Latimer, Kettering Road	Burton Latimer	SHLAA Category 3 Site	No
BL Site 6. Land off Wheatfield Drive	Burton Latimer	SHLAA Category 3 Site	No
BL Site 8. Land to the rear of Bunting Close	Burton Latimer	SHLAA Category 3 Site	No
BL Site 9. Land to the rear of White Lodge Farm, Higham Road	Burton Latimer	SHLAA Category 3 Site	No
BL Site 14 South west Burton Latimer	Burton Latimer	SHLAA Category 3 Site	No
Western Quarter Site A	Kettering	SHLAA Category 3 Site	Yes
Western Quarter site C / Land off Jutland Way	Kettering	SHLAA Category 3 Site	Yes
Western Quarter Site E	Kettering	SHLAA Category 3 Site	Yes
Western Quarter Site F	Kettering	SHLAA Category 3 Site	Yes
Western Quarter Site L	Kettering	SHLAA Category 3 Site	Yes
Land to the rear of 74-82 Rushton Road	Rothwell	SHLAA Category 3 Site	No
Part of Mawsley Wood Farm adjacent to Mawsley Village	Mawsley	SHLAA Category 3 Site	No
Land to the west of New Road and north of the River Ise	Geddington	SHLAA Category 3 Site	No
Land to the east of New Road and south of the Meadows	Geddington	SHLAA Category 3 Site	No
Kettering Hub	Kettering	SHLAA Category 3 Site	No
Broughton Allotments, Kettering Road	Broughton	SHLAA Category 3 Site	No
West Kettering	Kettering	SHLAA Category 3 Site	No
3 fields on the outskirts of Pytchley Village, Isham Road	Pytchley	SHLAA Category 3 Site	No
Ashley Road	Wilbarston / Stoke Albany	SHLAA Category 3 Site	No
The Grange (North), Pipewell Road / Stoke Road	Desborough	SHLAA Category 3 Site	No
Desborough Leisure Centre	Desborough	SHLAA Category 3 Site	No
Land to the rear of 109-159 Barton Road	Kettering	SHLAA	No
Land to the rear of 239 Barton Road	Kettering	SHLAA	No
Pioneer Ave (Factory between Station Road)	Burton Latimer	SHLAA	No
BL Site 2. Cranford Road	Burton Latimer	SHLAA	No
Land to the rear of 30-52 Cranford Road	Kettering	SHLAA	No
Tresham College	Kettering	SHLAA	No
Factory adjacent to 52 Lawson Street	Kettering	SHLAA	No
Ise Garden Centre, Warkton Lane	Kettering	SHLAA	No
67 Union Street	Kettering	SHLAA	No
Derelict Buildings	Rothwell	SHLAA	No
St Anthony's Hill	Desborough	SHLAA	No
Geldon Ironworks, Sackville Street	Kettering	SHLAA	No
Warkton Lane	Kettering	SHLAA	No
Desborough Leisure Centre	Desborough	SHLAA	No
Land west of London Road (CQ1)	Kettering	Kettering Town Centre AAP Site	Yes
Land at the Municipal Offices, London Road (CQ2)	Kettering	Kettering Town Centre AAP Site	Yes
Land at Lidl store site, west of Trafalgar Road (NRQ1)	Kettering	Kettering Town Centre AAP Site	Yes
Meadow Road Recreation Ground (NRQ10)	Kettering	Kettering Town Centre AAP Site	Yes
ATS & Topps Tiles site, Northampton Road/Northfield Avenue (NRQ11)	Kettering	Kettering Town Centre AAP Site	Yes
Bus Depot Site, Northampton Road (NRQ12)	Kettering	Kettering Town Centre AAP Site	Yes
Hazelwood Lane (NRQ13)	Kettering	Kettering Town Centre AAP Site	Yes
Former Lidl store site, north of Trafalgar Road (NRQ2)	Kettering	Kettering Town Centre AAP Site	Yes
Temporary car park, land west of Trafalgar Road (NRQ3)	Kettering	Kettering Town Centre AAP Site	Yes
Land north and east of Trafalgar Road (NRQ4)	Kettering	Kettering Town Centre AAP Site	Yes
B&Q & Comet site, Meadow Road/Jutland Way (NRQ5)	Kettering	Kettering Town Centre AAP Site	Yes
National Grid site north, Jutland Way (NRQ6)	Kettering	Kettering Town Centre AAP Site	Yes
National Grid site south, Jutland Way (NRQ7)	Kettering	Kettering Town Centre AAP Site	Yes
Meadow Road/Cromwell Road backland (NRQ8)	Kettering	Kettering Town Centre AAP Site	Yes
Commercial Road car park (NRQ9)	Kettering	Kettering Town Centre AAP Site	Yes
Market Place North (RQ1)	Kettering	Kettering Town Centre AAP Site	Yes
Market Place South (RQ2)	Kettering	Kettering Town Centre AAP Site	Yes
Montagu Street/Tordoff Place (SCQ1)	Kettering	Kettering Town Centre AAP Site	Yes
Carrington Street/Victoria Street (SCQ2)	Kettering	Kettering Town Centre AAP Site	Yes
Queen Street east (SCQ3)	Kettering	Kettering Town Centre AAP Site	Yes
Queen Street/Horsemarket north (SCQ4)	Kettering	Kettering Town Centre AAP Site	Yes
Queen Street/Horsemarket south (SCQ5)	Kettering	Kettering Town Centre AAP Site	Yes
Dalkeith Place (SCQ6)	Kettering	Kettering Town Centre AAP Site	Yes
Honda garage and petrol station (SHLAA 724)	Kettering	Kettering Town Centre AAP Site	Yes
Northampton Road/Saunders Close backland (SHLAA 727)	Kettering	Kettering Town Centre AAP Site	Yes
Wadcroft (SHQ1)	Kettering	Kettering Town Centre AAP Site	Yes
Morrisons Staff Car Park, Trafalgar Road (SHQ2)	Kettering	Kettering Town Centre AAP Site	Yes
Newlands Phase 1 (SHQ3)	Kettering	Kettering Town Centre AAP Site	Yes
Eden Street/Eskdaill Street (SHQ4)	Kettering	Kettering Town Centre AAP Site	Yes
Land South of Northall Street (Iceland Car Park) (SHQ5)	Kettering	Kettering Town Centre AAP Site	Yes
Land South of Northall Street (Tanners Gate 1) (SHQ6)	Kettering	Kettering Town Centre AAP Site	Yes
Land South of Northall Street (Tanners Gate 2) (SHQ7)	Kettering	Kettering Town Centre AAP Site	Yes
Dryden Street/Fleet Street (SHQ8)	Kettering	Kettering Town Centre AAP Site	Yes
Car Park West of the Station (STQ1)	Kettering	Kettering Town Centre AAP Site	Yes
Kettering Cars (STQ10)	Kettering	Kettering Town Centre AAP Site	Yes
Station Rd/Northampton Rd (STQ11)	Kettering	Kettering Town Centre AAP Site	Yes
Bus Depot (STQ12)	Kettering	Kettering Town Centre AAP Site	Yes
Land West of the Station (STQ2)	Kettering	Kettering Town Centre AAP Site	Yes
Land North of the Station (STQ3)	Kettering	Kettering Town Centre AAP Site	Yes

Potential Development Site	Town	Development Type	Part of Kettering Town Centre AAP?
Land Opposite Station Square (STQ4)	Kettering	Kettering Town Centre AAP Site	Yes
Land East of the Station (STQ5)	Kettering	Kettering Town Centre AAP Site	Yes
The Crescent North (STQ6)	Kettering	Kettering Town Centre AAP Site	Yes
The Crescent (STQ7)	Kettering	Kettering Town Centre AAP Site	Yes
The Crescent (STQ8)	Kettering	Kettering Town Centre AAP Site	Yes
The Crescent South (STQ9)	Kettering	Kettering Town Centre AAP Site	Yes
Job's Yard North (Y1)	Kettering	Kettering Town Centre AAP Site	Yes
Soans Yard (Y2)	Kettering	Kettering Town Centre AAP Site	Yes
Rothwell North	Rothwell	Rothwell and Desborough Urban Extensions AAP	No
Desborough North	Desborough	Rothwell and Desborough Urban Extensions AAP	No

Appendix B - Potential Development Sites in the Borough of Wellingborough

Potential Development Site	Town	Development Type
Wellingborough East	Wellingborough	Sustainable Urban Extension ¹
Wellingborough North	Wellingborough	Sustainable Urban Extension ¹
Chester Road	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Croyland Road	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
East of Eastfield Road	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Land between Finedon Road and Nest Lane	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Park Farm Way/Shelley Road	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Windsor Road	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Bourton Way	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Doddington Road/Spur Road	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Hardwick Park	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Midland Road	Wellingborough	Wellingborough Town Preferred Housing Allocation Site ¹
Wellingborough Town Centre AAP Site A	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site B	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site C	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site D	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site E1	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site E2	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site F	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site G	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site H	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site I	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site J	Wellingborough	Wellingborough Town Centre Area Action Plan
Wellingborough Town Centre AAP Site K	Wellingborough	Wellingborough Town Centre Area Action Plan
Churchill Road, Earls Barton	Earls Barton	Preferred Rural Housing Allocation Site ¹
High Street, Earls Barton	Earls Barton	Preferred Rural Housing Allocation Site ¹
Milner Road, Finedon	Finedon	Preferred Rural Housing Allocation Site ¹
High Street, Finedon	Finedon	Preferred Rural Housing Allocation Site ¹
Thrapston Road, Finedon	Finedon	Preferred Rural Housing Allocation Site ¹
High Street, Irchester	Irchester	Preferred Rural Housing Options ¹
Parsons Hall, Irchester	Irchester	Preferred Rural Housing Options ¹
Station Road, Irchester	Irchester	Preferred Rural Housing Options ¹
Hinwick Road, Wollaston	Wollaston	Preferred Rural Housing Options ¹
Earls Barton Sports Pavillion	Earls Barton	Sports Allocation ¹
Kangaroo Spinney	Wellingborough	Travellers Site ¹
Bond Site	Earls Barton	Travellers Site ¹
Fullers Yard	Earls Barton	Travellers Site ¹
Land rear of 14-16 Bradfield Road	Wellingborough	Travellers Site ¹

1 Site as identified in the Wellingborough Site Specific Development Plan Document - Preferred Options, October 2010. Sites may therefore be subject to change.

Wellingborough Town Centre Area Action Plan was adopted in July 2009.

Appendix C - Raised Flood Defences

Borough	NFCDD Reference	Responsibility	Description	Location	Comment	Length (m)
Kettering	0550053330202R59	private	<i>Floodbank or Spoil bank??</i>	<i>River Ise: Finedon Stn Rd Br - Weetabix Rd Br</i>		86
Kettering	0550053330202L58	private	<i>Floodbank or Spoil bank??</i>	<i>River Ise: Finedon Stn Rd Br - Weetabix Rd Br</i>		113
Kettering	0550053330202L57	private	Floodbank	River Ise: Finedon Stn Rd Br - Weetabix Rd Br	Gabions at CS with concrete berm and grass embankment	9
Kettering	0550053330202L56	private	<i>Floodbank or Spoil bank??</i>	<i>River Ise: Finedon Stn Rd Br - Weetabix Rd Br</i>		322
Kettering	0550053240401L73	local authority	<i>Channel (With slight floodbank or is it a Spoil bank?)</i>	<i>d/s Oakley Rd</i>	<i>erosion/lumps at CS & F(1)</i>	40
Kettering	0550053330201R61	private	<i>Floodbank or Spoil bank??</i>	<i>River Ise: Harrowden Bridge - Finedon Stn Rd Br</i>		222
Wellingborough	0550053350103R63	Environment Agency	Floodbank			230
Wellingborough	0550053350103L51	Environment Agency	Floodbank			255
Wellingborough	0550053330102L55	private	<i>Floodbank or Spoil bank??</i>			248
Wellingborough	0550053330102L54	private	<i>Floodbank or Spoil bank??</i>			637
Wellingborough	0550053330101R74	private	<i>Floodbank or Spoil bank??</i>			162
Wellingborough	0550053330101L72	private	<i>Floodbank or Spoil bank??</i>			211
Wellingborough	0550053330101L73	private	<i>Floodbank or Spoil bank??</i>			435
Wellingborough	0550053330101R78	private	<i>Floodbank or Spoil bank??</i>			262
Wellingborough	0550053330101R79	private	<i>Floodbank or Spoil bank??</i>			319
Wellingborough	0550053330102R51	private	<i>Floodbank or Spoil bank??</i>			16
Wellingborough	0550053340102R67	Environment Agency	Floodwall		Channel with concrete slabs as inward face	49
Wellingborough	0550053340102R66	Environment Agency	Floodwall		concrete structure with mastic expansion joints	63
Wellingborough	0550053340102R64	Environment Agency	Floodwall	D/s of culvert that runs under Castle Way.		3
Wellingborough	0550053330101R67	private	<i>Floodbank or Spoil bank??</i>			246
Wellingborough	0550053330101R65	private	<i>Floodbank or Spoil bank??</i>			204
Wellingborough	0550053340102R52	Environment Agency	Floodbank or Spoil bank	d/s end of castle fields park.	Channel with floodbank. floodbank does not follow course of channel	95
Wellingborough	0550053340102R68	Environment Agency	Floodwall		Channel with concrete wall inward face.	8
Wellingborough	0550053340102L68	Environment Agency	boundary wall			17
Wellingborough	0550053340102R51	Environment Agency	Flood Wall	Rear of housing: U/s of culvert under Senwick Road.	Channel with concrete flood defence wall along top. piled toe	98
Wellingborough	0550053340101L61	Environment Agency	Floodbank		road and housing lower than earth bank	56
Wellingborough	0550053330101L68	private	<i>Floodbank or Spoil bank??</i>			238
Wellingborough	0550053001003R52	Environment Agency	Floodbank (Against A45 Dual Carriageway)	alongside A45	earth bank against A45 road not maintained although main river	79
Wellingborough	0550053340103R70	local authority	Floodbank that protected swimming pool from flooding (pool now demolished)	croyley park		82
Wellingborough	0550053001013R54	Environment Agency	Floodbank (Whiston Lock)	Nene: White Mills Lock to Cogenhoe Lock	Grassy bank U/S of mooring next to lock (Whiston)	21
Wellingborough	0550053450101R55	private	wildlife lake	engine pond	wildlife/ amenity lake owned by compton estates	311
Wellingborough	0550053450101L55	private	pond with raised embankment	engine pond	land/pond owned by compton estates	460
Wellingborough	0550053001101R52	Environment Agency	Floodbank	River Nene: Cogenhoe Lock - Billing Bridge	Raised embankment protecting caravan park	83
Wellingborough	0550053001101R51	Environment Agency	Floodwall (Steel Sheet Piled Moorings with Wooden Capping)	River Nene: Cogenhoe Lock - Billing Bridge	Moorings	27
Wellingborough	0550053001102R52	private	Floodwall (Cogenhoe Mill Masonry Lined Channel)	Cogenhoe Mill channel		37
Wellingborough	0550053001101R54	Environment Agency	Floodbank	nene, cogenhoe lock - billing bridge	Boat slipway at u/s end of defence	547
Wellingborough	0550053001101L51	Environment Agency	Floodbank	River Nene: Cogenhoe Lock - Billing Bridge		1275
Wellingborough	0550053001301L53	Environment Agency	Channel	between Clifford Hill lock & Billing Lock		816
Wellingborough	0550053330201R61	private	<i>Floodbank or Spoil bank??</i>	<i>River Ise: Harrowden Bridge - Finedon Stn Rd Br</i>		222
Wellingborough	0550053330202R59	private	<i>Floodbank or Spoil bank??</i>	<i>River Ise: Finedon Stn Rd Br - Weetabix Rd Br</i>		86
Wellingborough	0550053330202L58	private	<i>Floodbank or Spoil bank??</i>	<i>River Ise: Finedon Stn Rd Br - Weetabix Rd Br</i>		113
Wellingborough	0550053330202L57	private	Floodbank	River Ise: Finedon Stn Rd Br - Weetabix Rd Br	Gabions at CS with concrete berm and grass embankment	9
Wellingborough	0550053330202L56	private	<i>Floodbank or Spoil bank??</i>	<i>River Ise: Finedon Stn Rd Br - Weetabix Rd Br</i>		322

Note: Assets with unclear description shown in italics

Appendix D - Hydraulic Model Information

Modelled watercourse	Scenarios modelled	
	Model without defences	Model with defences
Allledge Brook	None	50% AEP 20%AEP 10% AEP 4% AEP 2% AEP 1.33% AEP 1% AEP 1% AEP with climate change 0.5% AEP 0.1% AEP 0.1% AEP with climate change
Ecton Brook	50% AEP 20%AEP 10% AEP 4% AEP 2% AEP 1.33% AEP 1% AEP 1% AEP with climate change 0.5% AEP 0.1% AEP 0.1% AEP with climate change	50% AEP 20%AEP 10% AEP 4% AEP 2% AEP 1.33% AEP 1% AEP 1% AEP with climate change 0.5% AEP 0.1% AEP 0.1% AEP with climate change
Grendon Brook	1% AEP 1% AEP with climate change 0.1% AEP 0.1% AEP with climate change	50% AEP 20%AEP 10% AEP 4% AEP 2% AEP 1.33% AEP 1% AEP 1% AEP with climate change 0.5% AEP 0.1% AEP 0.1% AEP with climate change
Swanspool Brook	1% AEP 0.1% AEP	50% AEP 20%AEP 10% AEP 4% AEP 2% AEP 1.33% AEP 1% AEP 1% AEP with climate change 0.5% AEP 0.1% AEP 0.1% AEP with climate change

Modelled watercourse	Scenarios modelled	
	Model without defences	Model with defences
River Ise (inc. Slade Brook)	1% AEP 0.1% AEP	50% AEP 20%AEP 10% AEP 4% AEP 2% AEP 1.33% AEP 1% AEP 1% AEP with climate change 0.5% AEP 0.1% AEP 0.1% AEP with climate change
Middle Nene	1% AEP 0.1% AEP	50% AEP 20%AEP 10% AEP 4% AEP 2% AEP 1.33% AEP 1% AEP 1% AEP with climate change 0.5% AEP 0.1% AEP 0.1% AEP with climate change

Notes:

1. For all of the modelled watercourses except for Ecton Brook, results have been provided along with GIS shapefiles showing corresponding flood extents. Only modelled results have been provided for Ecton Brook, therefore flood extents for this watercourse have not been mapped.
2. Only one model has been provided for Ecton Brook since there is no flood defence on this watercourse. (i.e. the model with defences is the same as model without defences)

Appendix E - Guidance on the Preparation of FRAs

A FRA should be carried out under the direction of a qualified and competent professional and an appropriate level of FRA should be undertaken as soon as a site is considered for development - see **Figure E1**.

The PPS 25 Practice guide distinguishes between three levels of FRA which can be undertaken at increasing levels of detail, as development proposals progress.

Table E1 - Levels of flood risk assessment (Source: PPS 25 Practice Guide)

FRA Level	Description
1	<p>Screening study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information, including the SFRA, where there is one in place, Environment Agency Flood Map and their Standing Advice. The screening study will ascertain whether a FRA Level 2 or 3 is required.</p>
2	<p>Scoping study to be undertaken if the Level 1 study indicates that the site may lie within an area that is at risk of flooding or that the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include the following:</p> <ul style="list-style-type: none"> ▪ An appraisal of the availability and adequacy of existing information; ▪ A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; and ▪ An appraisal of the scope of possible measures to reduce the flood risk to acceptable levels. ▪ The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.
3	<p>Detailed study to be undertaken if the Level 2 study concludes that further quantitative analysis is required to assess flood risk issues related to the development site.</p> <p>The study should include:</p> <ul style="list-style-type: none"> ▪ Quantitative appraisal of the potential flood risk to the development; ▪ Quantitative appraisal of the potential impact of development site on flood risk elsewhere; and ▪ Quantitative demonstration of the effectiveness of any proposed mitigation measures.

Figure E1 illustrates the overall process associated with each level of FRA for development proposals. It is important that the Environment Agency, Anglian Water and other responsible bodies (such as Northamptonshire County Council as the Local Lead Flood Authority) are consulted at all levels of the FRA.

Given the nature of flood risk in the study area and the additional pressure that new development will generate, opportunities to achieve an overall reduction in flood risk should be explored and they should be clearly stated in the report.

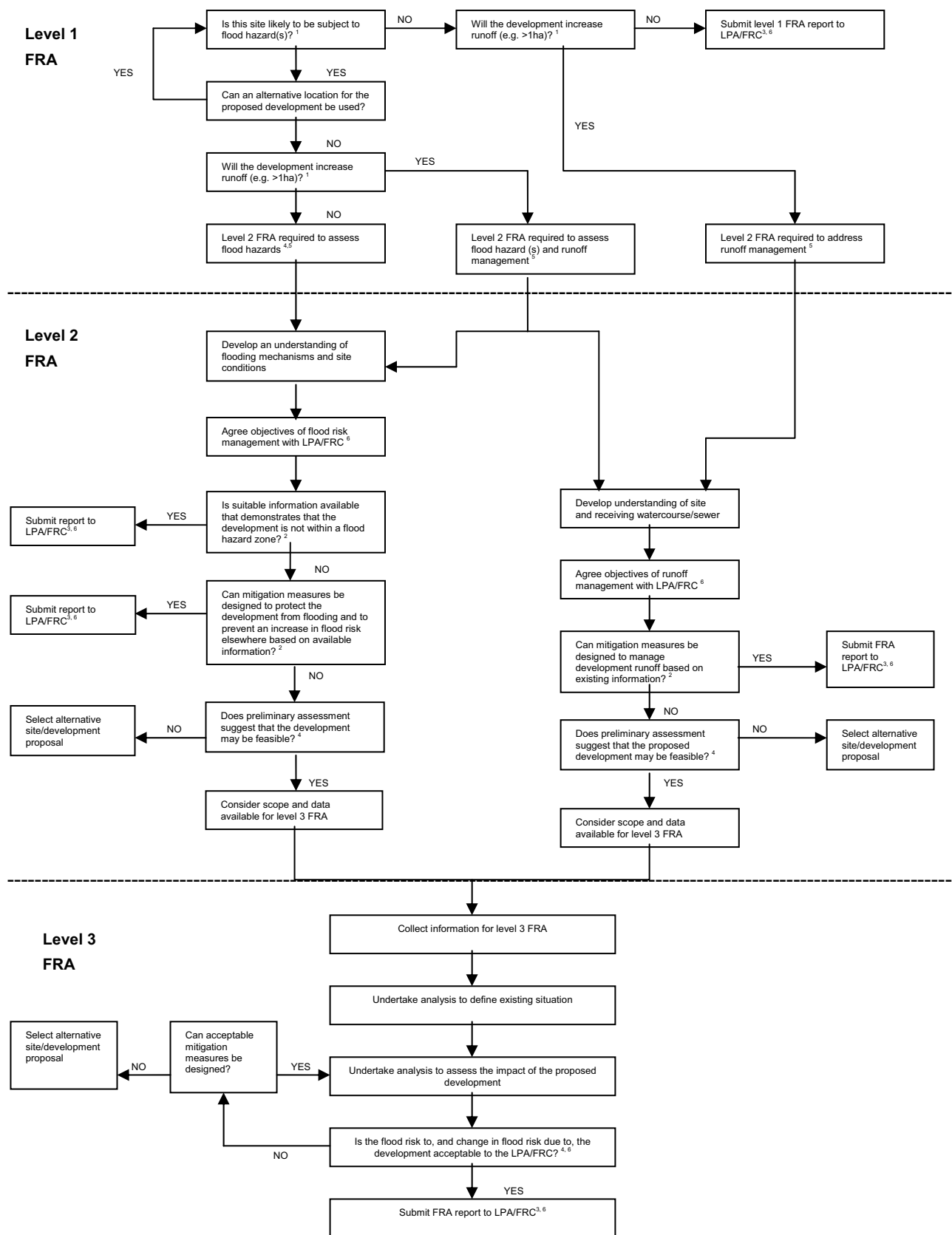


Figure E1 - FRA process for development proposals (Source: CIRIA C624)

Notes on Figure E1:

1. *If existing information is inadequate, the precautionary approach should be adopted and a “Yes” answer should be assumed.*
2. *If existing information is inadequate, the precautionary approach should be adopted and a “No” answer should be assumed.*
3. *It is recommended that the findings of the FRA are discussed with the LPA/FRC prior to formal submission of the report.*
4. *Development proposals should only be progressed if the proposals are likely to be consistent with those of sustainable development, as defined in relevant planning policies.*
5. *If the site is a brownfield site, it is likely to be beneficial to demonstrate that the proposed development will reduce runoff rates and volumes compared to the existing situation and a Level 2 FRA focusing on surface water management is therefore recommended.*

The Environment Agency's standing advice to Local Planning Authorities for consideration of flood risk issues within planning applications is available online at http://www.environment-agency.gov.uk/static/documents/Research/FRSA_LPA.pdf. This document contains a consultation matrix (see **Figure E2**) defining in which situations the Environment agency must be consulted. The Environment Agency's standing advice also gives recommendations on how flood risk should be considered in applications on which the Environment Agency is not directly consulted.

A1 Development Category	B1 Development (including boundary walls etc.) within 20 metres of the top of a bank of a Main River	C1 Includes culverting or control of flow of any river or stream	D1 Within Flood Zone 3	E1 Within Flood Zone 2	F1 Within Flood Zone 1
A2 Non-residential extensions with a footprint of less than 250 sq. metres; and Householder development and alterations	B2 Consult EA on flood defence consent requirements	C2 Consult EA with FRA showing design details of any culvert or flow control structure proposed	D2 No Consultation - see standard comment	E2 No Consultation - see standard comment	F2 No EA consultation required
A3 Change of use FROM 'Water Compatible TO 'Less Vulnerable' development*	B3 Only consult EA if site also falls within Flood Zone 3. FRA Required	C3 No EA consultation required	D3 Consult EA with FRA	E3 No EA consultation required	F3 No EA consultation required
A4 Change of use RESULTING IN 'Highly Vulnerable' or 'More Vulnerable' development*	B4 Only consult EA if site also falls within Flood Zone 3 or 2. FRA Required	C4 No EA consultation required	D4 Consult EA with FRA	E4 Statutory standing advice MAY apply - choose from list	F4 No EA consultation required
A5 Operational Development less than 1 hectare	B5 Consult EA on flood defence consent requirements	C5 Consult EA with FRA showing design details of any culvert or flow control structure proposed	D5 Highly Vulnerable - EA likely to object but consult EA with FRA Other vulnerabilities-consult EA with FRA and Sequential Test evidence and where required confirm Exception Test has been applied	E5 Statutory standing advice MAY apply - choose from list	F5 No consultation required - see surface water management good practice advice - see
A6 Operational Development of 1 hectare or greater	B6 Consult EA on flood defence consent requirements	C6 Consult EA with FRA showing design details of any culvert or flow control structure proposed	D6 Highly Vulnerable - EA likely to object but consult EA with FRA Other vulnerabilities-consult EA with FRA and Sequential Test evidence and where required confirm Exception Test has been applied	E6 Highly vulnerable-consult EA with FRA and Sequential Test evidence and confirm Exception Test has been applied Other vulnerabilities-consult EA with FRA and Sequential Test evidence	F6 Consult EA with FRA

Figure E2 - Consultation matrix

The Environment Agency's website also includes advice on the preparation of FRAs. <http://www.environment-agency.gov.uk/research/planning/93498.aspx>

Level 1 Flood Risk Assessment

A Level 1 FRA is to identify:

- The potential flooding hazards which may pose a risk to the development, or which the development may affect so as to increase flood risk elsewhere;
- Whether the proposed development may obstruct access to watercourses or flood defences or affect the integrity of a flood defence;
- Whether the development may lead to an increase in runoff; and
- Whether there are any flooding or surface water management issues related to the development that may warrant further investigation.

Within the context of this guidance note, the LPA is either of the Borough Councils' planning department. Flood Risk Consultees (FRC) is a generic term used for the Environment Agency and others who act as technical advisors to the LPA on flood risk issues.

The principal data sources available for Level 1 FRA within Kettering Borough and the Borough of Wellingborough are:

- The Environment Agency's Flood Map;
- The Kettering and Wellingborough Level 1 SFRA Update;
- The North Northamptonshire Water Cycle Study;
- The North Northamptonshire Flood Risk Management Strategy;
- Catchment Flood Management Plans for the River Nene and the River Welland published by the Environment Agency;
- Existing documentation relating to flooding problems and flood risk management such as published site-specific FRAs and historic flooding records;
- Flood alleviation scheme design reports/project appraisal reports/strategy studies that may be available from the Environment Agency and other Flood Risk Consultees; and
- The Environment Agency's flood defence asset survey information.

The decision not to proceed with a Level 2 FRA should only be taken when a Level 1 FRA clearly demonstrates that a development is not at risk of flooding and will not result in an increase in flood risk elsewhere. If this is the case, then it may be submitted to the LPA and FRC with the planning application as background information. Otherwise a Level 2 FRA should be undertaken or an alternative site/ development proposal considered.

Level 2 Flood Risk Assessment

The aims of a Level 2 FRA are to:

- Develop an understanding of the mechanisms of flooding at the site;
- Develop an understanding of the proposed development site within the context of the wider catchment;
- Identify available data for the FRA and its suitability;
- Confirm the classification of the site is according to PPS 25 Flood Zones and Flood Risk Vulnerability depending on the proposed land-use;
- Produce a qualitative assessment of the potential impact of the proposed development (including consideration of flood risk impact elsewhere);
- Develop an understanding of the potential development design and flood risk mitigation measures that may be employed at the site; and
- Define additional work required to produce a Level 3 FRA and/or produce a Level 2 FRA report if the scoping study identifies that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.

The process of undertaking a Level 2 FRA is summarised within **Figure E1**.

In order to determine the suitability of the site, a Level 2 FRA should be undertaken to assess each of the relevant potential flood risk issues identified in the Level 1 FRA. The potential interaction between sources of flooding must be addressed (e.g. high river levels may impede the discharge from the drainage system).

Given the development proposals in the area and the nature of flood risk, opportunities to achieve an overall reduction in flood risk should be explored and they should be clearly stated in the report.

If sufficient information has been obtained and reviewed to progress the outline design of the development in sufficient detail, it may be possible to submit a Level 2 FRA report in support of a planning application in consultation with the LPA/FRC. A Level 2 FRA Report will often provide an adequate level of detail for a development in Flood Zone 2, unless the development is of a nature such that PPS 25 deems it to be too vulnerable. If a Level 3 FRA is required then it may be advantageous to submit a Level 2 FRA to the LPA/ FRC to obtain agreement as to the potential viability both of the development and the proposed methodology for the Level 3 FRA. Depending on the conclusion of the Level 2 FRA, a Level 3 FRA may be undertaken or an alternative site/development proposal considered.

If it is considered that sufficient information exists to fully assess flood risk issues relating to a proposed development, the Level 2 FRA Report should contain the same level of information as a Level 3 FRA. In this case, the FRA should satisfy the minimum requirements stated in Annex E of PPS 25. In addition, the FRA Checklist given in Appendix B of the PPS 25 Practice Guide should be completed and submitted with the planning application.

Level 3 Flood Risk Assessment

A Level 3 FRA should provide a quantitative assessment of the flood risk issues identified and scoped in FRA Level 2. Typically, the objectives of a Level 3 FRA include:

- Review of Level 1 and 2 FRAs;
- Hydraulic modelling to define the flood hazard to the development, both under present-day conditions and allowing for the influence of climate change over the lifetime of the development;
- Hydraulic modelling to assess the potential impact of the proposed development on flood risk elsewhere;
- Outline design of flood mitigation measures, and associated modelling to demonstrate that the development will be safe during its lifetime whilst not increasing flood risk elsewhere;
- Sensitivity testing to demonstrate that the flood risk estimates the site are not overly dependent on the assumed model parameters;
- Demonstration of management of residual risk over the lifetime of the development involving appropriate developer contributions, flood resilience and resistance measures and flood warning and evacuation plans; and
- Preparation of a report to satisfy the minimum requirements of Annex E of PPS 25 incorporating the FRA Pro-forma and the amplified guidance given in PPS 25 Practice Guide Companion (*Reference 2*).

The process of undertaking a Level 3 FRA is summarised within **Figure E2**. Depending on the conclusion of the assessment, the Level 3 FRA report should be submitted as a part of the planning application or consider an alternative site/ development proposal.

Careful assessment of the residual risk needs to be undertaken. In particular, access and egress to the site during a flood event will be a key consideration. The DEFRA guidance 'Flood Risks to People' should be used to assess flood risk to life based on hydraulic conditions. Outputs from hydraulic models can be readily used to inform that assessment.

Consultation with emergency planners at Northamptonshire County Council (NCC) should be undertaken. The emergency planning team at can be contacted through the NCC customer services centre at the following address:

Customer Service Centre
Northamptonshire County Council
John Dryden House
8-10 The Lakes
Northampton
NN4 7YD
Tel: 01604 236236
Email: CustomerServices@northamptonshire.gov.uk

Surface water

Surface water management ought to be a key consideration in the FRA process and the recommendations from the SFRA update in terms of surface water flood risk should be emphasised. The recommendations are as follows: all new development within the Boroughs should contribute to the reduction of surface water flood risk. For greenfield sites, this will be achieved by restricting runoff to the greenfield runoff rates. For brownfield sites, this will be achieved by restricting runoff to the pre-development rate with a reduction where possible to provide betterment as recommended by PPS 25. Management of surface runoff from the proposed development sites should use a combination of site-specific and strategic SuDS measures encouraging source control where possible.

Further guidance on surface water management should be obtained from Annex F of PPS 25 and **Appendix F** of the update SFRA (Guidance on SuDS).

Appendix F - Guidance on SuDS

1. Requirements of PPS 25 regarding surface water management

Urban developments can have a big effect on the quantity and speed of surface water runoff. By replacing vegetated ground with buildings and paved areas the amount of water being absorbed into the ground is severely reduced, therefore increasing the amount of surface water present. This additional surface water increases the demand on drainage systems in built up areas.

Traditional drainage systems are designed to get rid of the water as quickly as possible to prevent flooding in the built up area. This can cause problems, particularly downstream, by altering the natural flow patterns of the catchment. In addition, water quality can be affected due to pollutants from the built up areas being washed into the watercourse due to the lack of treatment of the water. One technique which can reduce this problem is the use of Sustainable Drainage Systems (SuDS).

2. What are SuDS?

Sustainable Drainage Systems (SuDS) are techniques designed to control surface water runoff before it enters the watercourse. They are designed to mimic natural drainage processes, along with treating the water to reduce the amount of pollutants getting into the watercourse. They can be located as close as possible to where the rainwater falls and provide varying degrees of treatment for the surface water, using the natural processes of sedimentation, filtration, adsorption and biological degradation.

3. The Purpose of SuDS

SuDS are more sustainable than traditional methods because they can:

- Manage the speed of the runoff;
- Protect or enhance the water quality;
- Reduce the environmental impact of developments;
- Provide habitat for wildlife; and
- Encourage natural groundwater recharge.

In addition, they can be used to create more imaginative and attractive developments and are designed so that less damage is done, than conventional systems, if their capacity is exceeded.

4. Places where SuDS are appropriate

Surface water management using SuDS can be implemented at all scales and in most urban settings, ranging from hard-surfaced areas to soft landscaped features, even if there is limited space. Most techniques use infiltration but even if the area has little or no infiltration SuDS can still be used in the form of green roofs, permeable surfaces, swales and ponds.

5. The different types of measures

SuDS are made up of one or more structures built to manage surface water runoff, and used in conjunction with good site management. There are five general methods:

- i. Prevention – this can involve minimizing paved areas, replacing tarmac with gravel, rainwater recycling, cleaning and sweeping, careful disposal of pollutants, and general maintenance.
- ii. Filter strips and swales – these are vegetated surface features that drain water evenly off impermeable areas. Swales (figure 1) are long shallow channels whilst filter strips (figure 2) are gently sloping areas of ground. Both of these mimic

natural drainage by allowing rainwater to run in sheets through vegetation, slowing and filtering the flow.

Figure 1 - Cross-section of a Swale

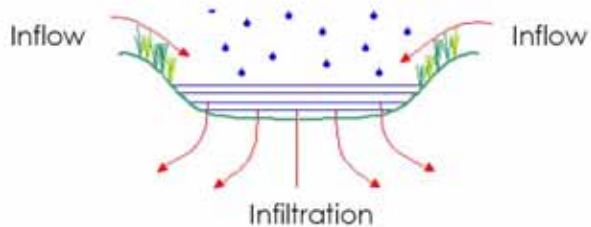
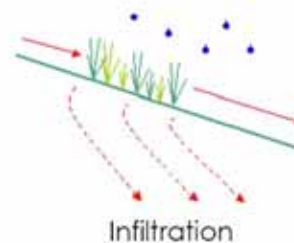


Figure 2 - Cross-section of a Filter Strip



- iii. Permeable surfaces and filter drains – these are devices that have a volume of permeable material below ground to store surface water. Runoff flows to this storage area via a permeable surface.
- iv. Infiltration devices – these enhance the natural capacity of the ground to store and drain water. They include soakaways, infiltration trenches and infiltration basins. See figure 3.
- v. Basins and ponds – these are areas for storage of surface runoff e.g. floodplains, wetlands, and flood storage reservoirs. They can be designed to control flows by storing water then releasing it slowly once the risk of flooding has passed. See figure 4.

Figure 3 Cross-section through an Infiltration Basin

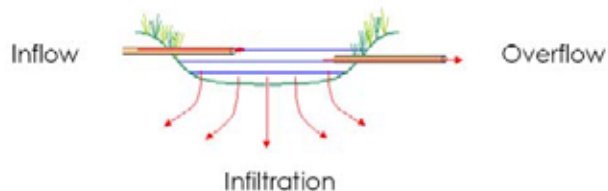
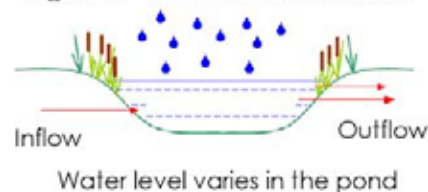


Figure 4 - Cross-section of a Pond



vi. References

Information taken from:

- Planning Policy Statement 25: Development and Flood Risk, Revised March 2010
- The SuDS Manual, CIRIA C697, 2007
- www.ciria.org/SuDS