

Preliminary Flood Risk Assessment



Contents

1. Introduction	3
2. Lead Local Flood Authority responsibilities	4
3. Methodology	6
4. Historic Flood Risk	11
5. Assessing Future Flood Risk	11
6. Climate Change	13
7. Identification of Flood Risk Areas	16
8. Review	17
9. Next Steps	17
Definitions	19
References	20

1. Introduction

This report has been prepared by Northamptonshire County Council to meet their duties as a Lead Local Flood Authority (LLFA) to deliver the requirements of the Flood Risk Regulations (2009) and to help inform the Local Flood Risk Management Strategy required under the Flood and Water Management Act 2010. The Flood Risk Regulations (FRRs) 2009 came into force in England and Wales on 10th December 2009. The Act transposed the EC Floods Directive (2007/60/EC) on the assessment and management of flood risks across EU Member States into domestic law and now implements its provision. The roles and responsibilities set out in the FRRs are consistent with the Pitt Review Recommendations of Sir Michael Pitt published in June 2008. These recommendations have now been facilitated by the publication of the Floods and Water Management Act (F&WMA) 2010, which received Royal Assent in April 2010.

The Preliminary Flood Risk Assessment (PFRA), comprising this document and the supporting spreadsheet (annexes 2 and 3) represents the first stage of the requirements of the Regulations. The PFRA process is aimed at providing a high level overview of historical and future flood risk from local flood sources, including surface water, groundwater, ordinary watercourses and canals. Flooding from the sewerage system will also be included when caused by rainwater entering or affecting the system. Instances where local sources are impacted by interactions with flooding from main rivers and reservoirs will also be included. Flooding associated with the sea, main rivers and reservoirs is the responsibility of the Environment Agency and does **not** need to be considered by the LLFA as part of the PFRA, unless it is considered that it may affect flooding from one of the sources listed above.

The PFRA is a high-level screening exercise and must therefore consider floods which have significant harmful consequences for human health, economic activity, the environment and cultural heritage. The PFRA identifies such areas and if they are considered to be nationally significant, as defined by Defra, they are highlighted as 'Flood Risk Areas'. Flood Risk Areas warrant further examination and management through the production of flood risk and flood hazard maps and flood risk management plans.

The key objectives of the preliminary flood risk assessment process are therefore to:

1. Collect information on historic and future (potential) floods and flood risk;
2. Use the information in the report to determine where the flood risk is 'nationally significant' with respect to its purpose of informing national and European strategy
3. Assemble the information into a Preliminary Assessment Report (this document);
4. Deliver the Preliminary Assessment Report and maps showing areas of significant flood risk,
5. Submit the Preliminary assessment Report and revised Flood Risk Area Maps to the EA; and
6. Ensure the plan is produced in accordance with national guidance, and is fit for purpose for use locally in Northamptonshire.

As a LLFA, Northamptonshire County Council (NCC) must submit their PFRA to the Environment Agency by 22nd June 2011.

1.1 Study area

The geographic extent of this study is the boundary of Northamptonshire County Council, outlined in Map 1. Northamptonshire lies predominantly in the Anglian Basin (85.3 %), the southernmost part lies in the Thames Basin (8.4 %), and the westernmost parts in the Severn Basin (6.4 %). Northamptonshire consists of seven local authorities including Northampton Borough Council, South Northamptonshire Council, Daventry District Council, Corby Borough Council, Kettering Borough Council, the Borough council of Wellingborough and East Northamptonshire District Council (see map 1).

Northamptonshire has several features which impact upon flood risk:

- It is a largely rural county
- Has a population of approximately 683,800 people¹
- Has several large towns such as Northampton, Corby, Kettering and Wellingborough
- No grade 1 Agricultural land
- A proposed special protection area (an international designation)- The Upper Nene Gravel pits
- No national parks
- No World Heritage Sites
- An area set for significant future growth

These will be explored in later chapters.

2. Lead Local Flood Authority responsibilities

2.1 Establishment of management structure

A management structure has been developed based on a partnership approach (see Figure 1.) to provide the Northamptonshire response to the Floods and Water Management Act 2010, the Flood Risk Regulations and to ensure that the flood risk management strategy development and delivery is coordinated and integrated. The partnership's primary purpose, therefore, is to ensure that effective flood risk management and resilience is built into service delivery in a manner which delivers better protection from flood risk for the County's communities and key infrastructure. The partnership's key activities will involve providing a single voice on Northamptonshire's flood risk management matters at a local and national level and providing strategic oversight of all flood risk and drainage matters in the County.

The Strategic Flood Risk Management Board, which will consider strategic / national flood risk matters, comprises: Environment Agency (Chair), NCC Cabinet member, Borough/District Councillor, Regional Flood Defence Committee Member Representatives, Local Resilience Forum (LRF) Rep/ Chair, NCC Director/ Chair of the Local Flood Risk Operational Group.

The purpose of the Local Flood Risk Operational Group, would be to enable the Local Lead Flood Authority (NCC) to fulfil its statutory role and to determine the work programme, projects and issues to be considered by 'Task Groups', which report into the Operational Group. Membership comprises: Northamptonshire County Council officer (Chair), a representative from all District/Borough Councils, Environment Agency, NCC Highways

¹ <http://www.northamptonshire.gov.uk/en/councilservices/council/ppp/pages/poptrends.aspx>

Authority, Highways Agency, Anglian Water Authority, County Emergency Planning, County Planning and County Environment Unit.

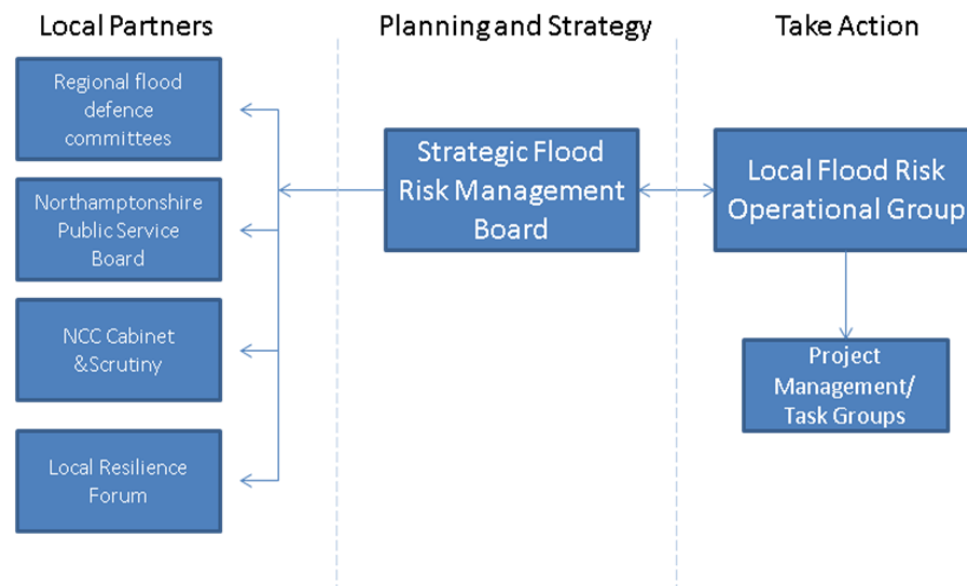


Figure 1. Diagram showing the Northamptonshire County Council Flood and Water Management Framework Structure.

In terms of reporting, those matters relating to NCC's duties and expenditure need to be reported to NCC Cabinet/Council for member decision, however, partnership matters are reported to the Public Service Board.

Through the membership on the Strategic Flood Risk Management Board, strong linkages will exist with the Regional Flood Defence Committees and with the Local Resilience Forum (LRF). The LRF will also be represented on the Operational Board to provide detailed input to local flood risk matters.

2.2 Public Engagement

One of several recommendations of the Pitt Review (2008) was to ensure effective public and stakeholder engagement and a coordinated approach to flooding and water management. This recommendation has now been encompassed within the Flood and Water Management Act (2010), which promotes partnership working and community and stakeholder engagement. Stakeholder engagement can afford significant benefits to local flood risk management including building trust, gaining access to additional local knowledge and increasing the chances of stakeholder acceptance of options and decisions proposed in future flood risk management plans. However, as the PFRA is based on readily available or derivable data as stated in the Environment Agency's PFRA Final Guidance (December 2010), it is recommended that public engagement will play a vital role in the shaping of the Local Flood Risk Management Strategy.

3. Methodology

The methodology for producing this PFRA is based on the Environment Agency's Final PFRA Guidance (December 2010) and Defra's Guidance on selecting Flood Risk Areas (December 2010).

3.1 Data collection from partner organisations

All partner organisations were contacted to ask for any relevant historical flooding information in Northamptonshire. The data investigated is summarised in the table below

Table 1. Data collected to inform the PFRA

Organisation	Name	Information sensitivity
Anglian Water	Sewer flooding incidents (DG5) Northampton	Private
Anglian Water	Sewer flooding incidents (DG5) County	Private
Anglian Water	Pumping stations, sewage treatment works map	Private
British Geological Survey	Groundwater Flooding Map	Public
British Waterways	British Waterways Approved Standard on Hydraulic Design of Canal Works	Private
British Waterways	British Waterways canal centreline	Private
British Waterways	Locks	Private
British Waterways	Sluices	Private
British Waterways	Weirs	Private
British Waterways	Overtopping	Private
British Waterways	Breaches	Private
British Waterways	Aqueducts	Private
British Waterways	Culverts	Private
Corby Borough Council	Corby water cycle strategy	Public
Corby Borough Council	Strategic Flood Risk Assessment Stage 2	Public
Corby Borough Council	Strategic Flood Risk Assessment Level 1	Public
Daventry District Council	email	Public
Defra	Groundwater Emergence Maps	Private
Dundee University	British Hydrological Society Chronology of British Hydrological Events	Public
Environment Agency	Welland Catchment Flood Management Plan	Public
Environment Agency	Great Ouse Catchment Flood Management Plan	Public
Environment Agency	Nene Catchment Flood Management Plan	Public
Environment Agency	National Flood and Coastal Erosion Risk Management Strategy	Public

Environment Agency	Anglian River Basin Management Plan	Public
Environment Agency	Thames River Basin Management Plan	Public
Environment Agency	Historic Flood Map Layers	Private
Environment Agency	Flood Event Outlines Mapping Layers	Private
Environment Agency	Areas Susceptible to Surface Water Flooding and Flood Map for Surface Water Mapping Layers	Public
Environment Agency	Flood Map Layers	Private
Environment Agency	National Receptor Dataset	Private
Environment Agency	Main Rivers Mapping Layers	Private
Environment Agency	Detailed river network Mapping Layers	Private
Environment Agency	Historic Surface Water and Groundwater Geodatabase	private
Environment Agency	Areas Susceptible to Groundwater Flooding Mapping Layers	Private
East Midlands Regional Assembly	East Midlands Regional Flood Risk Appraisal	Public
East Northants District Council	Strategic Flood Risk Assessment Stage 2	Public
East Northants District Council	Strategic Flood Risk Assessment Level 1	Public
Fire and Rescue	Call records	Private
Geomatics group	Lidar	Private
Highways Agency	Flood Hotspots	Private
Highways Agency	Flooding Records	Private
Internal Drainage Board	Flood records	Private Via consultants public
Kettering Borough Council	Strategic Flood Risk Assessment Stage 2	Public
Kettering Borough Council/Borough of Wellingborough Council	Strategic Flood Risk Assessment level 1	Public
Kettering Borough Council/Borough of Wellingborough Council	Strategic Flood Risk Assessment level 1 (update)	Public
Northampton Borough Council	Flood Risk Map	Public
Northampton Borough Council	Strategic Flood Risk Assessment Stage 2	Public

Northamptonshire County Council	Buckingham Internal Drainage Board map	Public
Northamptonshire County Council	Isham Flood Risk Assessment	Public
Northamptonshire County Council	Draft Northampton Surface Water Management Plan	Private
Northamptonshire County Council emergency planning	Draft Multi Agency Flood Plan	Private
Northamptonshire County Council Highways	Flooding hotspots	Public
Network Rail	List of locations of known flooding	Private
North Northants Joint Planning Unit	Flood Risk Management Study	Public
North Northants Joint Planning Unit	Water cycle strategy	Public
Northern Regional Flood defence committee	Northampton Standards of Protection Review	Public
Police records	Telephone records involving the word 'flood'	Private
Scott Wilson Consultants	Maps from Strategic Flood Risk Assessment	Public
Scott Wilson Consultants	Local flooding data- Daventry District Council	Public
Scott Wilson Consultants	Gauging station	Public
Scott Wilson Consultants	Internal Drainage Board flooding info	Public
Scott Wilson Consultants	Northampton Borough Council drainage problems	Public
Scott Wilson Consultants	South Northants Council problem drainage	Public
Severn Trent Water	DG5 County	Public
Stanwick Parish Council	Email	Public
Syresham Parish Council	Letter	Public
Thames Water	Asset maps, Sewer flooding incidents (DG5)	Private
West Northants Joint Planning Unit	West Northants Water Cycle Strategy	Public
West Northants Joint Planning Unit	West Northants Strategic Flood Risk Assessment Level 1	Public
West Northants Joint Planning Unit	Strategic Flood Risk Assessment Stage 2 Daventry and south Northants	Public
West Northants Joint Planning Unit	Strategic Flood Risk Assessment Stage 2 Northampton	Public

The guidance stresses that all information used to inform this report must be readily available and no extra work should be undertaken to find new data.

3.2 Data Limitations

There are several limitations to the data collected such as: incomplete and inconsistent datasets (the corresponding gaps in flood data will hinder also the identification of accurate flood risk areas); the varied quality of data, very few records of the consequences of flooding, such as the number of properties affected or the cost of cleanup; and restrictions on the use of some data sets due to confidentiality agreements and requirements under the data protection act.

3.3 Data Storage, Sharing, Security and Quality

The data collected for the PFRA has been catalogued and stored on the County Council's computer network system, access to which is restricted at a departmental level. Data is shared through the management structure described in section 2.1. All data has been collected to the highest possible quality however, the quality of individual datasets is highly variable as explained in section 3.2

3.4 Confidentiality agreements

Confidentiality agreements were entered into with:

- Anglian Water
- British Waterways
- The Highways Agency
- Severn Trent Water
- Thames Water

To ensure that the data was used only for the purpose of the PFRA and the Local Flood Risk Management Strategy.

3.5 Assessing Historic Flood Risk

The above flooding incident information was collated, mapped and reviewed in conjunction with partner organisations to identify the major historic flood events and their consequences.

3.6 Assessing Future Flood risk

3.6.1 Locally Agreed Surface Water Information

In line with the guidance provided, the assessment of future flood risk primarily relied on a technical review of the Environment Agency's Flood Map for Surface Water. The Flood Map for Surface Water uses a numerical hydraulic model to predict the extent of flood risk from a rainfall event that has a 1 in 30 chance of occurring in a year and also a rainfall event that has a lower probability of happening- a 1 in 200 annual chance. It constitutes the 'locally agreed surface water information' for Northamptonshire.

Environment Agency guidance on using surface water flood risk information recommends that LLFAs should: review, discuss, agree and record, what existing and readily available

surface water flood data best represents local conditions, i.e. 'locally agreed surface water information'. It is considered that the Flood maps for Surface Water best represent the risks in Northamptonshire, using the Areas Susceptible to Surface Water Flooding maps and historic flooding hotspots as supporting evidence. The Surface Water Management Plan for Northampton is not yet complete and so there is no additional local modelling available to include in relation to surface water flooding. It is considered that the 'Areas Susceptible to Surface Water Flooding' map can better represent the risk of surface water flooding than the 'Flood Map for Surface Water'. Such instances are where local sewer capacity is able to drain at less than 6mm/hr; or in areas that are very flat and longer storm durations are more likely to cause flooding than shorter durations. It is considered that these criteria are not applicable to Northamptonshire and so the Flood Maps for Surface Water are considered more appropriate. This approach has been endorsed by the Environment Agency and Anglian Water.

3.6.2 Property counts

When assessing future flood risk across the study area, the following factors were considered;

- Topography,
- Location of ordinary watercourses and modifications to them
- Effectiveness of any works constructed for the purpose of flood risk management,
- Location of populated areas,
- Location on non-residential properties (i.e. areas of economic importance),
- Location of critical infrastructure,
- Areas of environmental importance,
- Areas of cultural importance,
- The current and predicted impact of climate change

The number of properties identified to be at risk from flooding in Annex 2 is based on the number of properties within the Environment Agency's National Receptor Database (NRD). Residential properties are identified in the data tables by a code (known as MCM code 1). Property counts were conducted using the methodology outlined in the Environment Agency's technical note 'Flood Map for Surface Water Property Count Method' (November 2010).

Critical services are also identified in the NRD including: education, first school, further education, further education college, high school, higher education, infant school, junior school, middle school, nursery, primary school, private primary school, school, school for the deaf, secondary school, special school, technical college, university, pre school education, hospitals, nursing homes and rest homes, Police Stations, Fire & Ambulance Stations, Sewerage treatment works and Electricity installations.

Non-residential properties are essentially all the property types in the OS Base Function classification, apart from the 'residential' type (MCM code 1). However, non-residential properties include a number of types such as post boxes, parks and ponds, which have been removed from the NRD dataset.

Property counts, to determine the number of properties at future risk of flooding, were conducted using MapInfo.

3.7 Reviewing Flood Risk Areas

The Environment Agency has used a national methodology, which has been set out by Defra, to identify Indicative Flood Risk Areas across England. Of the ten indicative Flood Risk Areas that have been identified nationally, none are located within Northamptonshire. This has been verified using detailed Geographical Information System analysis as described in section 3.6.2.

4. Historic Flood Risk

The information in Table 1 was collated, mapped and reviewed in conjunction with partner organisation to identify the major historic flood events and their consequences. Much of the data was not geo-referenced. Therefore time was spent making it possible to display this information using GIS software and overlay layers to identify the spatial distribution of historic flood events and relate these datasets to receptor information, in order to assess the overall flood risk.

To determine which historic flooding events should be considered 'Locally Significant' the collated data was ranked in order of most adverse human and economic consequences to least. From there it was possible to see a clear distinction between significant events that affected thousands of properties and much smaller events that only affected tens of properties.

It was concluded that only one event was both significant enough to be reported nationally in this report and also had enough data supporting it to enter a detailed summary into Annex 1: The Easter floods of 1998. On the 10th April 1998 Northampton and the surrounding areas were flooded due to very heavy rainfall, channel exceedence, flood defence malfunction, surface water flooding and canal overtopping. An estimated 4,200 properties were affected causing over £75million worth of damage. Many of these properties were commercial properties and critical infrastructure. There were no reported environmental effects. Other flooding events along the Nene have occurred historically, but which are considered to be locally rather than nationally significant.

Due to the lack of detailed information available, no other historic flood events have been considered to have had 'significant harmful consequences'. However, a complete record of locations where flooding has occurred will be kept by Northamptonshire County Council to inform future PFRA cycles as well as the Local Flood Risk Management Strategy required as part of the Flood and Water Management Act 2010.

5. Assessing Future Flood Risk

The findings from assessing future flood risk are presented in detail in Annex 2 and summarised below.

5.1 Surface Water

The Environment Agency has produced a national assessment of surface water flood risk as two national mapping datasets. The first generation national mapping, Areas Susceptible to Surface Water Flooding contains three susceptibility bandings for a rainfall event with a 1 in 200 chance of occurring (map 4). The national methodology has since been updated to

produce the Flood Map for Surface Water, a revised model containing two flood events: a 1 in 30 annual chance (map 3) and 1 in 200 annual chance (map 2) and two depth bandings (greater than 0.1m and greater than 0.3m). Using this dataset, the number of properties at risk of surface water flooding within Northamptonshire has been estimated. Using the Flood Map for Surface Water for a rainfall event with a 1 in 200 annual chance of occurring, approximately 60,700 residential properties are at risk from flooding to a depth of 0.1m and 18,800 residential properties are at risk from flooding to a depth of 0.3m. The economic impacts of such a flood would be significant whereas the environmental impacts would not. For further details and for different scenarios see annex 2.

5.2 Groundwater Flooding

There is no local information available regarding future groundwater flood risk in Northamptonshire. The national dataset, Areas Susceptible to Groundwater Flooding, has been used to form the basis of the assessment of future flood risk from groundwater (map 5).

Areas Susceptible to Groundwater Flooding is a strategic scale map showing groundwater flood areas on a 1km square grid. It was developed specifically by the Environment Agency for use by Lead Local Flood Authorities (LLFAs) for use in Preliminary Flood Risk Assessment (PFRA) as required under the Flood Risk Regulations. The data was produced so that LLFAs can obtain a broad feel for the wider areas which might be at risk from groundwater flooding.

This data shows that there are 101 Km² areas that show that significant levels of groundwater flooding (identified as having a greater than or equal to 75% proportion of each 1 km square that is susceptible to groundwater flood emergence) and only 62 of these contain properties- a total of 3820 residential properties.

5.3 Canals and Ordinary Watercourses

There is no available information on future flood risk from canals. However, British Waterways are currently working on a study to better understand the future flood risk from canals, which will be available to inform the second cycle of the PFRA process in 2017.

The fluvial flood map (map 6) has been used to assess the risk of flooding from ordinary watercourses. The Detailed River Network was used to identify ordinary watercourses and this was cross referenced with the Flood Map for Rivers and the Sea to assess future flood risk from this source. Based on this methodology, no areas were identified that seemed to be at significant risk from ordinary watercourses.

5.4 Developments which may increase local flood risk

5.4.1 West Northamptonshire

Flood risk is a significant concern for West Northamptonshire. All new developments will need to demonstrate that they have regard to existing and future flood patterns and that the need for effective protection and flood risk management measures from all sources is addressed. Policy S10 (Sustainable Development Principles) in the West Northamptonshire

Core Spatial Strategy (at the pre-submission stage at the time of drafting this report) sets out how future development will, in some cases, improve flood risk management. All new development should comply with Policy BN7 of the West Northamptonshire Joint Core Strategy (based on Planning Policy Statement 25).

New development should help achieve the long-term flood management goals set out in the Environment Agency's Catchment Flood Management Plans.

5.4.2 North Northamptonshire

The North Northamptonshire Core Spatial Strategy states in Policy 14 (General Sustainable Development Principles) that development should not increase the risk of flooding on the site or elsewhere, and where possible will lead to a reduction in flood risk. Several studies have been undertaken in Northamptonshire to inform the future development in terms of future flood risk including:

- Corby Water Cycle Strategy
- Corby Borough Council SFRA levels 1 and 2
- East Northants District Council Strategic Flood Risk Assessment levels 1 and 2
- Kettering Borough Council/Borough council of Wellingborough Strategic Flood Risk Assessment levels 1 and 2
- Kettering Borough Council Strategic Flood Risk Assessment level 2
- Northampton Borough Council Strategic Flood Risk Assessment level 2
- North Northamptonshire Water Cycle Strategy
- North Northamptonshire Joint Planning Unit Flood Risk Management Study
- West Northants Water Cycle Strategy
- West Northants Strategic Flood Risk Assessment levels 1 and 2

6. Climate Change

6.1 The Evidence

There is clear scientific evidence that global climate change is happening now. It cannot be ignored.

Over the past century around the UK we have seen sea level rise and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation, however the broad trends are in line with projections from climate models.

Greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.

We have enough confidence in large scale climate models to say that we must plan for change. There is more uncertainty at a local scale but model results can still help us plan to adapt. For example we understand rain storms may become more intense, even if we can't be sure about exactly where or when. By the 2080s, the latest UK climate projections (UKCP09) are that there could be around three times as many days in winter with heavy

rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

6.2. Key Projections for Anglian River Basin District

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are

- Winter precipitation increases of around 14% (very likely to be between 3 and 31%)
- Precipitation on the wettest day in winter up by around 14% (very unlikely to be more than 29%)
- Relative sea level at Felixstowe very likely to be up between 10 and 41cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flows in a typical catchment likely to increase between 8 and 16%

6.2.1 Implications for Flood Risk

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.

Wetter winters and more of this rain falling in wet spells may increase river flooding. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected.

Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Even small rises in sea level could add to very high tides so as to affect places a long way inland.

Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

6.3 Key Projections for Thames River Basin District

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are

- Winter precipitation increases of around 15% (very likely to be between 2 and 32%)
- Precipitation on the wettest day in winter up by around 15% (very unlikely to be more than 31%)
- Relative sea level at Sheerness very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flows in a typical catchment likely to increase between 8 and 18%

6.3.1 Implications for Flood Risk

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.

Wetter winters and more of this rain falling in wet spells may increase river flooding in both rural and heavily urbanised catchments. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected.

Rising sea or river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

There is a risk of flooding from groundwater-bearing chalk and limestone aquifers across the district. Recharge may increase in wetter winters, or decrease in drier summers.

6.4 Key Projections for Severn River Basin District

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are

- Winter precipitation increases of around 12% (very likely to be between 2 and 26%)
Precipitation on the wettest day in winter up by around 9% (very unlikely to be more than 22%)
- Relative sea level at Bristol very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flows in a typical catchment likely to increase between 9 and 18%
Increases in rain are projected to be greater at the coast and in the south of the district.

6.4.1 Implications for Flood Risk

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.

Wetter winters and more of this rain falling in wet spells may increase river flooding along the Severn and its tributaries. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected.

Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

6.5 Adapting to Change

Past emission means some climate change is inevitable. It is essential we respond by planning ahead. We can prepare by understanding our current and future vulnerability to

flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term, sustainable benefits.

Although the broad climate change picture is clear, we have to make local decisions against deeper uncertainty. We will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that we do not increase our vulnerability to flooding.

6.6 Long Term Developments

It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk.

In England, Planning Policy Statement 25 (PPS25) on development and flood risk aims 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, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall."

Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).

7. Identification of Flood Risk Areas

There are no identified Flood Risk Areas in Northamptonshire of national significance (map 7). The methodology for identifying a Flood Risk Area is as follows. National flood risk information was used to identify 1 kilometre grid squares where "local flood risk is an issue". Thresholds for these squares are:

- Number of people at risk greater or equal to 200
- Critical services (as defined in section 3.6.2) at risk greater or equal to 1
- Non-residential properties at risk greater or equal to 20

Where more than 5 highlighted grid squares are touching a cluster is formed. If these clusters contain more than 30,000 people at risk, the cluster is identified as an indicative Flood Risk Areas. The indicative Flood Risk Areas are meaningful areas in which the magnitude of the flood risk in a national context justifies further investigation through maps and management in plans as required by the Regulations and the results reported to the European Commission.

The locally agreed surface water information is the same as that used to produce the flood risk areas. Also, the largest historical flooding even in Northamptonshire does not reach the thresholds required for the formation of a flood risk area. Therefore no new information has come to light to suggest a flood risk area within Northamptonshire and so Annex 3 contains

no records. The grid squares and clusters highlighted in Northamptonshire (map 7) will be used to inform the Local Flood Risk Management Strategy.

8. Review

8.1 Local Authority Review

The process around the production of the PFRA, in relation to the impact for Northamptonshire County Council, was presented to the Customers & Communities Scrutiny Committee on the 16th February 2011. The final report, including any comments received from the Environment Agency and Borough/District Partners, was presented to the meeting of the Council's cabinet on the 10th May 2011 and was approved. The formal deadline for submission to the EA is the 22nd June 2011.

8.2 Environment Agency Review

Under the Flood Risk Regulations (FRR), the Environment Agency has a role to review, collate and publish the outputs of the PFRA process and report this to the European Commission. All PFRAs must be submitted to the Environment Agency by the 22nd of June 2011. The EA will then submit their National PFRA to the European Commission by the 22nd of December 2011.

9. Next Steps

As no indicative Flood Risk Areas have been identified in Northamptonshire, the subsequent two stages of the FRR process will not need to be carried out by the County Council. However, in order to continue to fulfil their role as Local Lead Flood Authority, the County Council are required Under Section 9(1) of the Flood and Water Management Act, to develop, maintain, apply and monitor a strategy for local flood risk management in its area (a local flood risk management strategy). The strategy will identify:

- The risk management authorities in the LLFA area and what flood risk management functions they may exercise in relation to the area.
- The objectives for managing local flood risk. These should be relevant to the circumstances of the local area.
- The measures proposed to achieve the objectives.
- How and when the measures are expected to be implemented. In some instances this could be linked to the Flood Risk Regulations outputs – The Preliminary Flood Risk Assessment.
- The costs and benefits of those measures and how they are to be paid for.
- The assessment of local flood risk for the purpose of the strategy. In the first instance it is likely that the LLFA will use the findings from the Local FRMS and any other studies that are available, such as Catchment Flood Management Plans and Strategic Flood Risk Assessments. The strategy can identify gaps in understanding of the local flood risk and specify what actions need to be taken to close these gaps.
- How and when the strategy is to be reviewed. A review cycle is not specified, so it is up to the LLFA to decide what is appropriate. It may be advisable to link it to the cycles for the Flood Risk Regulations outputs.

- How the strategy contributes to the achievement of wider environmental objectives.

All records of flood events will be documented consistently and in accordance with the INSPIRE Directive (2007/2/EC)². A centralised database will be kept up to date by the County Council, who have the overall responsibility to manage flood data through the whole administrative area. All data collected for the PFRA will be updated annually and used to inform the Local Flood Risk Management Strategy as well as the next PFRA in 6 years time.

² The INSPIRE Directive (2007) establishes a framework for spatial information at a European level to support Community environmental policies and policies or activities which may have an impact on the environment.

Definitions

Main river – watercourses legally defined and marked as such on the main river map. Generally they are larger streams or rivers, but can be smaller watercourses. The Environment Agency has legal responsibility for them.

Local flood risk – flood risk from sources other than main rivers, the sea and reservoirs, principally meaning surface runoff, groundwater and ordinary watercourses.

Surface runoff – rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer. Flooding from surface runoff is sometimes called pluvial flooding. Note that the term 'surface water' is used generically to refer to water on the surface.

Groundwater – water which is below the surface of the ground and in direct contact with the ground or subsoil. It is most likely to occur in areas underlain by permeable rocks, called aquifers. These can be extensive, regional aquifers, such as chalk or sandstone, or may be more local sand or river gravels in valley bottoms underlain by less permeable rocks.

Ordinary watercourse – any river, stream, ditch, cut, sluice, dyke or non-public sewer which is not a main river.

Artificial water bearing infrastructure – includes reservoirs (see above), sewers, water supply systems and canals. Flooding from canals that are non Main River should be included in a PFRA. LLFAs do not need to assess flooding from sewers, unless wholly or partly caused by rainwater or other precipitation entering or otherwise affecting the system. Floods of raw sewage caused solely, for example, by a sewer blockage do not fall under the Regulations. The Regulations also do not apply to floods from water supply systems, e.g. burst water mains.

Other – other rare sources of flooding are mentioned in the Floods Directive and include snowmelt and tsunamis. Snowmelt would count as precipitation and so could lead to surface runoff. Tsunamis are a form of flooding from the sea. It is anticipated that the main focus of LLFAs in their PFRA will be ordinary watercourses, surface runoff and groundwater.

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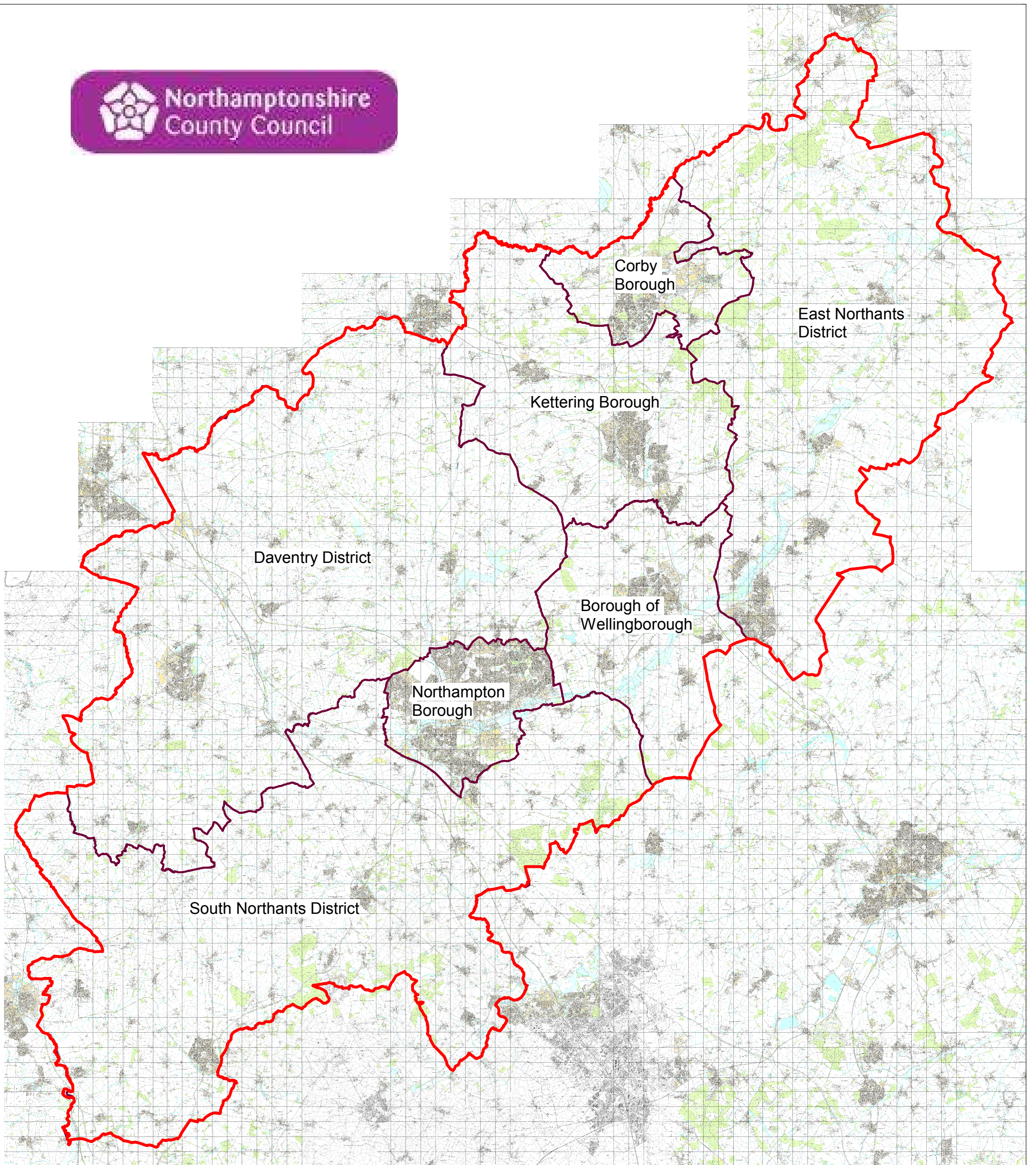
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Map 1. County and District Boundaries

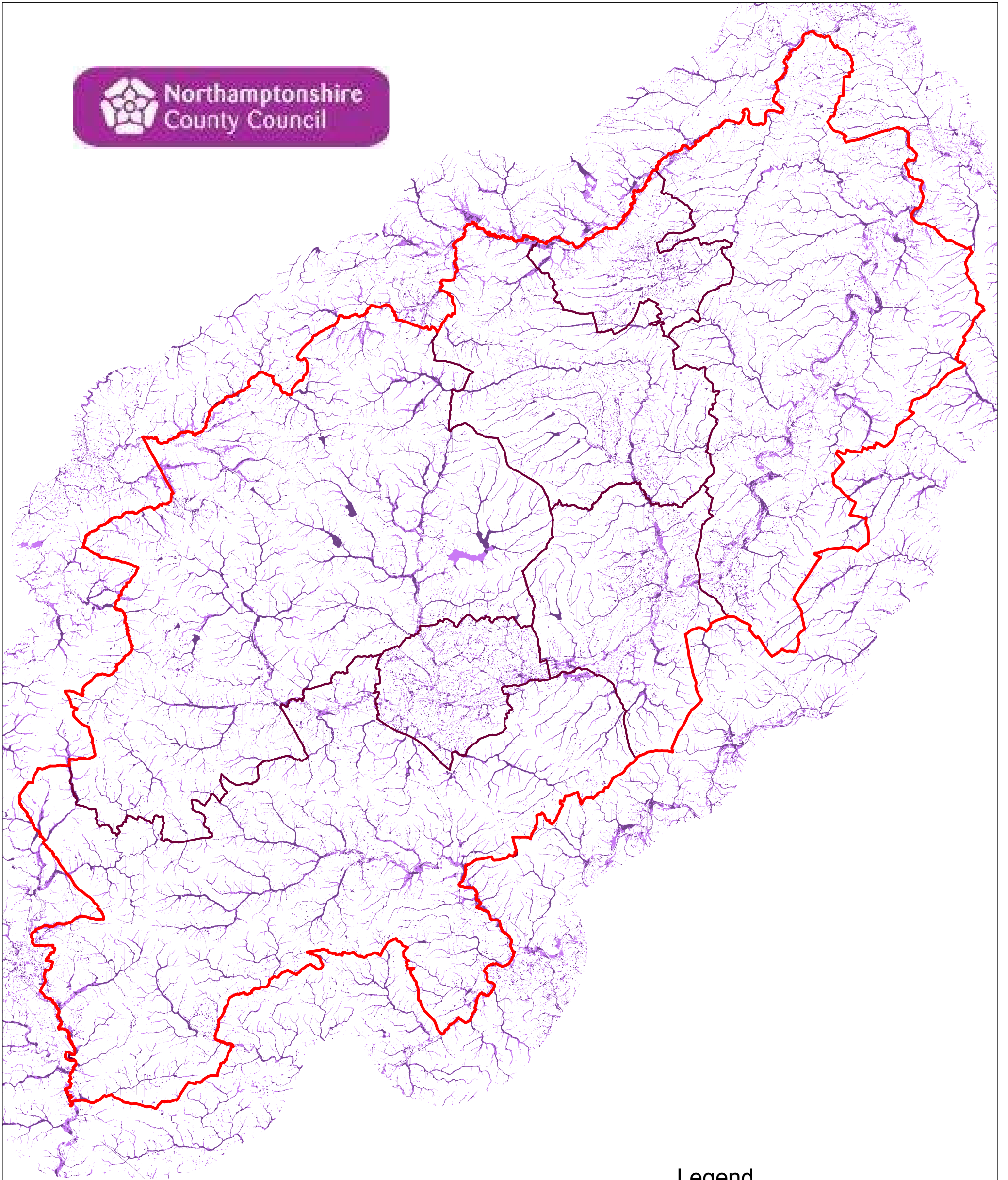
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Legend

 County Boundary

 Borough and District Boundaries







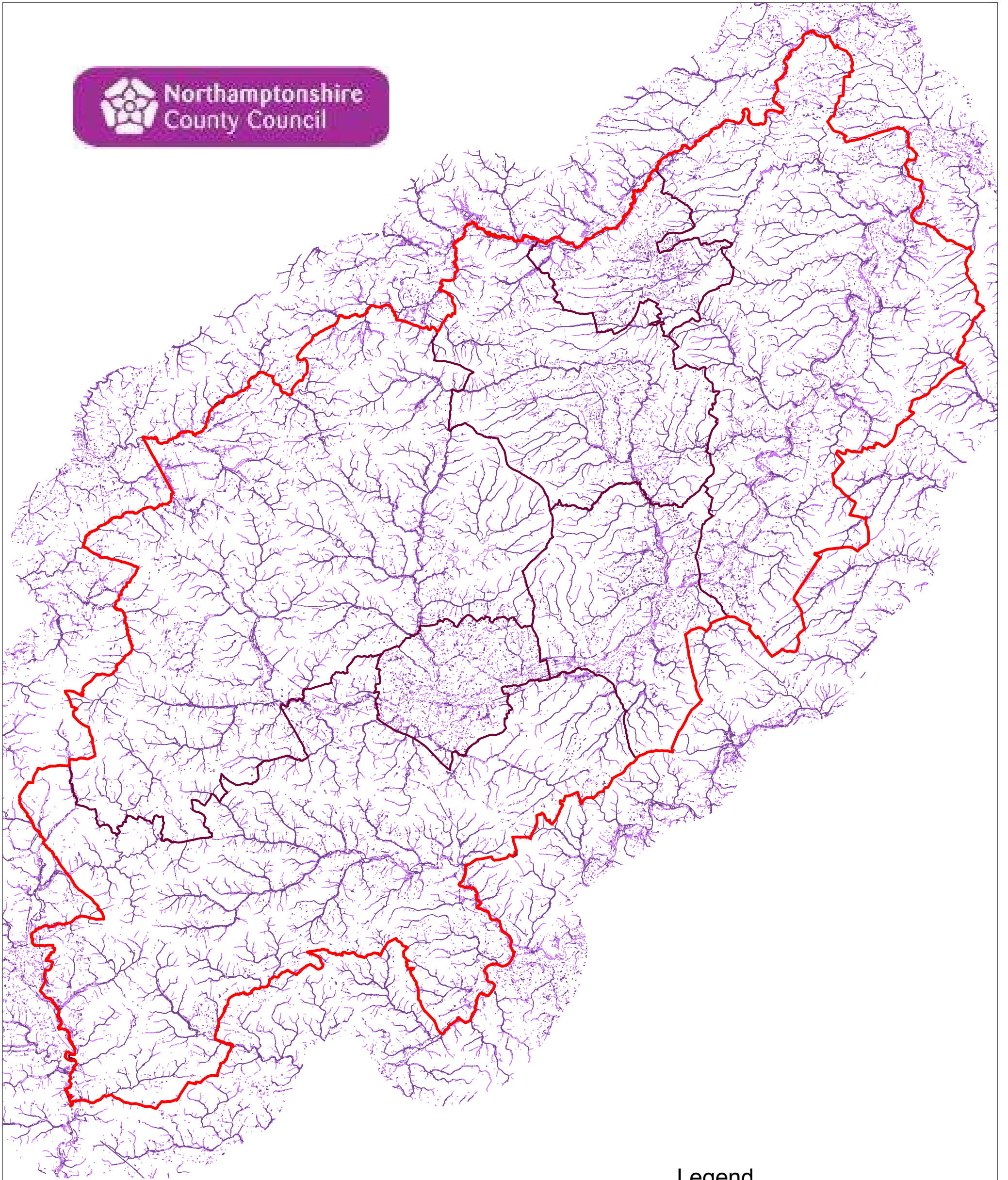
Map 2. Flood Map for Surface Water 1 in 200 Annual Chance

Scale: 1:254900

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This map gives an indication of the broad areas likely to be at risk of surface water flooding. It is not suitable for use at an individual property scale due to the method used. Copyright © Environment Agency 2010.

Legend

-  County Boundary
-  District Boundary
-  FMfSW 1 in 200 yr
>0.3m deep
-  FMfSW 1 in 200 yr
>0.1m deep







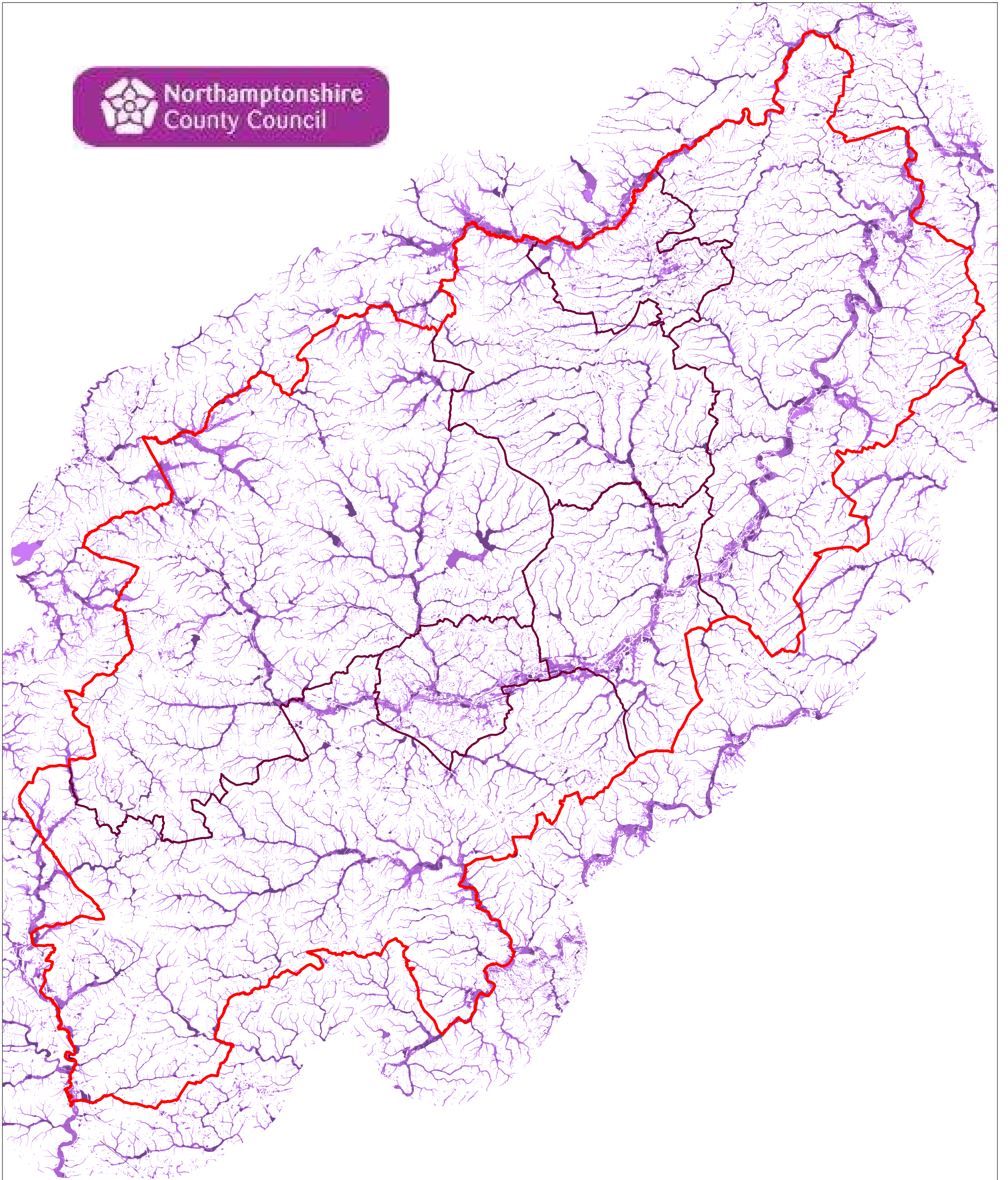
Map 3. Flood Map for Surface Water 1 in 30 Annual Chance

Scale: 1:254900

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This map gives an indication of the broad areas likely to be at risk of surface water flooding. It is not suitable for use at an individual property scale due to the method used.

Legend






-  County Boundary
-  District Boundary
-  FMfSW 1 in 30 yr
>0.3m deep
-  FMfSW 1 in 30 yr
>0.1m deep

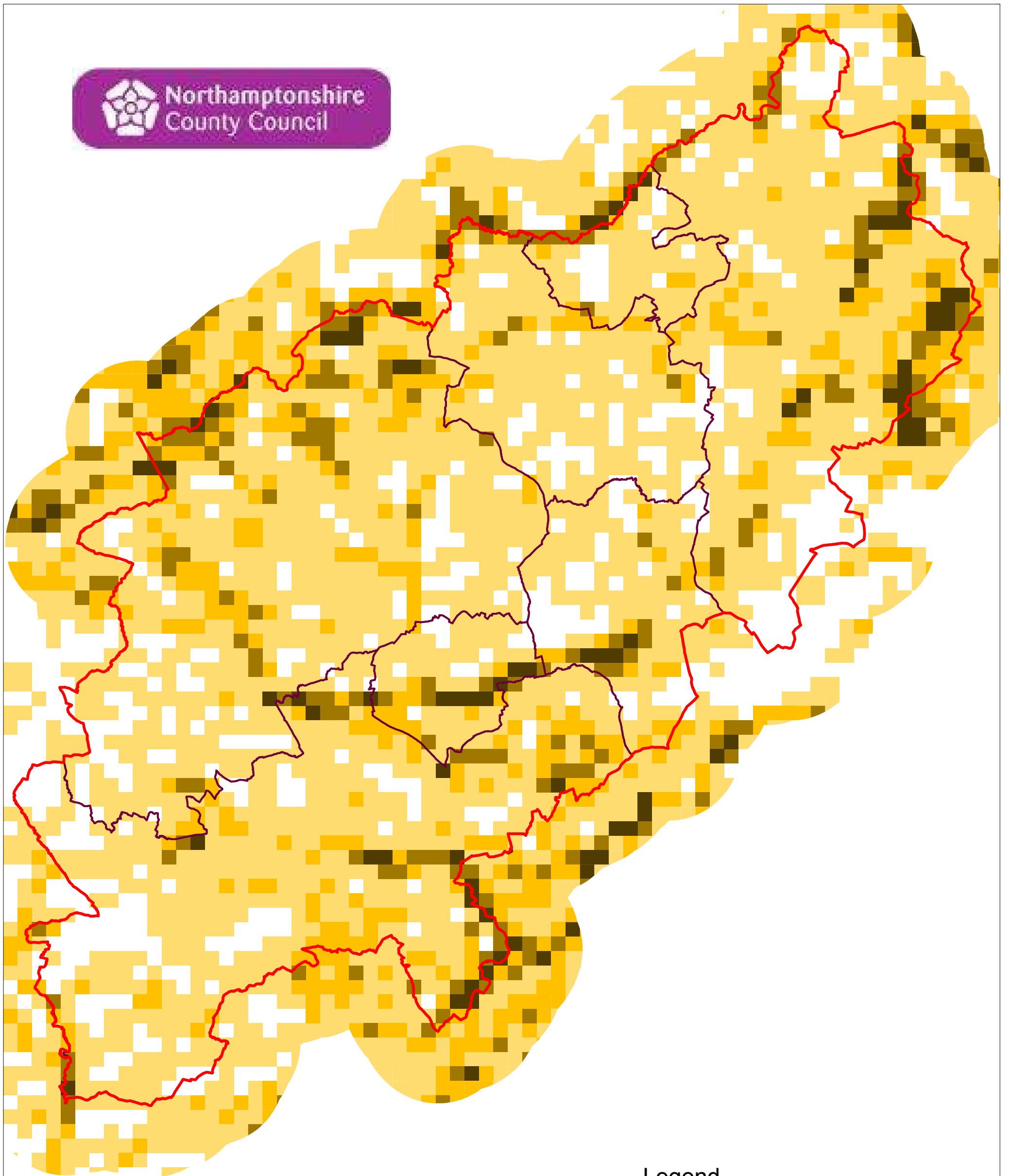


Map 4. Areas Susceptible to Surface Water Flooding

Scale: 1:254900

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Background mapping: 1:50 000

- Legend
-  County Boundary
 -  District Boundary
 -  ASTSWF More
 -  ASTSWF Intermediate
 -  ASTSWF Less









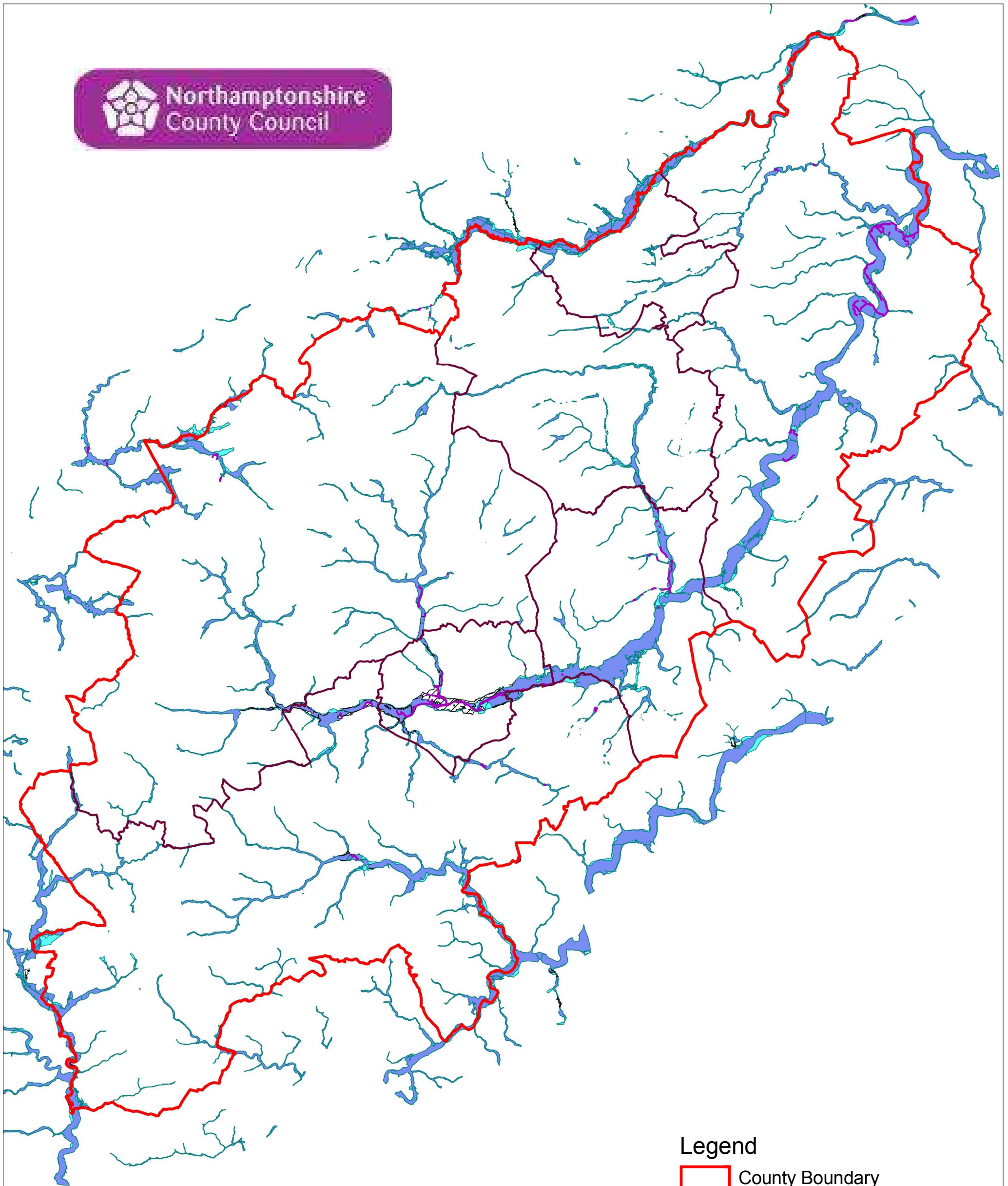
Map 5. Areas Susceptible to Ground Water Flooding

Scale: 1:254900

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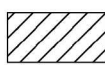


Legend

-  County Boundary
-  District Boundary
-  ASTGWF ≥ 75 percent
-  ASTGWF ≥ 50 , < 75 percent
-  ASTGWF ≥ 25 , < 50 percent
-  ASTGWF < 25 percent

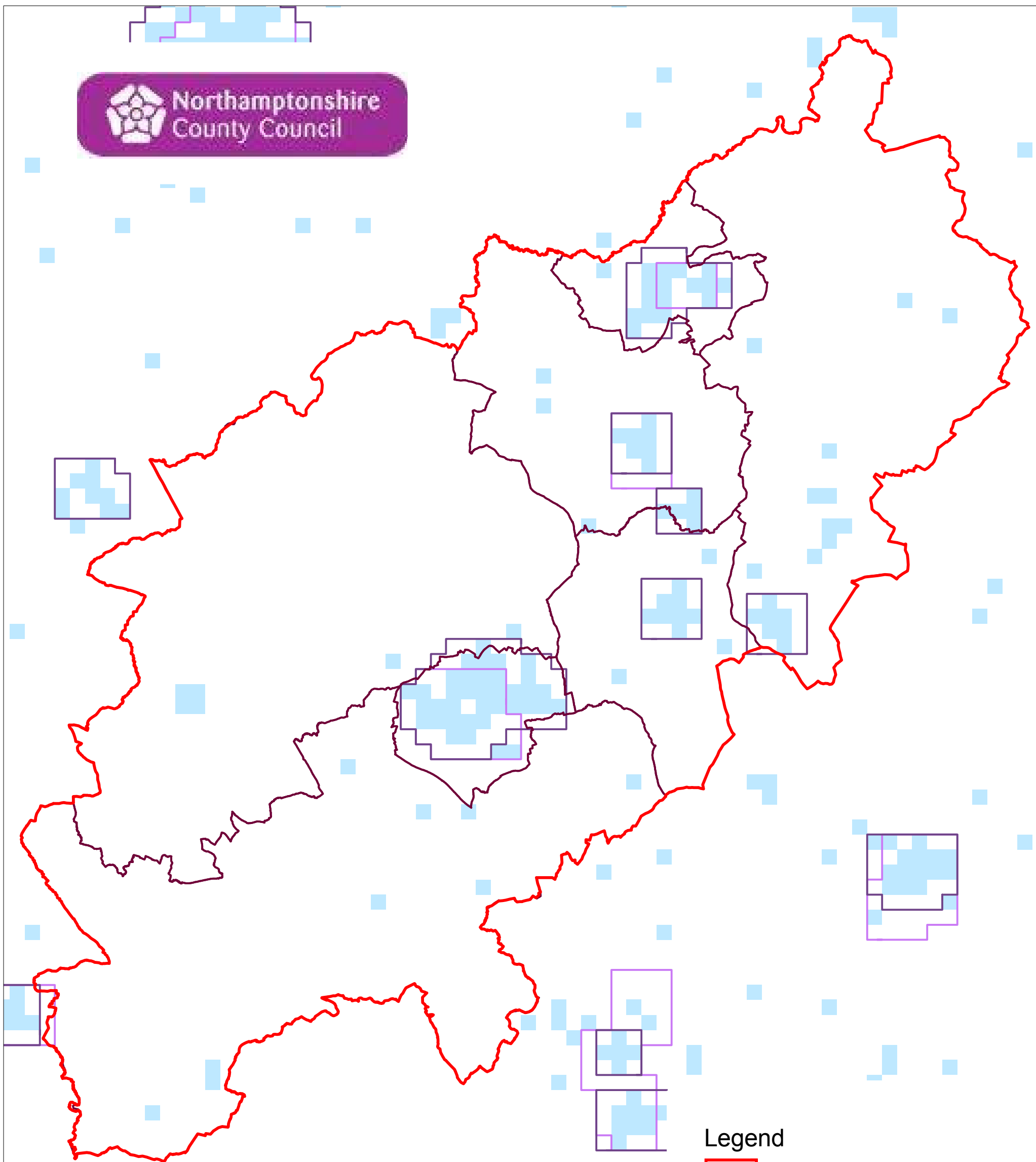


Map 6. Flood Zones and Flood Defences





Scale: 1:254900


- Legend**
-  County Boundary
 -  District Boundary
 -  Flood Defences
 -  Areas benefiting from Flood Defences
 -  Flood Zone 3
 -  Flood Zone 2

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Legend

-  County Boundary
-  District Boundary
-  Clusters attributed to FMfSW
-  Clusters attributed to ASTSWF

 1 km grid squares
above Flood Risk
Thresholds

Map 7. 1 Kilometer Grid Squares above Flood Risk Thresholds

Scale: 1:254900

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