Preliminary Flood Risk Assessment

July 2011

City of York Council

Preliminary Flood Risk Assessment Report

Contents

Abbreviations

Acronym	Definition
AStSWF	Areas Susceptible to Surface Water Flooding
CFMP	Catchment Flood Management Plan
CYC	City of York Council
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EC	European Commission
FMfSW	Flood Map for Surface Water
FWMA	Flood & Water Management Act 2010
IDB	Internal Drainage Board
IUD	Integrated Urban Drainage
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
LoSA	Level of Service Agreements
LPA	Local Planning Authority
LRF	Local Resilience Forum
MoU	Memorandums of Understanding
PPS25	Planning and Policy Statement 25: Development and Flood Risk
PFRA	Preliminary Flood Risk Assessment
RBD	River Basin District
RFDC	Regional Flood Defence Committee
SAB	SuDS Approving Body
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
WAG	Welsh Assembly Government
YWS	Yorkshire Water Services

Executive Summary

Under the EC Floods Directive, which has been transposed into UK law through the Flood Risk Regulations (2009), City of York Council is required to undertake a Preliminary Flood Risk Assessment (PFRA) to assess the harmful consequences of past and potential future flooding, and to identify areas of significant flood risk ('flood risk areas').

City of York Council is a Lead Local Flood Authority (LLFA) as defined in the regulations, and has responsibility for preparing the deliverables of the Flood Risk Regulations for 'local flood risk' (flooding from surface runoff, ordinary watercourses and groundwater). The Environment Agency has responsibility for preparing the deliverables of the Flood Risk Regulations for flooding from Main Rivers and the Sea.

The PFRA process is aimed at providing a high level overview of flood risk from local flood sources, including surface water, groundwater, ordinary watercourses and canals. As a LLFA, City of York Council must submit their PFRA to the Environment Agency for review by 22nd June 2011. The methodology for producing this PFRA has been based on the Environment Agency's Final PFRA Guidance and Defra's Guidance on selecting Flood Risk Areas, both published in March 2011.

The first stage of the PFRA is to assess past floods that have had significant harmful consequences for human health, economic activity or the environment, or could have harmful consequences if they were to occur now. Little information on past flooding was available but that relating to one event in 2007, caused by flooding from local sources, was collected and analysed. This provided limited information but based on the evidence that was collected; no past flood events were considered to have had 'significant harmful consequences'.

The PFRA has also considered the potential risk of future flooding. This has been based on hydraulic modelling which predicts the potential impact of flooding on people, property and the environment. The best available information on potential future floods is the national Surface Water maps produced by the Environment Agency. This has been used to inform an assessment of the numbers and types of properties in York that are vulnerable to surface water flooding during an extreme rainfall event. The events modeled are in excess of any experienced or recorded in York to date.

The final stage of the PFRA process is the identification of 'Flood Risk Areas'. Indicative 'Flood Risk Areas' have been calculated by the Environment Agency using a threshold defined nationally by ministers at the Department for food and rural affairs (Defra). An indicative 'Flood Risk Area' has been identified where clusters of at least 30,000 people have been identified as being at risk of flooding from local sources.

Of the ten indicative 'Flood Risk Areas' that have been identified nationally by the Environment Agency and Defra, none are located in York and City of York is not proposing to add a new 'Flood Risk Area' for the purposes of the PFRA.

1 Introduction

1.1 Preliminary Flood Risk Assessment

The chief drivers behind the preparation of the PFRA report are two sets of new legislation: the Flood Risk Regulations (The Regulations), which came into force on the 10th December 2009, and the Flood & Water Management Act (FWMA) which gained Royal Assent on the 8th April 2010. Under these pieces of legislation, all Unitary Authorities, and in two-tier systems, all County Councils, are designated a Local Lead Flood Authority (LLFA) and have formally been allocated a number of key responsibilities with respect to local flood risk management. A full description of these responsibilities is provided in Chapter 2.

The purpose of the Flood Risk Regulations was to transpose the EC Floods Directive (Directive 2007/60/EC on the assessment and management of flood risk) into domestic law in England and Wales and to implement its provisions. In particular it places duties on the Environment Agency and LLFAs to prepare a number of documents including:

- Preliminary Flood Risk Assessments;
- Flood hazard and flood risk maps;
- Flood Risk Management Plans.

Table 1-1 shows the elements of work required from City of York Council under the Flood Risk Regulations 2009, along with the timescales of their respective delivery. The first two elements of work are covered by the preparation of this PFRA report.

Table 1-1: Elements of Work required under the Flood Risk Regulations 2009

22 June 2011	**Prepare Preliminary Assessment Report.**	*The PFRA should focus on local flood risk from surface water, groundwater, ordinary watercourses and canals.*
22 June 2011	**On the basis of the PFRA, identify Flood Risk Areas.**	*Flood Risk Areas are areas of significant risk identified on the basis of the findings of the PFRA, national criteria set by the UK Government Secretary of State and guidance provided by the Environment Agency.*
22 June 2013	Prepare **Flood Hazard Maps** and **Flood Risk Maps** for each Flood Risk Area.	*Used to identify the level of hazard and risk of flooding within each Flood Risk Area to inform Flood Risk Management Plans.*
22 June 2015	Prepare **Flood Risk Management Plans** for each Flood Risk Area.	*Plans setting out risk management objectives and strategies for each Flood Risk Area.*

The required scope of this PFRA is to consider past flooding and possible future flooding from the following local flood sources:

- Surface water;
- Groundwater;
- Ordinary watercourses; and
- Canals.

It is also required that the PFRA report must consider floods which have significant harmful consequences for human health, economic activity and the environment.

The regulations do not require a LLFA to include in its PFRA report details of flooding associated with the sea, main rivers and reservoirs as this is the responsibility of the Environment Agency, unless it is considered that it may affect flooding from one of the sources listed above.

1.2 Aims and objectives

The PFRA is a high level screening exercise to identify areas of most significant flood risk across Europe. The aim of this PFRA is to provide an assessment of local flood risk across the study area, including information on past floods and the potential consequences of future floods.

The key objectives can be summarised as follows:

- Identify relevant partner organisations involved in future assessment of flood risk; and summarise means of future and ongoing stakeholder engagement;

- Describe arrangements for partnership and collaboration for ongoing collection, assessment and storage of flood risk data and information;

- Provide a summary of the systems used for data sharing and storing, and provision for quality assurance, security and data licensing arrangements;

- Summarise the methodology adopted for the PFRA with respect to data sources, availability and review procedures;

- Assess historic flood events within the study area from local sources of flooding (including flooding from surface water, groundwater and ordinary watercourses), and the consequences and impacts of these events;

- Establish an evidence base of historic flood risk information, which will be built up on in the future and used to support and inform the preparation of York's Local Flood Risk Strategy;

- Assess the potential harmful consequences of future flood events within the study area;

- Review the provisional national assessment of indicative Flood Risk Areas provided by the Environment Agency and provide explanation and justification for any amendments required to the Flood Risk Areas.

1.3 Study Area

The study area for this PFRA is defined by the administrative boundary of City of York Council, a small Unitary Authority located in the flat Vale of York in North Yorkshire. The geographical extent of this area is shown in figure 1.

Figure 1 – Geographical Extent of City of York Unitary Authority

In April 1996 York City Council became the larger City of York Council Unitary Authority, covering an area of approximately 275 km^2, with its boundaries extended to include a rural belt with many villages of various sizes which were formerly within the Ryedale, Selby and Harrogate District Council areas. It is bordered by North Yorkshire County Council on its northern, western and southern boundaries, and by East Riding of Yorkshire Council on its eastern boundary, which is formed by the river Derwent. The study area has no coastline. The geographical context of the authority area is shown in figure 2.

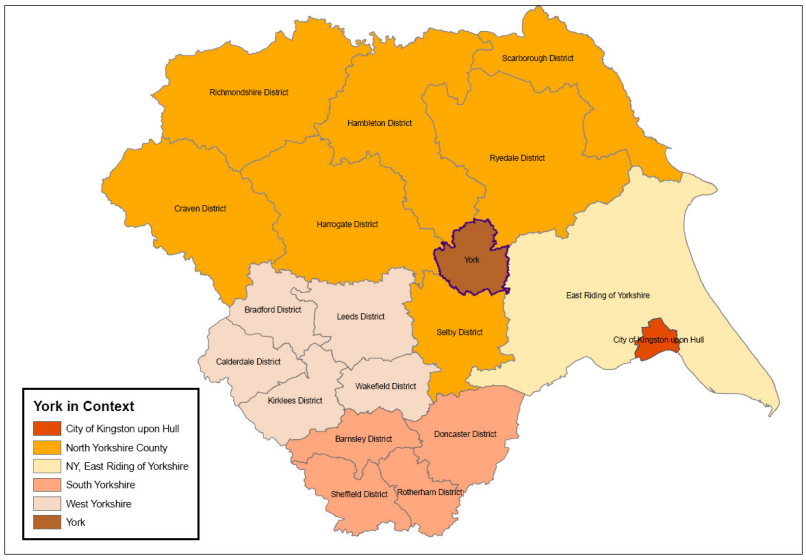


Figure 2 – Geographical Context of City of York Unitary Authority

The study area is within the Humber Basin district. The majority is within the Ouse catchment with a strip near the eastern boundary being in the Derwent catchment. It is within the Yorkshire and North East Environment Agency Region and is represented on the Yorkshire Regional Flood and Coastal Committee (YRFCC) to which it pays a levy. The area is served by one water company, Yorkshire Water Services.

The study area is overlapped by four Internal Drainage Boards, Ainsty (2008), Foss (2008), Kyle and Upper Ouse, and Ouse and Derwent. The Council pays a Special Levy to all of these and is able to nominate members, though not all of these places are currently taken. One Council officer has been a nominated member of all Boards since shortly after the creation of the Unitary authority.

2 Lead Local Flood Authority responsibilities

The preparation of a PFRA is one of several responsibilities of LLFAs under the new legislation. This section provides a brief overview of other responsibilities the Council is obliged to fulfill under their role as a LLFA.

2.1 Coordination of Flood Risk Management

In his review of the summer 2007 flooding, Sir Michael Pitt stated *"the role of local authorities should be enhanced so that they take on responsibility for leading the coordination of flood risk management in their areas*". As the designated LLFA, CYC is therefore responsible for leading local flood risk management in its area.

It is well known that York suffers frequent flooding from the rivers Ouse and Foss, and to a lesser extent the river Derwent. The effects are well recorded, predictable and subject to a well rehearsed response plan. Because of this there is a longstanding relationship between the various partners involved, and both the River Flood Emergency Plan and Multi Agency Plan are reviewed annually.

Due to the increasing frequency of non river flooding, these reviews include discussions of the effects of surface water flooding and response. In addition to the various Directorates within the Council and the emergency services the participants are:

2.1.1 The Environment Agency

The Council has had a good working relationship with the Environment Agency since its inception in 1996, and with its predecessors before that. Its drainage engineers have always worked closely with the Agency's officers in all aspects of flood risk management, particularly in managing the frequent fluvial flood events that affect York and also in liaison over planning issues.

2.1.2 Internal Drainage Boards

There are four Internal Drainage Boards around York to which the council pays a special levy and may nominate members. Since 1998 one of these nominees has been a council drainage engineer and as a result the council's drainage engineers enjoy a good working relationship with all of the Boards. Within their Districts the IDBs are responsible for managing flood risk from ordinary watercourses.

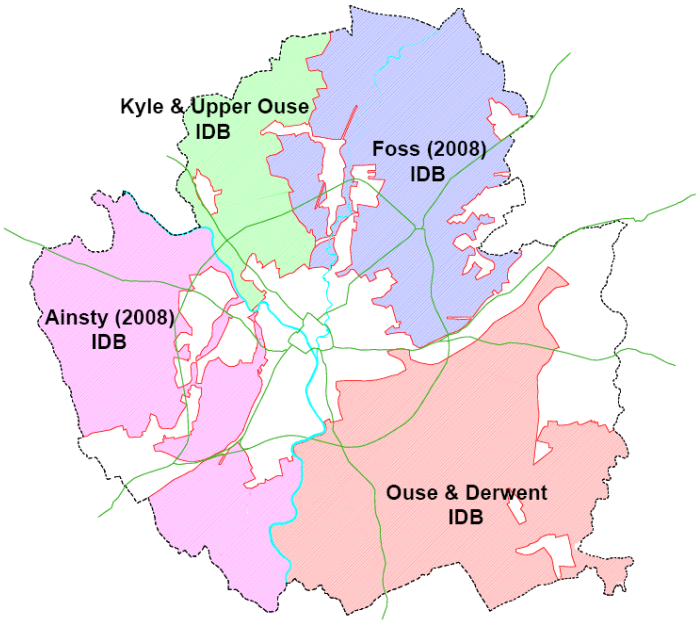


Figure 3 – IDB Districts

2.1.3 Yorkshire Water Services Ltd

Until 1998 the council were sewerage agents for YWS and engineers familiar with the network are still employed by the council in the drainage team. Since the loss of the agency they have continued to liaise with YWS engineers in investigating drainage problems and this relationship has been strengthened by the signing of an information sharing protocol following the enactment of the Flood and Water Management Act 2010.

The Council is a member of the North Yorkshire Flood Risk Partnership, comprising CYC and NYCC elected members and officers, YWS, EA, IDB and the RFCC. This meets quarterly.

Neither the Council's own area nor the immediate surrounding areas have suffered surface water flooding on a significant scale at any location. Localised discrete areas have been recorded to flood from more intense rainfall events, the locations of which are largely confirmed by the EA mapping. Many of these have already been proactively investigated by the Council with the EA, IDB and YWS in conjunction with local ward members, parish councils and residents as necessary. These are continuing to be investigated in the ongoing Surface Water Management Plan.

2.2 Communication with partners and the public

On the basis of the foregoing information a formal partnership has not specifically been set up as all interested parties are in regular dialogue regarding flooding issues. The Council will liaise appropriately when planning and carrying out investigations and, where considered necessary, formalise arrangements.

2.3 Further Responsibilities

Besides coordinating and leading on local flood management, there are a number of other key responsibilities that have arisen for Lead Local Flood Authorities from the Flood & Water Management Act and the Flood Risk Regulations. These responsibilities include:

- **Investigating flood incidents** – LLFAs have a duty to investigate and record details of significant flood events within their area. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying risk management authorities where necessary and publishing the results of any investigations carried out.

- **Asset Register** – LLFAs have a duty to maintain a register of structures or features that are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.

- **SuDS Approving Body** – LLFAs are designated the SuDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SuDS) within their area.

- **Local Strategy for Flood Risk Management** – LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.

- **Works powers** – LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area.

- **Designation powers** – LLFAs, as well as district councils and the Environment Agency have powers to designate structures and features that affect flooding or coastal erosion in order to safeguard assets that are relied upon for flood or coastal erosion risk management.

3 Methodology and data review

The PFRA is a high level screening exercise used to identify areas where the risk of flooding is considered to be significant and warrants further examination and management through the production of flood risk and flood hazard maps, and flood risk management plans. It must include an assessment of past floods which had significant harmful consequences for human health, economic activity or the natural/cultural environment, or which would have harmful consequences if they reoccurred.

For the purpose of this report a consequence is defined as significantly harmful in accordance with nationally agreed criteria, which is if one or more of the following have been affected within a 1km^2 area:

- Greater than 200 people
- Greater than 1 critical service
- Greater than 20 non-residential properties

3.1 Methodology

Past Floods

The historic flood events for which York is well known have been due to main rivers and are outside the scope of this report. Information on past surface water flooding was sought within the LLFA, and from parish councils, IDBs, the Environment Agency, YWS and Network Rail. The only source of information related to an event in 2007, following which the council had actively obtained information and in some locations carried out investigations with partner organisations.

Future Floods

The PFRA must also include an assessment of the possible consequences of future floods (also known as potential floods). At the national scale the Environment Agency has produced two surface water flood maps:

- Environment Agency 'Areas Susceptible to Surface Water Flooding' national map (AStSWF) – this map, which covers England and Wales, was released in June 2009 to provide a general indication of areas which are more likely to suffer from surface water flooding, and;

- Environment Agency 'Flood Map for Surface Water' national map (FMfSW) – this map, which covers England and Wales, was released in November 2010 and provides a revised approach to mapping surface water flooding including accounting for the presence of drainage systems.

Surface Water Management Plan

A SWMP is currently being carried out covering the whole of the Council's area to improve the authority's understanding of surface water issues. The data referred to above has been used as a basis for this study.

3.2 Data Sources

Available data is summarised in tables 3-1 and 3-2.

Table 3-1: Data Sources within City of York Council.

CYC Department	Data	Description
Structures & Drainage Team	2007 Summer floods	Spreadsheet converted to GIS shape file. Position and extents validated by drainage engineer.
Communities& Neighbourhood Services	2007 Summer Floods – call out records	Spreadsheet converted to GIS shape file.
Structures & Drainage Team	2007 – 2010 Drainage Investigations	Spreadsheet converted to GIS shape file. Position and extents validated by drainage engineer.

Table 3-2: Data Sources - External Organisations.

Organisation	Data	Description
Environment Agency	Areas Susceptible to Surface Water Flooding	First generation Surface Water Flooding maps. Only 2 of the 3 bandings were used – Less and Intermediate susceptibility.
	Flood Map for Surface Water	Second generation Surface Water Flooding maps. Issued December 2010. Mapping for the 1 in 200 event was used in 2 depth bandings (greater then 0.1m and greater than 0.3m)
	Areas Susceptible to Ground Water Flooding	Made up of 1 km^2 areas showing percentage of the area susceptible to flooding. Only those squares where the area at risk exceeded 75% were included in the analysis.
	National Receptors Dataset	Dataset of receptors that were used to develop sub-sets of receptors with local significance in respect of social, economic and cultural significance.
	Indicative Flood Risk Areas	Identified by national EA analysis
	Places Above the Flood Risk Threshold	Identified by national EA analysis
	Registered Parks and Gardens at Risk from Surface Water Flooding	Identified by national EA analysis
	Ouse and Derwent Catchment Management Plans	Provide an overview of all types of inland flood risk in each river catchment with recommendations for risk management now and over the next 50 – 100 years.
Ordnance Survey	Basemaps	Including Mastermap
Yorkshire Water Services	DG5 Records	Provided as a GIS shape file. Recorded incidents of network exceedance.
	Sewer Network Records	Surface Water, combined and foul, including Ex-section 24 sewers.

3.3 Data Analysis

The records of historic flooding were descriptive and were first converted into a geo-referenced format. This made it possible to overlay this information with surface water flood maps to confirm the link between the incident and a surface water flooding source. It also enabled the identification of specific, locally significant receptors by comparison with the National Receptors dataset.

A similar approach was taken with the assessment of future flooding where flood risk sources used were;

- Flood Map for Surface Water Flooding – 1 in 200 event with flooding greater than 0.1m.
- Flood Map for Surface Water Flooding – 1 in 200 event with flooding greater than 0.3m.

3.4 Quality Assurance, Security and Data Restrictions

A datashare protocol has been set up with YWS prior to the data exchange for this study. This format will be used in future to form the basis of agreements with other partners as necessary.

As part of this study, records were reviewed by the council's drainage engineers, but there is no formal method at present for recording the confidence in each data item.

Datasets from external partners and those developed in house are held in the corporate data repository, although as data owners of the FRM datasets the drainage team determine security access. The data is not accessible to view across the authority or in public sites but on the engineering web browser which is restricted through a secure user list and CYC log-in credentials.

4 Past flood risk

4.1 Surface Water Flooding

The Council has limited records of past surface water flooding but there is no evidence of significant flooding, as defined in chapter 3. The most comprehensive records relate to the consequences of intense rainfall in June 2007 when areas in Haxby, Wigginton, Rufforth, Strensall, Clifton, Rawcliffe, Acomb and Holgate were affected by very localised rainfall events ranging from 1 in 7 to 1 in 100 year return period. These records show that 138 locations reported flood related problems, of which 7 were believed to be habitable properties suffering from internal flooding. The flooding mostly affected roads where the rainfall exceeded the drainage infrastructure design capacity of 1 in 30 years. These flooding records correlated well with those of Yorkshire Water Services. There are no other records available from other sources.

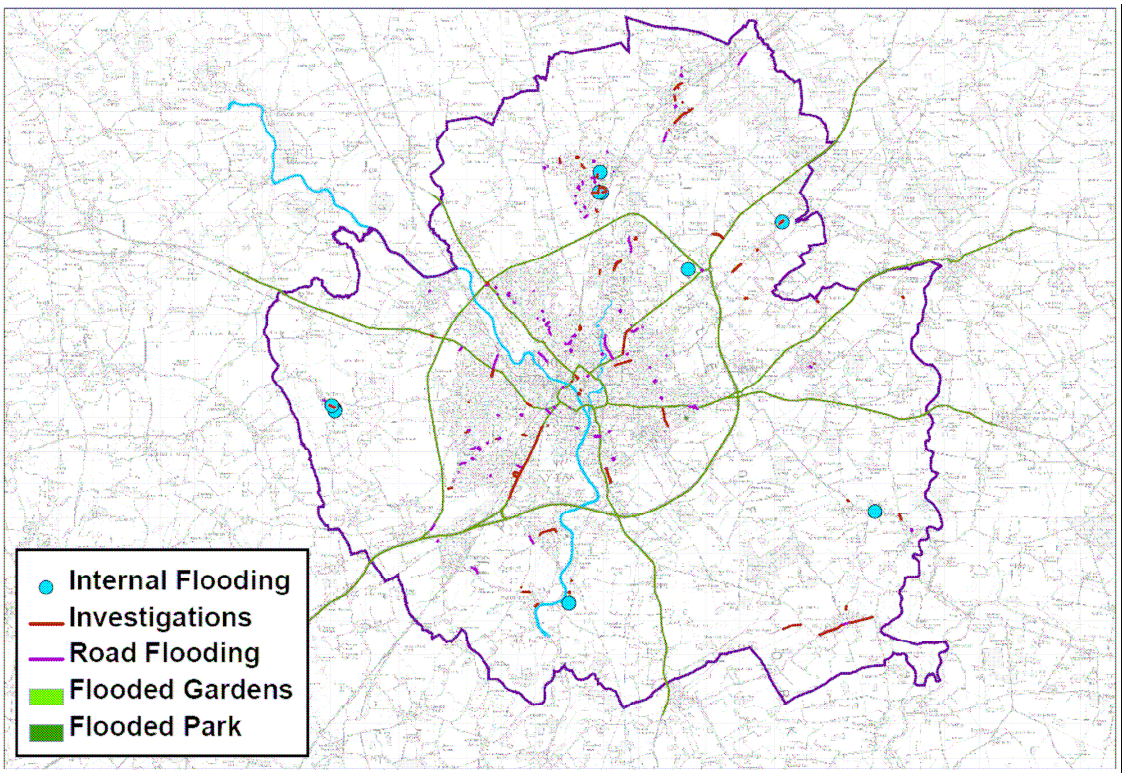


Figure 4 – Historic Recorded Flooding (2007)

4.2 Groundwater Flooding

Groundwater flooding occurs as a result of water rising up from the underlying aquifer or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels.

The British Geological Survey maps show the bedrock in the area to consist of the Sherwood Sandstone group, a thick soft sandstone of Triassic age that forms the centre of the Vale of York. This is always classified as a Major Aquifer. Superficial deposits overlaying the sandstone consist predominantly of sands and gravels, with some clay and till. Bands of alluvium deposits intersect the City of York along the path of the River Ouse and River Foss.

The drift deposits overlying the Sherwood Sandstone are classified as a Minor Aquifer, where the drift is relatively permeable, and a Non-Aquifer, where the drift deposits are fairly thick and have low permeability.

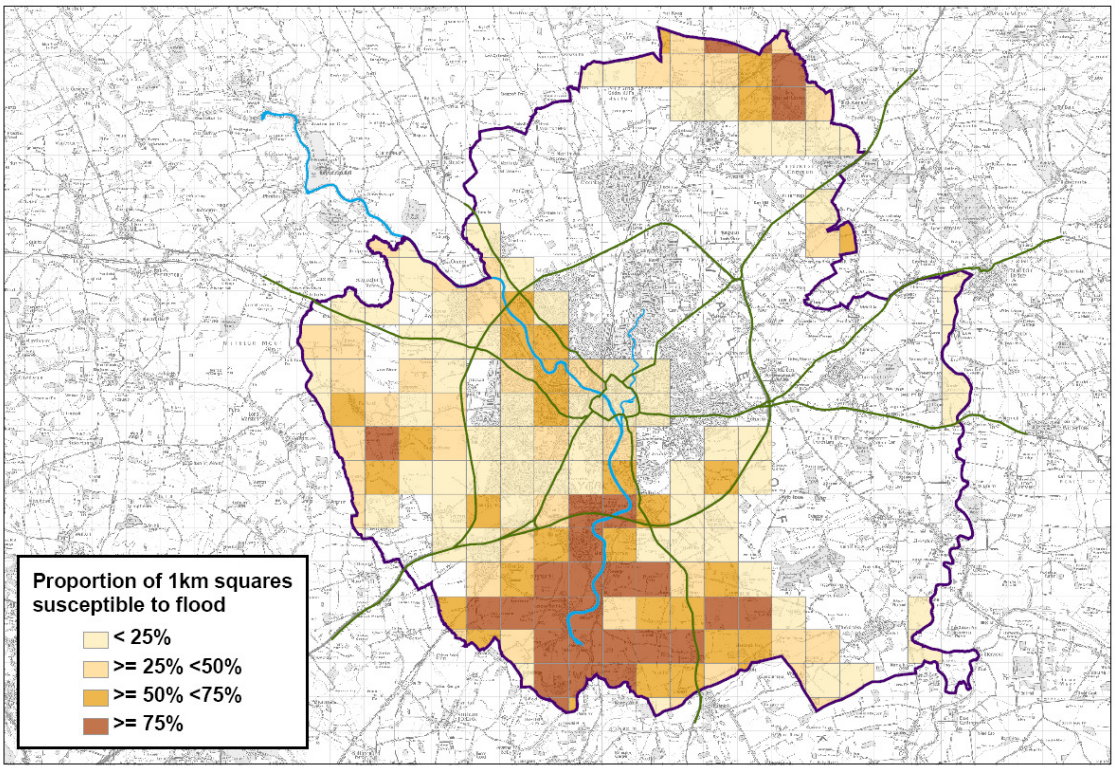


Figure 5 – Groundwater Flooding Map

Although the above map suggests a potential for groundwater flooding, the Council has no record of areas where groundwater emergence is known to be a cause of flooding.

4.3 Canal and Ordinary Watercourse Flooding

There are no artificial canals in the York area though the river Foss is a canalised main river. The effects of it flooding are recorded by the Environment Agency in their fluvial flooding mapping which falls outside this assessment.

In 2006 ordinary watercourses with potential to cause property flooding were designated main river. As a result the lower reaches of Blue Beck, Burdyke and Holgate Beck, all tributaries of the Ouse, and Tang Hall Beck and Osbaldwick Beck, tributaries of the Foss are now the responsibility of the EA. Upstream lengths of these watercourses and their tributaries are designated ordinary watercourses and are the responsibility of the Council or appropriate IDB.

The EA's Detailed River Network (DRN) showing all rivers and watercourses is reproduced as Figure 6, and Figure 3 shows the IDB districts.

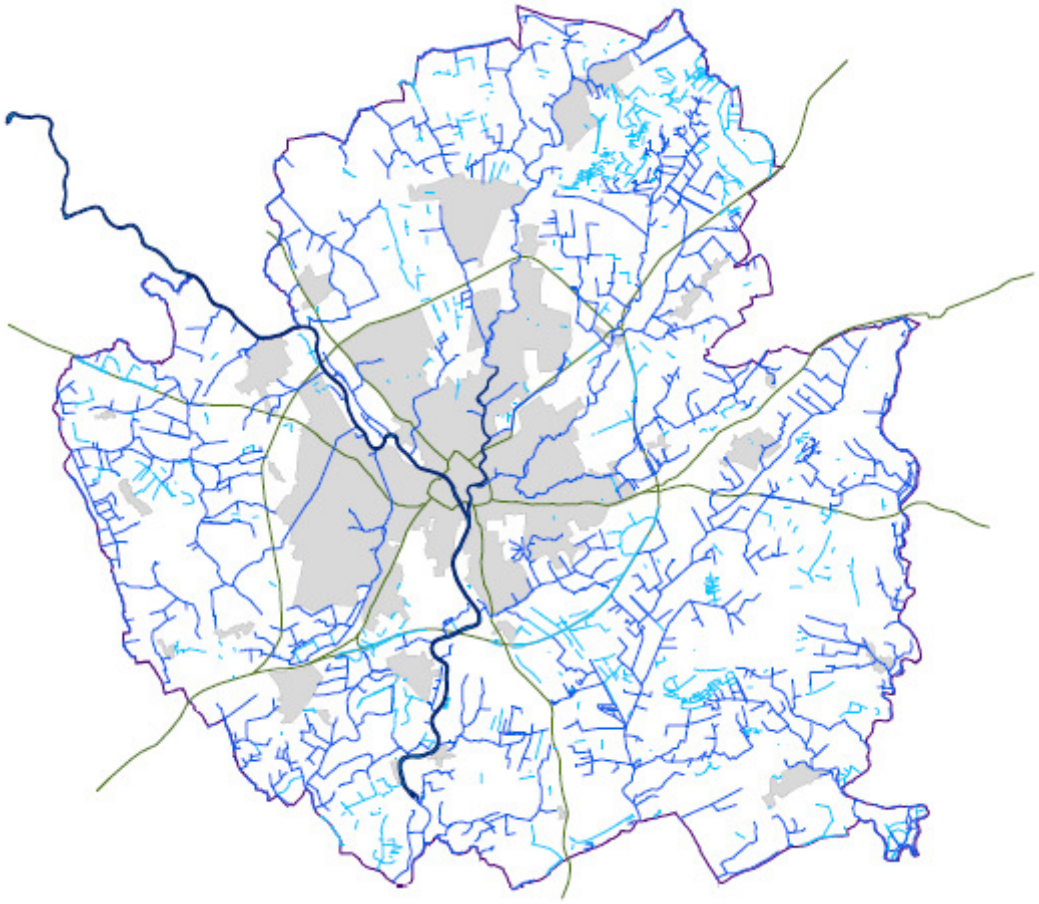


Figure 6 – Detailed River Network

Within the drainage districts significant ordinary watercourses are:-

1. Flowing into the Ouse:

- Blue Beck, draining residential and commercial development in Rawcliffe and Clifton Moor north west of the city, the responsibility of Kyle and Upper Ouse IDB to Rawcliffe Lake. The lake is the responsibility of YWS and its level is controlled by them. Downstream of this to the Ouse Blue Beck is main river.
- Burdyke, draining residential and commercial development in Clifton north of the city, to the south of Bootham Stray, the responsibility of Kyle and Upper Ouse IDB. Downstream of this point to the Ouse is main river, including Burdyke pumping station.
- Holgate Beck, draining residential development in Woodthorpe, Acomb and Holgate west of the city to the north of Hob Moor, the responsibility of Ainsty (2008) IDB. Downstream of this point to the Ouse is main river including Holgate Beck pumping station.
- Germany Beck, draining residential development in parts of Heslington and Fulford including the existing and new university campuses, along with agricultural land east of the city to the River Ouse south of Fulford. The entire length is the responsibility of Ouse and Derwent IDB.

2. Flowing into the Foss:

- Westfield Beck, draining areas of residential development in Haxby, Wigginton and New Earswick north of the city to join the Foss south of New Earswick. This is the responsibility of Foss (2008) IDB. Westfield Beck pumping station, owned by YWS, diverts excess flows from the Haxby and Wigginton catchments to the river Foss to protect the downstream village of New Earswick from flooding.
- South Beck, draining Monk's Cross Retail Park and residential development in Huntington north east of the city. The upstream of length is the responsibility of Foss (2008) IDB and final 350 m to the Foss is the responsibility of CYC.
- Tang Hall Beck, draining residential development in Tang Hall and agricultural land in the upper catchment around Stockton on Forest north east of the city, the responsibility of Foss (2008) IDB to the outskirts of Heworth. Downstream is main river.
- Osbaldwick Beck, draining residential development in Osbaldwick and agricultural land in the upper catchment around Holtby and Murton east of the city, the responsibility of Foss (2008) IDB to the outskirts of Tang Hall. Downstream is main river.

3. Flowing into the Derwent:

- Elvington Beck draining residential development and agricultural land to the west of the village of Elvington, including part of the former airfield which is now in commercial and leisure use. The entire length is the responsibility of Ouse and Derwent IDB including the pumping station at the confluence of the beck and the river Derwent.

The main river reaches of Blue Beck, Burdyke, Holgate Beck, Tang Hall Beck and Osbaldwick Beck, and the ordinary watercourse Elvington Beck have all flooded property due to backing up from the Rivers Ouse, Foss and Derwent. This is fluvial flooding and therefore outside the scope of this report.

There is no evidence of historic flooding from the ordinary watercourses in the outlying rural areas covered by the four Internal Drainage Boards.

In the suburban areas,

- Westfield Beck west of Haxby reached a level in June 2007 high enough to flood gardens and roads. There were concerns that this was exacerbated by problems with Westfield Beck pumping station and the operating regime was reviewed by CYC, YWS, EA and the Foss IDB. There is confidence that its efficiency is now maximised.

- Elvington Beck has also caused surface water flooding of roads due to intense rainfall, unconnected with levels in the Derwent. Subsequent investigation revealed the cause was lack of maintenance and restricted capacity which is being addressed.

4.4 Interaction with Main Rivers and the Sea

Known surface water flooding locations are dispersed across the Council's area and recorded events do not appear to have been related to river flooding which is well documented.

4.5 Past flooding – Conclusions

On the basis of the available past flooding data, as summarised above, no historical flood events are considered to have had "significant harmful consequences" and therefore none will be recorded in Annex 1 of the Preliminary Assessment Spreadsheet. The existing database will be added to, as events occur to support future PFRAs and CYC's Local Flood Risk Management Strategy.

5 Future flood risk

5.1 Surface Water Flooding

There is no local information currently available on surface water flood risk in York but a Surface Water Management Plan is currently underway covering the whole administrative area. The results from this study will be used to support the next cycle of the PFRA process and the production of flood risk hazard and flood risk maps.

The Environment Agency has produced a national assessment of surface water flood risk in the form of two national mapping datasets. The first generation national mapping, Areas Susceptible to Surface Water Flooding (AStSWF), contains three susceptibility bandings for a rainfall event with a 1 in 200 chance of occurring. The national methodology has since been updated to produce the Flood Map for Surface Water (FMfSW), a revised model containing two flood events (1 in 30 annual chance and 1 in 200 annual chance) and two depth bandings (greater than 0.1m and greater than 0.3m).

The Flood Map for Surface Water is considered to be the best representation and is included as Figure 7 highlighting areas at risk of surface water flooding in the future.

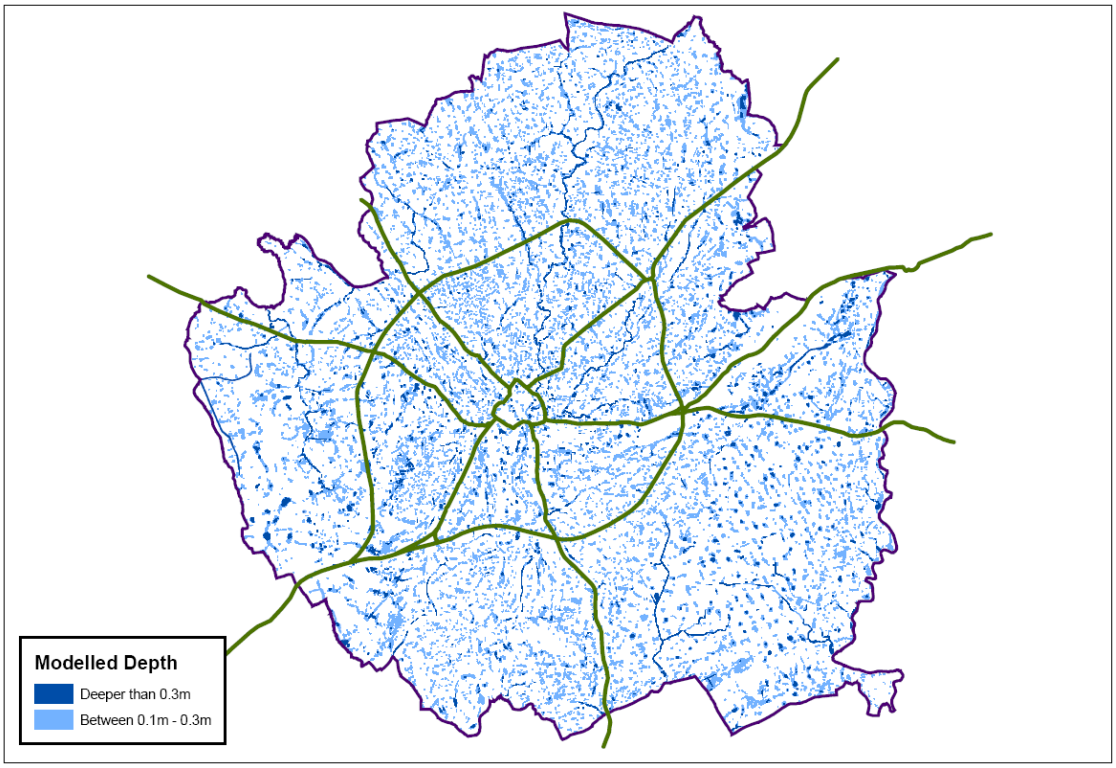


Figure 7– Flood Map for Surface Water 1 in 200 Year Event

Using this dataset, the number of properties at risk of surface water flooding in the York area has been estimated by the EA. For a rainfall event with a 1 in 200 annual chance of occurring, 11,500 properties are at risk from flooding to a depth of 0.1m and 1,700 are at a risk of flooding to a depth of 0.3m. The predicted flooding locations are dispersed throughout the area and it is considered unlikely that this number of properties would be affected simultaneously as this type of rainfall is usually very localised.

5.2 Groundwater Flooding

There is no local information available which provides evidence on future groundwater flood risk. The Environment Agency has produced a national dataset, Areas Susceptible to Groundwater Flooding, (Figure 5) and this has been used to form the basis of the assessment of future flood risk from groundwater. Groundwater emergence is not believed to be an issue.

5.3 Canals and Ordinary Watercourse Flooding

The EA's Flood Map shows the extent of fluvial flooding from the rivers Ouse and Derwent, the canalised river Foss and the enmained watercourses. It also shows the extent of flooding from ordinary watercourses. Whilst ordinary watercourse flooding largely affects rural areas, Westfield Beck in the Foss (2008) IDB area affects many properties in New Earswick. However this form of flooding is outside the scope of this report and there is no evidence of significant surface water flooding, as defined in chapter 3, at this location or from any other ordinary watercourses.

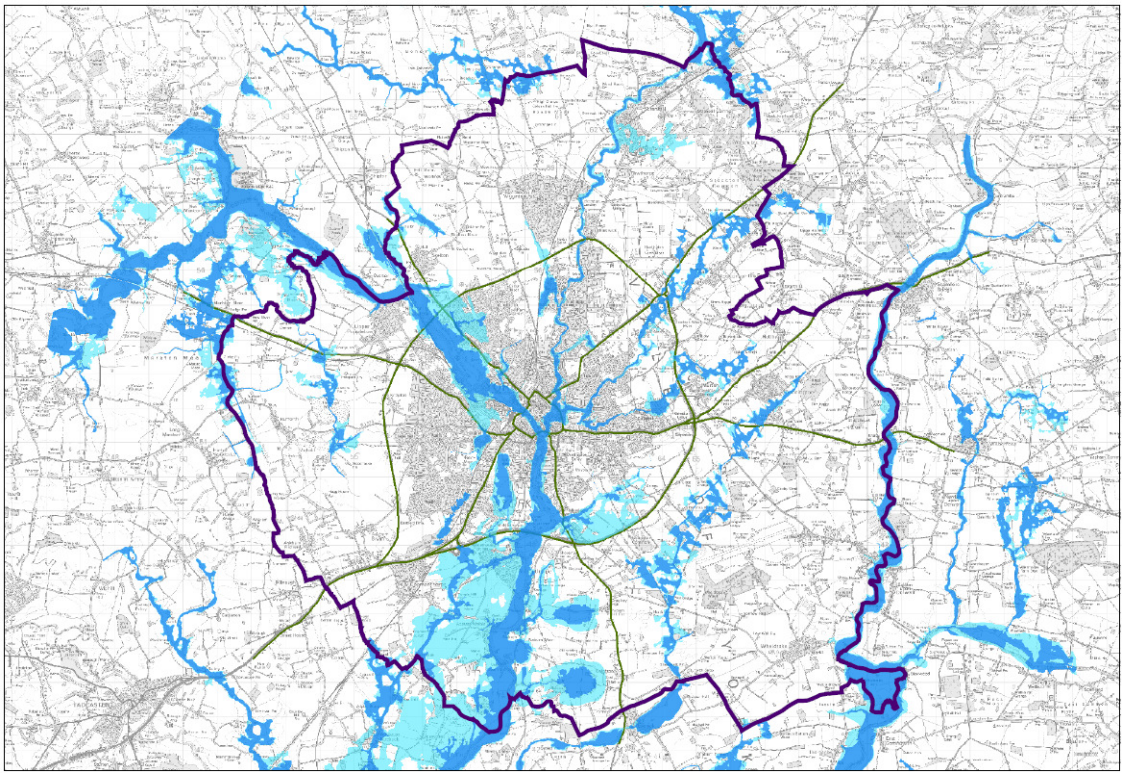


Fig 8 – Fluvial Flood Map

5.4 Interaction with Main Rivers and the Sea

An examination of the flood map for rivers and the surface water flood maps did not identify any areas where there would be a risk of surface water flooding due to an interaction with river flooding.

5.5 Locally Agreed Surface Water Information

A definition of 'locally agreed surface water information' has been considered in conjunction with the Environment Agency, Internal Drainage Boards and Yorkshire Water Services to agree what surface water information best represents local conditions.

As there is no local information on future flooding available, the 'locally agreed surface water information' is the Flood Map for Surface Water dataset, which gives an overview of the future flood risk from surface water across York and is considered to be the most appropriate source of information.

The Surface Water Management Plan currently in preparation is expected to provide more accurate information on future flood risk and will be used to update locally agreed surface water information in subsequent cycles of the PFRA process.

6 Effects of Climate Change and Long Term Developments

6.1 The impacts of climate change

6.1.1 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%.

6.1.2 Key Projections for Humber 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 12% (very unlikely to be more than 24%)
- Relative sea level at Grimsby 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 14%

6.1.3 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.

6.1.4 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 for 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.

6.2 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 that are "significant" (in terms of the Government's criteria).

7 Identification of Flood Risk Areas

7.1 Overview

The PFRA is a high level screening exercise to identify the areas of greatest flood risk across Europe. To ensure a consistent national approach Defra has identified significance criteria and thresholds to be used in defining flood risk areas. Guidance on applying these thresholds is available in the Defra document "Selecting and reviewing Flood Risk Areas for local sources of flooding". This sets out agreed key risk indicators and threshold values that must be used to determine Flood Risk Areas.

7.2 Review of Indicative Flood Risk Area

In England the following process has been undertaken by the Environment Agency to identify "flood risk areas":

- England has been divided up into a 1km^2 grid
- The Environment Agency 'Flood Map for Surface Water' (> 0.3m depth of flooding) has been used to count the number of people, number of non-residential properties and number of critical services at risk of surface water flooding within the 1km^2 cell.
- Where a 1 km^2 cell has more than 200 people and / or more than 20 non-residential properties and / or one or more critical service at risk of surface water flooding the cell is classified as a 'place above the flood risk thresholds'.
- Clustering analysis has been undertaken to identify clusters of 1 km^2 cells which are 'places above flood risk thresholds', and
- Where a cluster contains more that 30,000 people at risk of surface water flooding this has been classified as an 'indicative flood risk area'.

Using this criteria there are ten 'Flood Risk Areas' in England, none of which are in York.

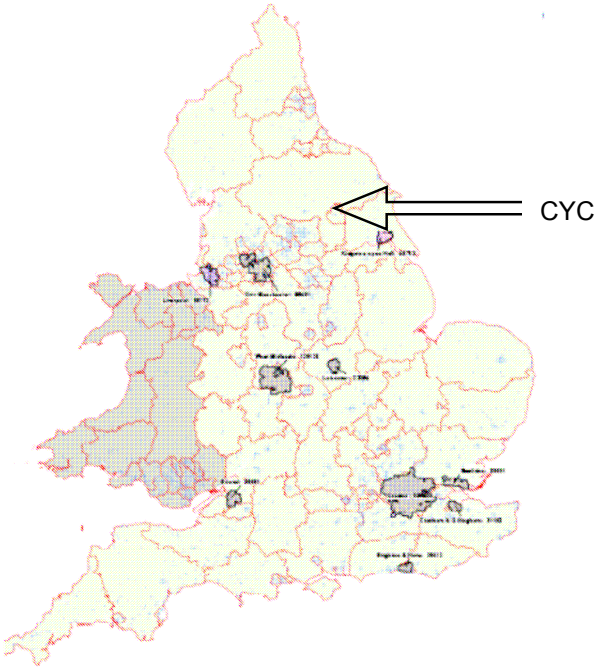


Figure 9 – EA Flood Risk Areas

The EA used the above criteria to identify locally significant flood risk locations for consideration by LLFAs on the basis of local knowledge. Six of these 1km^2 areas fall within the CYC authority boundary. Four are in the City centre, one around the A59 north of Acomb, and one west of New Earswick.

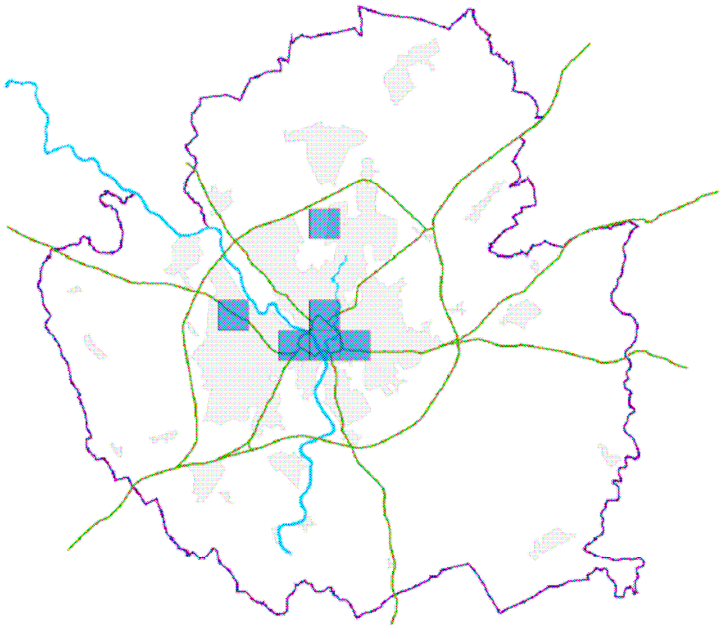
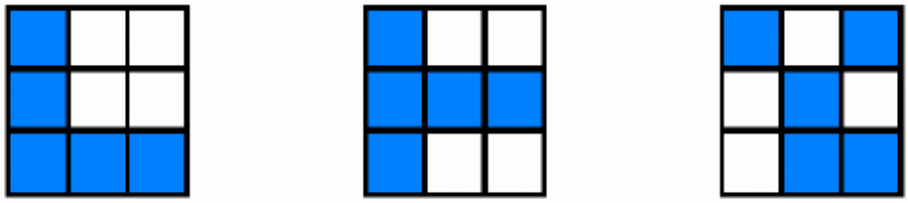


Figure 10 – Flood Risk Locations Identified by the EA

Where a cluster contains more that 30,000 people at risk of surface water flooding this has been classified as an 'indicative flood risk area'. Examples of qualifying clusters are shown below.



Example of qualifying clusters

As shown in figure 10, no clusters of 30,000 people have been identified using the locally agreed surface water data for CYC. As such no amendments are proposed to the indicative flood risk areas. York has not been identified as an Indicative Flood Risk Area. Therefore no information has been inserted in Annex 3 of the spreadsheet.

8 Next steps

8.1 Future Management Arrangements

In accordance with the Flood Risk Regulations the PFRA is to be reviewed on a six yearly cycle. To support future reviews City of York Council will:

- Complete its Surface Water Management Plan.
- Further develop its data recording processes and tools – including a flood incidents database and an asset register.
- Develop a Local Flood Risk Management Strategy

9 References

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10 Annexes

- Annex 1 - Records of past floods and their significant consequences (preliminary assessment report spreadsheet)
- Annex 2 - Records of future floods and their consequences (preliminary assessment report spreadsheet)
- Annex 3 - Records of Flood Risk Areas and their rationale (preliminary assessment report spreadsheet)
- Annex 4 - Review checklist
- Annex 5 - GIS layer of flood risk area(s) if one/any exist