Stoke-on-Trent Preliminary Flood Risk Assessment (PFRA)
Executive Summary

This is the Preliminary Flood Risk Assessment (PFRA) for Stoke-on-Trent. The following document is intended to explain the current and future flood risk issues in the City and provide details of how the City Council as the Lead Local Flood Authority (LLFA) will manage this going forward with other partners such as the Environment Agency (EA). The PFRA is required to meet the requirements of the European Flood Directive and as a result the PFRA is a statutory process which ties in with the UK legislation through the ‘Flood and Water Management Act’.

The PFRA is a high level screening exercise which involves collecting information on past (historic) and future (potential) floods (Ref 1). PFRAs are based on existing and available information bringing together information from national and local sources.

The EA has provided a methodology to standardise submissions nationally and define indicative flood risk areas across England. Of the ten indicative Flood Risk Areas identified, none are situated within the City of Stoke-on-Trent no further flood risk areas have been identified under the current criteria.

In order to fulfil the requirements of the Environment Agency and European Commission we have also examined records relating to historic flood events and also used national datasets provided by the EA to identify potential future local flood risk locations. This defines our agreed ‘Locally Agreed Surface Water Information’ at the time of conducting this PFRA.

As part of this work and other work related to the development of a ‘Surface Water Management Plan’ we have compiled a database of 154 local flood sites based on local records and knowledge. The level of data available to support these sites is not yet considered to be at the right level of robustness for inclusion in this report and the majority of sites within the database would not have ‘significant harmful consequences’ as described for the purposes of PFRA reporting.
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## Glossary of Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Title</th>
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<tbody>
<tr>
<td>2d</td>
<td>Two Dimensional</td>
</tr>
<tr>
<td>AAP</td>
<td>Area Action Plan</td>
</tr>
<tr>
<td>ASTSWF</td>
<td>ASTSWF Areas Susceptible to Surface Water Flooding</td>
</tr>
<tr>
<td>BAP</td>
<td>Biodiversity Action Plan</td>
</tr>
<tr>
<td>CFMP</td>
<td>CFMP Catchment Flood Management Plan</td>
</tr>
<tr>
<td>Defra</td>
<td>Department for Environment, Food and Rural Affairs</td>
</tr>
<tr>
<td>DG5</td>
<td>Name comes from origin ‘Director General of OFWATS Report on Issue Number 5’ hence DG5</td>
</tr>
<tr>
<td>EA</td>
<td>Environment Agency</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FMfSW</td>
<td>Flood Map for Surface Water</td>
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<td>FMG</td>
<td>Flood Management Group</td>
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<tr>
<td>FWMA</td>
<td>Flood &amp; Water Management Act 2010</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>IUD</td>
<td>Integrated Urban Drainage</td>
</tr>
<tr>
<td>LDF</td>
<td>Local Development Framework</td>
</tr>
<tr>
<td>LiDAR</td>
<td>Light Detection and Ranging</td>
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<tr>
<td>LLFA</td>
<td>Lead Local Flood Authority</td>
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<td>Abbreviation</td>
<td>Full Title</td>
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<tr>
<td>--------------</td>
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<tr>
<td>LPA</td>
<td>Local Planning Authority</td>
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<tr>
<td>PFRA</td>
<td>Preliminary Flood Risk Assessment</td>
</tr>
<tr>
<td>PPS25</td>
<td>Planning and Policy Statement 25: Development and Flood Risk</td>
</tr>
<tr>
<td>SAB</td>
<td>SuDS Approving Body</td>
</tr>
<tr>
<td>SAC</td>
<td>Special Areas of Conservation</td>
</tr>
<tr>
<td>SFRA</td>
<td>Strategic Flood Risk Assessment</td>
</tr>
<tr>
<td>SPA</td>
<td>Special Protection Areas</td>
</tr>
<tr>
<td>SuDS</td>
<td>Sustainable Drainage Systems</td>
</tr>
<tr>
<td>SWMP</td>
<td>Surface Water Management Plan</td>
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<tr>
<td>RFDC</td>
<td>Regional Flood Risk Defence Committee</td>
</tr>
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</table>
Chapter 1 - Introduction

This is the Preliminary Flood Risk Assessment (PFRA) for Stoke-on-Trent. The following document is intended to explain the current and future flood risk issues in the City and provide details of how the City Council as the Lead Local Flood Authority (LLFA) will manage this going forward with other partners such as the Environment Agency. The PFRA is required to meet the requirements of the European Flood Directive and as a result the PFRA is a statutory process which ties in the UK legislation through the ‘Flood and Water Management Act’.

What is a PFRA?

The PFRA is a high level screening exercise which involves collecting information on past (historic) and future (potential) floods (Ref 2). PFRA’s are based on existing and available information bringing together information from national and local sources.

What is the PFRA process and responsibilities?

The PFRA process is based on developing a consistent approach to flood management across the EU, based on a six year planning cycle. Figure 1 below provides an extract from the PFRA Guidance on the proposed cycle. The current PFRA represents the conclusions from the first 2 boxes, namely the preliminary flood risk assessment and flood risk area identification.

Figure 1. Stages of the Flood Risk Regulations (Ref 3)

What are the City Council’s Responsibilities?

Stoke-on-Trent City Council is the Local Lead Flood Authority (LLFA) for the City. The LLFA is responsible for assessing risk from sources of flooding other than main rivers, the sea and

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reservoirs. The LLFA is therefore concerned with assessing the risks associated with surface water runoff, groundwater and ordinary watercourses; they must also consider the interaction these sources have with drainage systems, local sewers, rivers and reservoirs. The full definition of flooding sources and responsibilities can be found within the PFRA Guidance (see references). It should be noted that floods of raw sewage are not covered under the Regulations and hence are not part of the LLFA’s responsibility.

The PFRA is not intended to be the primary mechanism for managing local flood risk; it should focus on areas of the most significant risk. In many cases local strategies such as the Surface Water Management Plan (SWMP) will be a more appropriate mechanism for managing flood risk and providing evidential support for funding (Ref 4).

**Study Area – Stoke-on-Trent**

The City currently has a population of around 238,000. It is unusual in terms of its structure being polycentric (multicentered) rather than monocentric which is the more usual structure of cities around the globe. The city consists of the six towns: Hanley (City Centre), Stoke, Burslem, Tunstall, Longton and Fenton.

The City is most famous for its ceramics leading to its nickname of ‘the potteries’, though both the ceramics and mining industries upon which the city was founded have decreased significantly over the past 30 years.

**Main Rivers and Hydrology**

Stoke-on-Trent City Council is covered almost exclusively by a portion of the Upper Trent catchment (Ref 5) which occupies as much as 87.7km$^2$ of the total 93km$^2$ area which makes up the City (94%). The remaining 6% includes the Blithe catchment to the south east of the city (covering 0.5km$^2$) and the Wheelock catchment on the northern boundary of the City Council (covering a mere 0.01km$^2$).

The Blithe catchment, like the Wheelock, contains no major rivers or drainage paths, although the River Blithe itself skirts a portion of the south eastern Council boundary. As the highest city in Britain, the only major watercourse which drains into Stoke-on-Trent from outside is the Head of Trent which originates at the Knypersley Reservoir just to the north. Various tributaries also drain into the City, namely the Lyme Brook which joins the River Trent at Hanford, drainage paths which form the Fowlea and Newstead Brooks and various small drainage paths to the east of the River Trent. Other minor watercourses within the Council boundary which flow into the River Trent include the Causley Brook, Chitlings Brook, Adderley Green Brook, Bagnall Brook, Barnfield Brook, Scotia Brook, Longton Brook, Ford Green Brook and Longton Cockster Brook. It should also be Pfra 15062010
mentioned that the Caldon and Trent & Mersey canals also pass through the City. These canals have their overflows and feeder system.

**Figure 2. Study Area and Local Watercourses**

![Study Area and Local Watercourses](image)

**Geology and Topography**

The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of runoff reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface runoff, whereas more permeable rock such as limestone and sandstone may result in a more subdued response.
The geology of Stoke-on-Trent is represented by three major geological periods from the Carboniferous through to the Permian and younger Triassic period. The majority of the area is underlain by Carboniferous rocks. The higher Peak District to the northwest of the Stoke-on-Trent is characterised by the harder Millstone Grit and Carboniferous Limestone of the Dark and White Peaks respectively. Within the upper parts of the River Trent catchment, the watercourse flows across Triassic Sherwood Sandstone and Mercia Mudstone formations, except for areas beneath Stoke-on-Trent, where coal measures are exposed. The sandstone generally provides well drained soils, unlike the mudstones and coal measures whose soils are not as well drained. Outside the urbanised areas the underlying geology becomes more significant and largely consists of till underlain by Westphalian Carboniferous rocks from which extensive coal reserves have been exploited in the past.

Drift deposits of various origins are found within the City. Till is sediment that is deposited by glaciers and made up of clay, which can be found throughout the City area. The upland parts of the watercourses within the study area will have high erosion potential, particularly during periods of high flows, and sediment may be transported through the city via the main watercourses, as indicated by the presence of River Terrace Deposits along the Trent and at its confluence with the Fowlea Brook and the Lyme Brook, as well as Alluvium deposits (sediments deposited by rivers) consisting of clays, silts and sands beneath these three rivers.

In terms of topography, Stoke-on-Trent is the highest city in Britain. The Stoke-on-Trent uplands are around 220m above ordnance datum with steep slopes which may lead to increased runoff. The southern parts of the City are at a lower topography of approximately 95m above ordnance datum.

**PFRA Aims and Objectives**

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 provide details of how this will be managed going forward, also providing information on how communication with wider stakeholders can be improved;
- 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 on in the future and used to support and inform the preparation of the SWMP and provide a focus for the flood management group;
• 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 to establish any impact on Stoke-on-Trent.

This document is split into 5 sections:

Chapter 1 provides background information related to the PFRA including the area covered by this document, local topography, main watercourses and local flood risk.

Chapter 2 contains details of the role of Stoke-on-Trent City Council as the Lead Local Flood Authority (LLFA) and discusses in detail how local flood risks will be managed in partnership with other key groups such as Severn Trent Water Ltd (Severn Trent).

Chapter 3 provides details of the data available to inform the PFRA and the limitations of these existing sources. It also describes how data regarding flooding will be managed and analysed going forward.

Chapter 4 discusses historical floods and the definition of ‘significant’ flooding events.

Chapter 5 discusses future floods; this chapter includes a commentary on ‘locally agreed surface water information’.

Chapter 6 Provides our local review of the flood risk areas defined by the EA.

Chapter 7 Provides information on the definition of new Flood Risk Areas and the processes of approval which have been followed for the PFRA

Chapter 8 Provides information on next steps.

These boxes indicate key points within the document
Chapter 2 – Role of the Lead Local Flood Authority

Introduction

The role of Lead Local Flood Authority (LLFA) is enshrined within the Flood and Water Management Act 2010. This legislation is linked to the Flood Risk Regulations (2009) and was introduced to improve the management of flood risk in the light of a number of major national flooding events which took place in 2000, 2002 and 2007. In this Chapter the role and responsibilities of Stoke-on-Trent City Council as the LLFA are described.

Roles and Responsibilities of the LLFA

Going forward the roles and responsibilities of the City Council as LLFA are detailed below, these have been identified from the PFRA and associated Surface Water Management Plan Guidance documents and are:

- Ensuring that appropriate flood risk and management partnerships are in place;
- Collating information on past and potential future flood risks;
- Provide feedback to the EA on national dataset information for the area;
- Determine what represents ‘locally agreed surface water information’, (this relates to agreeing what data best represents local surface water conditions);
- Record available information on local drainage capacity;
- Define the impacts of local flooding on human health, economic activity, cultural/heritage sites and the environment. These estimated impacts will define whether a flood site is ‘significant’ for the purposes of recording with the EA and European Union ‘Flood Risk Sites’ (this is discussed in more detail in Chapter 6).
- Investigation of flood incidents, the LLFA have a duty to investigate significant flood events;
- The LLFA is the Sustainable Urban Drainage System (SuDS) Approving Body (SAB) for the City and therefore should approve, adopt and maintain new drainage systems within the City Boundary. This is likely to require a continuation of processes which already take place as part of planning approvals;
- The LLFA is responsible for the development of flood risk management strategies and reports such as this PFRA and the local Surface Water Management Plan (SWMP);
These new responsibilities also come with additional powers:

- The LLFA has the power to request additional data from other bodies such as the Environment Agency and Severn Trent (the approach to this is currently under consultation); and
- The LLFA has designation powers to safeguard assets which are relied upon for flood risk management.

Communication is central to the ability of the City Council (as LLFA) to discharge its responsibilities and protect local inhabitants from the effects of flooding. The Pitt Review (Ref 6) highlighted the need to communicate and share information to improve the management and response to flood risk:

> ‘we must be willing to work together and share information. We recognise there are issues of commercial confidentiality and security, but we firmly believe that the public interest is best served by closer cooperation and a presumption that information will be shared. We must be open, honest and direct about risk, including with the public. We must move from a culture of ‘need to know’ to one of ‘need to share’. (Ref 7)

The next section details how Stoke-on-Trent City Council will work with key partners and stakeholders to improve communication and develop flood risk management plans.

**Co-ordination of Flood Risk Management**

**Flood Management Group**

In this section the approach to developing a flood management group (FMG) is described. Key points include:

- Identifying the difference between ‘partners’ and ‘stakeholders’;
- The roles of each partner in the FMG;
- The responsibilities of each partner to the FMG; and
- The proposed governance of the FMG including key meetings, decision points and how the emerging programmes and strategies will be communicated to the public as wider stakeholders.

**Partners and Stakeholders**

The guidance provided by Defra for the development of Surface Water Management Plans (SWMPs) provides a clear distinction between ‘partners’ and ‘stakeholders’:
‘a partner can be defined as someone (person or organisation) with responsibility for the decisions or actions that need to be taken. They will share the responsibility for decisions and actions.

A stakeholder can be defined as anyone affected by the problem or solution or who is interested in the problem or solution’

Based on this definition, within Stoke-on-Trent the FMG will contain the following organisations are defined as ‘partners’:

- Severn Trent (as the providers of sewerage facilities and drinking water)
- Environment Agency (responsible for local rivers including the Trent)
- Defra (as the national policy lead in relation to flooding)
- Staffordshire County Council (as the LLFA for the surrounding area)
- Staffordshire Moorlands District Council (as planning authority for the adjoining district)
- Newcastle-under-Lyme Borough Council (as planning authority for the adjoining district)
- Highways Agency (responsible for two key strategic routes which bisect the City, namely the A500 and A50 (T))
- British Waterways (responsible for local canals and locks, some of which may provide attenuation facilities in flooding conditions)

There are also a number of partners internal to the City Council, including:

- The Planning and Regeneration Groups
- The Emergency Planning Group

The following groups are classed as stakeholders:

- Local riparian owners
- North Staffordshire Chamber of Commerce
- Local services; such as, North Staffordshire University Hospital, Schools, Care Homes for Vulnerable People
- Central Networks (eon) local electricity infrastructure manager
In terms of governance and operation the above partner organisations have been split into three groups which reflect the importance of their input to the process and the regularity with which they will be required to provide inputs into the FMG:

**Figure 3. Partner Organisations, Tier Groups.**

<table>
<thead>
<tr>
<th>Tier 1 Partner</th>
<th>Tier 2 Partner</th>
<th>Tier 3 Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>must attend all FMG meetings, will always provide inputs to the FMG, some members called together in emergency situations</td>
<td>must attend a minimum of 3 FMG meetings per year, some members may be called during emergency events</td>
<td>expected to provide inputs to regular meetings but only need to attend 1-2 meetings per year to provide strategic feedback</td>
</tr>
</tbody>
</table>

- • Stoke-on-Trent City Council LLFA (EP)
- • Severn Trent (EP)
- • Stoke-on-Trent Planning Department
- • Emergency Planner (EP)
- • Newcastle-under-Lyme Planning Department
- • Staffordshire Moorlands Planning Department
- • Environment Agency

- • Stoke-on-Trent City Council Director and local Portfolio holder (EP)
- • Staffordshire County Council (EP)
- • Highways Agency
- • British Waterways

- • Defra

Note: Partners listed above with (EP) designations would be involved in any live emergency flooding events

Table 1 below provides more details of the roles and responsibilities of the above partners within the FMG.
### Table 1. FMG Roles and Responsibilities

<table>
<thead>
<tr>
<th>Partner</th>
<th>Reason for Inclusion</th>
<th>Role within Partnership</th>
<th>Responsibilities</th>
<th>Information to be provided to FMG</th>
</tr>
</thead>
</table>
| Severn Trent | Severn Trent are the local providers of clean drinking water supplies and waste water collection and treatment. They are the legal owners of combined sewers a critical element of local water transport. | Tier 1 partner, expected to work in conjunction with the City Council to identify flooding issues related to sewer/drainage capacity. Severn Trent will be involved in the development of mitigation options. They are also likely to be interested in local planning applications and impacts. | Severn Trent already collects data on flooding as part of statutory duties. Severn Trent will share information that will help in the development of both emergency and long term mitigation planning. | • DG5 Register Updates  
• Programme of works  
• Technical advice in the development of schemes  
• Sewer records and as built drawings  
• Long term strategy advice and support |
| Stoke-on-Trent, Newcastle-under-Lyme and Staffordshire Moorlands Planning and Regeneration Departments | The local planning authorities can impact on flood risk in a number of ways: through changing relevant planning policies, through local strategies such as Area Action Plans or Local Development Frameworks and through the process of reviewing site specific planning applications. | Tier 1 partner (though not expected to attend emergency events). The planning representatives will highlight wider planning constraints and gain a better understanding of local flood risk, mitigation costs, and provide details of local planning applications. | Planning departments will provide information as described in the adjacent box. | • Updates on local plans such as AAPs or LDFs  
• Outline of proposed planning policies and strategies and timescales  
• List of sites currently seeking planning permission and flood zone category (based on existing SFRA), current state of the application e.g. pre-app, initial, detailed, at committee, previously refused etc.. |
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<tr>
<th>Partner</th>
<th>Reason for Inclusion</th>
<th>Role within Partnership</th>
<th>Responsibilities</th>
<th>Information to be provided to FMG</th>
</tr>
</thead>
</table>
| Health, Safety and Emergency Planner              | Manager responsible for the development and implementation of emergency plans for the City                                                                                                                          | Tier 1 partner who will feed information from emergency services on proposed plans and flood risk information | Help to produce emergency plans based on information provided by FMG and ensure that all contact details between the FMG group and emergency services are up to date                                                  | • Relevant contact details of emergency services  
• Emergency planning advice  
• Feedback from emergency services on flood risk information and any identified problem sites                                                                                                           |
| Stoke-on-Trent City Council  
Assistant Director of City Services and  
Cabinet Portfolio Holder | Director and Cabinet Member responsible for developing high level budget allocations and responsible for the prioritisation of internal resources                                                                 | Tier 2 Partner, expected to attend meetings concerning forward programmes and high level strategy focus. The Cabinet member will help to aid in the dissemination of flood risk priorities | Provide strategic feedback to the FMG and help to secure relevant budget allocations and approvals. They are also likely to be involved in emergency planning meetings should significant flooding occur | • Leadership on major issues of funding and priorities  
• Support the FMG at key decision points  
• Help to disseminate flood risk information (within the bounds of the confidentiality rules)                                                                                                                 |
| Staffordshire County Council                      | Authority responsible for all highways drainage and structures within both Newcastle-under-Lyme and Staffordshire Moorlands. Also LLFA for adjoining areas                                                                 | Tier 2 partner, will share information on highways/transport schemes which may impact on local flood risk  | To engage with the FMG on future works which could affect local flood risk. Also likely to be involved in emergency planning through identification of safe routes to the city in the event of flooding, also provide information on adjoining flood risk areas | • Information on clear routes in the event of emergencies  
• Information on proposed highways works  
• Adjoining Flood Risk Information                                                                                                                                                    |
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<tr>
<th>Partner</th>
<th>Reason for Inclusion</th>
<th>Role within Partnership</th>
<th>Responsibilities</th>
<th>Information to be provided to FMG</th>
</tr>
</thead>
</table>
| Highways Agency             | Responsible for the development and maintenance of two key routes which bisect the city (A500 and A50). Flood Risk mapping provided by the Environment Agency indicate sections of these routes could be at risk of flooding | Tier 2 Partner, expected to be interested in any works which could affect highway drainage on these routes may also be able to provide information on works proposed to enhance/manage the route | Exchange any drainage information that could be useful to the FMG and forward works programmes | • Drainage information  
• Forward works programme |
| British Waterways (Note: BWB to be changed to a charitable trust, precise implications are not yet fully known) | Currently responsible for all inland waterways. In Stoke-on-Trent this would relate to canals | Tier 2 Partner expected to provide information on canal flood risks or possible attenuation locations | To provide information and consider improvement works in partnership with the FMG | • Forward works programme  
• Sites of canal flooding, overtopping or locations where attenuation may be possible |
| Environment Agency/Defra    | Authority responsible for managing flood risk from main watercourses reservoirs and seas | Tier 1 partner expected to keep FMG updated on forward plans in relation to the River Trent, will be informed of significant flood risk locations and local flooding events through the FMG | To provide information on forward works to improve flood defences, wider policy information and funding, also peer review function in FMG | • Any national datasets in relation to local watercourses  
• Funding allocations  
• Programme of works  
• National policy information |
The above table represents the initial partnership group roles and responsibilities, it is likely that as the partnership evolves some of the designations and responsibilities will change to reflect the needs of the group and the changing responsibilities of members (for example British Waterways).

In terms of events there are two key meetings which must take place each year:

- In November; a full meeting with all partners to discuss forward planning and funding and disseminate information on the previous years plan and main events
- In February; a full partnership meeting to finalise budgets and forward works and agree the contents of proposed flood management information such as works undertaken and proposed forward programme.

Tier 1 partners are likely to attend the FMG every 2-3 months, Tier 2 partners, every 3-4 months and Tier 3 partners are likely to attend 1-2 meetings per annum.

Stoke-on-Trent City Council as the LLFA will be expected to Chair the partnership. This role will entail the development of Agendas and Minutes, maintain records of attendance and information provided to the FMG and managing data to prevent leaks which could affect commercial confidentially or adversely affect local landowners. As a result the inaugural meeting of the FMG will require that all partners agree the basis upon which information can be used and minutes recorded and disseminated. An example of a 2 year FMG meeting programme is shown below.

**Figure 4. Example of 2 Year FMG Meeting plan**

All partners to the FMG can call an emergency meeting of the group at any time via the LLFA contact, this may arise when flooding has occurred and urgent remedial action is required.

In the event that partners cannot send a relevant individual to attend the FMG then they are expected to send briefing information to the LLFA contact prior to the meeting along with apologies.
Stakeholders

Local flooding and flood risk management will also impact on a number of other groups classed as stakeholders, these groups include:

- Local residents and business owners
- Local riparian owners
- Local developers and land owners
- Local service providers
- Utility suppliers such as Central Networks

Communication with these groups should be carefully managed as part of the FMG. The proposed approach is split into two main types:

- Day to day reporting, information and management; and
- Annual reporting

The day to day reporting and management of inquiries from stakeholders will be tackled using existing City Council systems such as ‘Stoke on-call’, this will be supplemented by a new website which will allow reporting and inquiries regarding flooding and provide a location where strategic documents can also be accessed. There is further work to be undertaken to develop the correct protocol for website reporting and inquiries and verification through site visits, however this work is underway and it is expected that a website for flooding will be opened at the end of 2011.

More formal consultation and reporting will be undertaken as part of an annual reporting process which will provide stakeholders with an opportunity to review the works undertaken over the previous year and comment on any forward works programme that may affect them. As a minimum the report is expected to contain:

- Number of flooding complaints made over the previous year and whether any new confirmed sites have been identified;
- Any significant local floods;
- Details of emergency plans;
- Appropriate contact details for reporting flood incidents;
- Works undertaken over the previous year; and
- Forward works planned over the next 12 to 18 months.

This annual report should therefore be developed after the finalisation of forward plans and budgets (shown in the above example as February). A hard copy of the annual report will be made available at all City Council offices which are open to the public whilst an electronic copy will be available via the dedicated website and City Council web pages. As part of this we will also seek to
get riparian owners to come forward for inclusion in a database that will ensure that they receive automatic flood risk updates.

**Summary**

In this Chapter we have described the approach to managing flood risk within the City. The sharing of information and partnership working involved will require the development of a dedicated Flood Management Group (FMG) which will be lead by the City’s existing highway and drainage engineers. The role of each organisation has been defined and an outline timetable of meetings developed. This FMG will be critical to managing flood risks within the City and is an essential component of both the PFRA and SWMP.
Chapter 3 – Methodology and Data Review

Introduction

The PFRA is intended to be a high level screening exercise used to identify locations where the risk of flooding is significant and warrants further examination. The definition of significant has been provided for the purposes of the PFRA and partially drives the data level required for the PFRA. In addition the approach to deriving the PFRA is based on guidance provided by the Environment Agency in December 2010, the PFRA is based on readily available data and the following methodology takes this into account.

Methodology

Data Collection and Analysis

Data on past historical flood events has been collated from a number of sources including local engineers and maintenance staff, but also from previous reports conducted on behalf of the City Council in support of the Core Spatial Strategy (for which a strategic flood risk assessment was conducted). Anecdotal information has been collated and documented within a spreadsheet (see Chapter 8). This analysis was conducted by the City Councils Highways and Drainage Engineers who will be used to co-ordinate the Flood Management Group. The Lead Drainage Engineer has also reviewed the data sets provided by the EA and comparisons have been drawn from comparing the AStSWF and FMfSW against the geographical locations of local flooding reports (based on local knowledge) and the SFRA. This analysis demonstrated a high degree of correlation between the data sets held locally and those provided by the EA.

Identifying Flood Risk Areas

Information on historic and potential future flood risk is used to formally identify ‘Flood Risk Areas’. Areas are defined upon the basis of the impacts of flooding assessed using key indicators. The Key indicators are shown in Table 2.
### Table 2. Key Flood Risk Indicators

<table>
<thead>
<tr>
<th>Impacts of Flooding on:</th>
<th>Flood Risk Indicators:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Health</td>
<td>No of Residential Properties Flooded Critical Services (Hospitals, Police/Fire/Ambulance Stations, Schools, Nursing homes etc).</td>
</tr>
<tr>
<td>Economic Activity</td>
<td>Number of non-residential properties Length of Road or rail Area of agricultural Land</td>
</tr>
<tr>
<td>Cultural Heritage</td>
<td>Cultural Heritage Sites (World Heritage Sites)</td>
</tr>
<tr>
<td>Environment</td>
<td>Designated Sites (SSSIs, SACs, SPAs, etc) and BAP habitat</td>
</tr>
</tbody>
</table>

The above indicators have been used by Defra and the EA to identify flood risk areas which exceed a pre-determined threshold. The areas which have been identified using this methodology and exceed 30,000 people at risk have been mapped for England and identified as ‘Indicative Flood Risk Areas’. There are 10 areas, none of which impinge on the Stoke-on-Trent area.
# Data Sources

Table 3 below provides details of data sources which are available for the development of the PFRA.

## Table 3. PFRA Data Sources

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas Susceptible to Surface Water Flooding</td>
<td>First generation national mapping, outlining areas of risk from surface water flooding across the country with three susceptibility bandings (less, intermediate and more)</td>
</tr>
<tr>
<td>Flood Map for Surface Water</td>
<td>Updated national surface water flood mapping which was released at the close of 2010. Dataset includes two flood events, 1 in 30 and 1:200 and includes two depth bandings 0.1m and 0.3m.</td>
</tr>
<tr>
<td>Flood Map (Rivers and the Sea)</td>
<td>Shows the extent of flooding from rivers with a catchment of more than 3km²</td>
</tr>
<tr>
<td>Areas susceptible to Groundwater Flooding</td>
<td>Coarse national mapping showing areas susceptible to groundwater flooding</td>
</tr>
<tr>
<td>National Receptors Dataset</td>
<td>A national dataset of social, economic, environmental and cultural receptors including residential properties schools hospitals transport infrastructure and electricity substations</td>
</tr>
<tr>
<td>Indicative Flood Risk Areas</td>
<td>Nationally identified flood risk areas, based on the definition of 'significant' flood risk (see above)</td>
</tr>
<tr>
<td>Historic Flood Map</td>
<td>Spatial flood information based on limited historical flood data</td>
</tr>
<tr>
<td>River Trent Catchment Flood Management Plans</td>
<td>EA document which describes local flooding risks from all sources and discusses local policies which will be pursued to reduce flood risk</td>
</tr>
</tbody>
</table>
### Data Limitations

The above table highlights the overall quality of data available to assess flood risk areas as part of the PFRA, in many cases data is limited and records are not always available for review. National datasets developed by the Environment Agency provide the most robust source of information at this time, but these are not without limitation. Many of the datasets have been developed using macro scale models which primarily assess flooding based on topography but which cannot predict the implications of large structures and funnelling caused by the built environment in urban areas. In addition the interaction of various water bearing structures and mains cannot be easily modelled and is unlikely to be taken account of within the existing national datasets. Stoke-on-Trent has a large number of underground culverts with a high degree of interaction between these and local features.
watercourses; this is likely to complicate surface water risks in some locations. However, a review of these national datasets against local knowledge and flooding locations indicates a broad correlation between the local sites and the locations shown within the Environment Agency Datasets. This provides a high degree of reassurance regarding the overall robustness for use at the preliminary level and to identify locations for further modelling and analysis.

For the future, the City Council as the LLFA, plans to identify critical locations based on risk factors and undertake more detailed modelling to understand how the urban environment and local drainage conditions affect flood risk. This will be developed in conjunction with any additional modelling being undertaken by the Environment Agency.

Quality Assurance, Security and Data Restrictions

The varied quality of data will need to be managed as part of both the PFRA and SWMP and all incoming data provided to the FMG will be graded according to the guidance provided by Defra and shown in Table 4 below:

Table 4. Data Quality, Grading System (Ref 8)

<table>
<thead>
<tr>
<th>Data Quality Score</th>
<th>Description</th>
<th>Explanations</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Best Available</td>
<td>No better available: not possible to improve in the near future</td>
<td>High resolution LiDAR, river flow data, rain gauge data</td>
</tr>
<tr>
<td>2</td>
<td>Data with known deficiencies</td>
<td>Best replaced as new data is available</td>
<td>Typical sewer or river model that is a few years old</td>
</tr>
<tr>
<td>3</td>
<td>Gross assumptions</td>
<td>Not invented but based on experience and judgement</td>
<td>Location, extent and depth of surface water</td>
</tr>
<tr>
<td>4</td>
<td>Heroic assumptions</td>
<td>An educated guess</td>
<td>Ground roughness for 2d models</td>
</tr>
</tbody>
</table>

In its role as LLFA the City Council must be mindful of the confidentially and sensitivity of some of the information provided by groups involved in the FMG, there are also legitimate concerns
regarding the release of data which is based on anecdotal evidence and has not been fully verified. The control of this data shall be defined as part the inauguration of the FMG.

All data on flood risk will be stored on servers maintained by the City Council, access to the files associated with flood risk management will be password protected. Hard copy information will be stored in one location and gradually incorporated into electronic storage.

Summary
In this chapter the criteria associated with ‘significant’ risk locations has been described. The data sources which are available for the development of the PFRA are currently limited, though it is expected that data will be improved as part of the greater communication between partners, facilitated by the FMG and through more detailed analysis commissioned as part of the SWMP. The chapter sets out, in brief, how data will be managed and graded, it is unlikely that any data classed below level 2 will be made publicly available, however it will be used in the development of the SWMP and local emergency plans.
Chapter 4 – Historic Flooding

Introduction
The previous chapter outlined the current data sources available to the City Council for the development of the PFRA. Anecdotal events on local flood hotspots has also been collated as part of the SWMP, but due to a lack of auditable information this is not considered appropriate for release at this time. The identified hotspots do not contain any locations which would be classed as ‘significant’ for the reporting in PFRA and so are not considered relevant to the definition of ‘flood risk areas’. Information on known and recorded major flood events are detailed below.

Historic Flood Events

Flooding from Artificial Drainage Systems and Surface Water Runoff
Work conducted in 2008 to inform the Strategic Flood Risk Assessment in support of the Core Spatial Strategy examined records from Severn Trent regarding flooding associated with the public sewerage system by foul water, surface water or combined sewerage. This analysis indicated that there are particular flood risks associated with the back up of water during heavy rainfall events and this can cause roads to be flooded. Particular locations in Bentilee, Meir Hay (between Meir and Weston Coyney), Trent Vale and Hartshill. This information broadly accords with the national datasets provided by the Environment Agency and the more detailed hotspot information provided locally; however the scale of the impact differs between these datasets and local knowledge of events.

Recent years have seen a number of large scale flood events throughout the UK including October 1998, summer and autumn 2000, February 2002, New Year 2003, February 2004 and more recently summer 2007.

Stoke-on-Trent has largely escaped any significant flooding due, in large part, to its high altitude and its vicinity to the head of the River Trent. Therefore, there are very few historical records of any flooding in and around the city. There are, however, records of flooding near the Fowlea Brook, which runs through the city centre, from 1947, 1996, 1998 and in the Weston Coyney area in July 2000. Early in 1947 severe weather conditions conspired to bring together a significant snow thaw with above average rainfall producing widespread flooding throughout Britain; the Fowlea Brook was no exception. There are, however, very few detailed records of this event and the extent of Pfra 15062010
flooding is not known. In 1996 there was a major storm over the Fowlea Brook catchment with an estimated return period of 318 years (Ref 9) and localised flooding occurred near the Liverpool Road culvert. Post-flood investigations highlighted that there were restrictions within the culvert, and this was likely to have been the main cause of flooding. Another severe storm over the Fowlea Brook catchment also resulted in localised flooding near the Liverpool Road culvert at the end of August 1997. Again, a blocked trash screen was identified as a probable cause.

The most significant recent flood events in Stoke-on-Trent occurred in August 1987 and July 2000. In 1987 the major cause was an intense localised thunderstorm over the city and rapid urban run-off into the River Trent. This was worsened by a skip being washed into the river, completely blocking the Bucknall Road Bridge. In July 2000 a storm, moving from the south hit the south east corner of the city. Records held by Severn Trent demonstrated that the storm, at its height could have been classed as a 1 in 50 (2% annual probability) event. This storm caused flooding, structural damage and some properties were so badly affected that residents were temporarily re-housed.

Groundwater Flooding

Within the city there are no additional records with regard to groundwater flooding. There is an area to the south-west of the City which includes a number of springs which have on occasion caused localised flooding but minimal disruption to property. There is also a location within the City where a high water table coupled with previous mining activities and heavy rainfall can cause localised flooding, however, further work needs to be undertaken to fully understand the causation factors and impacts of flooding at this site.

Analysis of Historic Flood Events

Analysis of historic events and further interrogation of locally held records and anecdotal evidence has yielded some additional information on local flooding events. This preliminary analysis suggests that the information provided by the Environment Agency is likely to be the most robust dataset available for the PFRA. Analysis conducted as part of the SFRA does not indicate that there are any significant flood risk locations associated with groundwater flooding and that flooding from artificial drainage systems is highly localised and unlikely to affect the datasets provided by the Environment Agency. The next section verifies the ‘locally agreed surface water information’ and considers future flood risk in the City.

Pfira 15062010
Consequences of Historic Floods

The consequences of historic floods are briefly outlined above, however few records of the actual numbers of properties affected have been kept and information on specific impacts remain sketchy. There is merit in including the larger scale events in the Annex 1 submission and so this has been completed for the major events.
Chapter 5 - Future Flood Risk

Like many local authorities and Lead Local Flood Authorities (LLFAs), Stoke-on-Trent City Council has limited data available for the assessment of flood risk, as a result further detailed analysis of priority locations will be required to improve knowledge of potential future flood risk within the City. This work is already underway as part of the SWMP and it is likely that this information will be available to feed into the next stages of the PFRA. In this section future flood risk associated with surface water is discussed and the ‘locally agreed surface water information’ is defined.

The PFRA is designed as a high level screening exercise which is used to identify areas where the risk of future flooding is classed as ‘significant’. In the context of the PFRA ‘significant’ future flooding is described in Table 5 below.

<table>
<thead>
<tr>
<th>‘Significant harmful consequences’ defined as…</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 people or</td>
<td>Flooded to a depth of 0.3m during a rainfall event with a 1:200 chance of occurring (or 0.5%)</td>
</tr>
<tr>
<td>20 businesses or</td>
<td></td>
</tr>
<tr>
<td>1 critical service</td>
<td></td>
</tr>
</tbody>
</table>

Surface Water Flooding

Whilst work is underway to assess local surface water flooding and examine some sites in more detail, the Environment Agency have developed two national datasets which provide an initial assessment of surface water flood locations. The first generation national dataset known as ‘Areas Susceptible to Surface Water Flooding’ (AStSWF) contains three susceptibility bandings for a rainfall event with an annual probability of 0.5%. This initial dataset has been updated recently to produce the ‘Flood Map for Surface Water’ (FMfSW); this is based on revised modelling with two different annual probability rates; 3% and 0.5%. The modelling also provides two depth rates for each probability, 0.3m and 0.1m. Maps illustrating these datasets are provided in Appendices A and B for the City. This dataset is then used to predict the number of properties potentially affected by the modelled flood maps for surface water, for an annual probability event of 0.5% with a potential depth of 0.1m or greater, approximately 13,000 properties could be affected in Stoke-on-Trent.

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This approximate value is based around a significant storm taking place across the whole City a circumstance which has never actually occurred. Nonetheless, risk identification and management is concerned with identifying these more serious events and impacts in addition to more frequent and small scale flooding events.

For comparison the same rainfall event is predicted to affect approximately 18,000 properties in the City of Derby and 30,000 properties in Bristol. Such large scale effects are not easily eradicated through engineering measures and at this stage it is therefore most important that such risks are identified and communicated effectively.

**Groundwater Flooding**

There is no additional local information on groundwater flooding within the City, however some preliminary identification of flood sites where water table levels may be a contributing factor in flooding have been identified, further investigation is required to verify this. The Environment Agency’s national dataset; ‘Areas Susceptible to Groundwater Flooding’ remains the best dataset for the identification of groundwater flooding risks; this is shown in Appendix C.

**Canals and Ordinary Watercourses**

British Waterways were not able to provide any further information on canal flood risk locations, though it is understood that they are in the process of developing more detailed analysis of canal flood risks which may be available to feed into the next stage of the PFRA. It is likely that the closer communication between British Waterways and the City Council as part of the FMG will improve the quality of information available.

Once again national datasets in relation to fluvial flooding represent the best available information for the PFRA. This has been cross referenced against analysis conducted as part of the SFRA and no additional ‘significant’ flood risk areas have been identified which should be included in the national dataset.

**Locally Agreed Surface Water Information**

The paucity of more detailed data regarding surface water flooding means that the datasets provided by the Environment Agency represent the best available information at the time of writing this PFRA. As a result the ‘locally agreed surface water information’ is represented by the ‘Flood Maps for Surface Water’ (FMfSW) provided by the Environment Agency. This data set is considered to be the most appropriate source of information on surface water, though it should be considered in conjunction with the existing SFRA which has defined flood zones in accordance with PPS 25. The
EA dataset is not intended to replace the allocation provided in this document for the purposes of planning.

In addition, further modelling of priority locations is a key component of the current SWMP for the City, as such it is expected that surface water flood risk areas will be better understood during the next stage of the PFRA process.

**Potential Consequences of Future Flooding**

The Environment Agency have used the Flood Maps for Surface Water and National Receptors database to identify areas across the country in which risk factors exceed a given threshold as described in the previous table 4. The assessment was carried out based on 1km² grids and the grid squares that exceed the criterion are identified. The squares where these thresholds are exceeded are shown in Appendix D and cover much of the city.

It is important to recognise that this designation does not mean that all the properties in the square will suffer flooding; based on the risk criteria, the designation may actually relate to the risk of one ‘critical service’ (e.g. hospital, police station, electricity substation) being flooded within the 1km² grid.

**Impact of Climate Change and Long Term Development**

**Climate Change**

The specific impacts of climate change on local flooding risk has not been modelled in any detail either nationally or locally. Climate change analysis and predictions are still relatively new and only high level estimates are available. However, there is clear scientific evidence that global climate change is happening now and cannot be ignored. Over the past century around the UK, sea levels have risen and increases in 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.

There is enough confidence in large scale climate models to say that plans for change must be developed. There is more uncertainty at a local scale but model results can help to plan to adapt. For example; rain storms may become more intense. By the 2080s, the latest UK climate projections Pfra 15062010
(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%.

Adapting to Change

Past emission means some climate change is inevitable. It is essential therefore that the City plans ahead. The City can prepare by gaining a deeper understanding of 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.

The broad climate change picture is clear; however local impacts and hence decisions will remain somewhat uncertain. A range of measures should be considered retaining the flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that vulnerability to flooding does not increase.

This analysis is by no means a detailed assessment of potential local conditions and solutions for climate change and as such does not provide firm estimates for local areas such as Stoke-on-Trent, as a result the situation with regard to climate change predictions will need to be monitored.

Long Term Development

The City of Stoke-on Trent is undergoing significant planning and structural changes as a result of the major changes in local industry within the city. The adopted Core Spatial Strategy anticipates the construction of 13,500 additional houses by 2026, many of which will be placed on currently derelict open space. The overall strategy plan provides the following target figures for housing, office and retail space up to 2026.

<table>
<thead>
<tr>
<th>Development Type</th>
<th>Newcastle-Under-Lyme</th>
<th>Stoke-On-Trent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing (dwellings) Gross</td>
<td>6,257</td>
<td>13,500</td>
</tr>
<tr>
<td>Office (floorspace m²)</td>
<td>60,000</td>
<td>85,000</td>
</tr>
<tr>
<td>Retail (floorspace m²)</td>
<td>35,000</td>
<td>120,000</td>
</tr>
<tr>
<td>Employment Sites (ha) total provision</td>
<td>83 (not including RIS site)</td>
<td>270</td>
</tr>
</tbody>
</table>

Source: Core Strategy pages 44-52

The majority of the housing allocation will be met through expansion of areas on the periphery of the urban area, although it is understood that significant housing renewal will take place in areas Pfra 15062010
within City Centre and the surrounding centres. This approach will ensure that the existing city centre is consolidated to be the main shopping and employment destination, with smaller town centres receiving smaller scale enlargement.

This development will undoubtedly place additional demands on existing sewerage and man made water carrying structures while the development of land will decrease the amount of permeable ground within the city. This situation is, in part, mitigated by the introduction of sustainable urban drainage systems and the collection of funds from development to improve sewerage facilities. However the SWMP will need to take a strategic view of the requirements for surface water and waste water capacity within the City. In addition, adherence to PPS 25 and the designation of flood risk zones in the city defined within the SFRA should minimise the impacts of development. This can only be truly managed if the FMG is fully incorporated within planning decisions and kept abreast of planning policy developments, once again, the development of appropriate partnerships will be critical to managing development risks going forward.
Chapter 6 – Review of Indicative Flood Risk Areas

Indicative Flood Risk Areas

Defra and the Welsh Assembly Government (WAG) have identified significance criteria and thresholds for the identification of flood risk areas. These were outlined in Chapter 5. The flood risk areas within the city based on these criteria and using 1km$^2$ grids are also shown in Appendix D. Where a cluster of these grid squares leads to an area where flood risk is most concentrated, and over 30,000 people are predicted to be at risk of flooding, this area has been identified as an ‘Indicative Flood Risk Area’.

Figure 5 below shows the flood risk area dataset, this includes 10 areas, none of which are located within or near to the City. As there are no major ‘indicative Flood Risk Areas’ within or near the City, there is no additional analysis required to define or approve these clusters.
Figure 5. National Indicative Flood Risk Locations

This indication should be treated with caution and referred to as a level of risk to the residents living in these areas. The risk areas may be subject to change as further studies are undertaken and data become available. Always refer to the local flood authority for updated information.

Legend:
- Small Local Flood Authorities
- Indicative Flood Risk Areas from DEFRA
- Indicative Flood Risk Areas from ADW
Chapter 7 - Identification of Flood Risk Areas

There are no relevant flood risk areas identified within the area covered by this PFRA. Given the overall paucity of additional data to inform the identification of any new areas, the City Council do not propose to submit any further ‘flood risk areas’ as part of this PFRA submission. However, the maps shown in Appendices A-D do indicate that a prolonged storm within the city could impact on a large number of properties and critical services, as a result should the threshold criteria change or further modelling reveal that more grids could be affected then this would be reported in the next PFRA stage.

Summary

This PFRA fulfils the requirements of the EU Floods Directive, in doing so the PFRA has approved/designated:

- Locally Agreed Surface Water Information: based on the national dataset ‘Flood Maps for Surface Water’ and the existing Strategic Flood Risk Assessment conducted for the Core Spatial Strategy
- Flood Risk Areas: based on the thresholds defined nationally, namely 1km$^2$ grid sections where 200 people, or 20 commercial properties, or 1 critical service within the square could be affected.
- National Flood Risk Areas: we have agreed that there are no national flood risk areas within the City of Stoke-on-Trent as there are no areas where a cluster of 1km$^2$ locations could affect more than 30,000 people within the City.
- Examined local Historical Flood data: the examination of local information from engineers and other local partners has not identified any ‘significant’ flood risk sites based on the above definition.
- Examined other sources of flooding: we have considered local information on groundwater flooding (or as a component to flooding) and flooding associated with artificial drainage structures. This has not yielded any additional ‘significant’ flood sites.
- Provided details of historic and future flood information for review by the Environment Agency and subsequent release to the EU (Electronic Appendix).
- Provided details of LLFA responsibilities: we have identified the City Council’s responsibilities as the LLFA for the City as how we will manage flood risk in partnership with other key organisations.
The completion of these elements represents our Preliminary Flood Risk Assessment for the City. Spreadsheets contained in Annex 1-4 represent our formal return to the Environment Agency for EU review. The PFRA is a high level screening exercise, however further work will be completed as part of the more detailed work to be conducted as part of the Surface Water Management Plan for the City, this document will help to form the basis of the next PFRA reporting element which is required by June 2013 (see Figure 1 at the beginning of this document). This is discussed in greater detail in the following section, ‘Next Steps’.
Chapter 8 - Next Steps

Over the coming months and years work will continue to both assess and mitigate flood risks within the City. Locally, the primary mechanism for developing flood risk information and mitigation works will be via the SWMP. This detailed analysis and the local partnerships required to support it will provide much greater depth of information to feed into the next steps of the PFRA and is formed from four primary areas of work as described below:

- Local flood website; were individuals and organisations can register local flood events or report and concerns regarding local watercourses and water bearing structures.
- The Flood Management Group; chaired by the City’s dedicated team, this group will provide a structured forum for local flood risk partners to share information and discuss solutions. The Flood Management Group will be responsible for the delivery of annual reports and programmes and will be facilitated by resources at the City Council as part of its responsibilities as the LLFA.
- Flood Database; the City Council as LLFA will develop and maintain a database of all flood events within the City (see Figure 6 below). The database will be linked to a geospatial database which will map both flood events, frequency, depth and extents of flooding at the impacts of these events on residential properties, commercial properties and key services.
- Flood Risk modelling; at locations where flood risks are not fully understood or which have had a number of reported flooding incidents and have been prioritised, further analysis and modelling will take place. This modelling will also take into account future planned development impacts and climate change impacts as part of scenario tests.

Figure 6. Example of the Proposed Flood Incident Database
Of all of the above activities, the development of the Flood Risk Management Group is the most critical. It is this group which will be fundamental to ensuring that flood risk issues are recorded and mitigation of risk management process are put in place.

**Scrutiny & Review Procedures**

The scrutiny and review procedures that must be adopted when producing a PFRA are set out by the European Commission. Meeting quality standards is important in order to ensure that the appropriate sources of information have been used to understand flood risk and the most significant flood risk areas are identified.

Another important aspect of the review procedure is to ensure that the guidance is applied consistently; a consistent approach will allow all partners to understand the risk and manage it appropriately. The scrutiny and review procedure will comprise two key steps, as discussed below.

**Local Authority Review**

The first part of the review procedure is through an internal Local Authority review of the PFRA, in accordance with appropriate internal review procedures. Internal approval should be obtained to ensure the PFRA meets the required quality standards, before it is submitted to the Environment Agency.

Within Stoke-on-Trent, the PFRA will be taken to Overview and Scrutiny then to the City Council Cabinet before being formally delivered to the Environment Agency.

**Environment Agency Review**

Under the Flood Risk Regulations, the Environment Agency has been given a role in reviewing, collating and publishing all of the PFRAs once submitted. The Environment Agency will undertake a technical review (area review and national review) of the PFRA, which will focus on instances where Flood Risk Areas have been amended (not applicable to Stoke-on-Trent) and ensure the format of these areas meets the provided standard. If satisfied, they will recommend submission to the relevant Regional Flood Defence Committee (RFDC) for endorsement. RFDCs will make effective use of their local expertise and ensure consistency at a regional scale. Once the RFDC has endorsed the PFRA, the relevant Environment Agency Regional Director will sign it off, before all PFRAs are collated, published and submitted to the European Commission.

The first review cycle (the 6 year cycle) of the PFRA will be led by Stoke-on-Trent City Council and must be submitted to the Environment Agency by the 22nd of June 2017. They will then submit it to the European Commission by the 22nd of December 2017 using the same review procedure described above.

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References

Ref 1 – Definition as provided on Page (iii) of the PFRA Final Guidance’ published by the Environment Agency in December 2010. Hereafter referred to as ‘PFRA Guidance’
http://www.environment-agency.gov.uk/research/planning/125459.aspx

Ref 2 – See above reference

Ref 3 – Reproduced from PFRA Guidance, Page 2

Ref 4 – PFRA Guidance Page 4

Ref 5 – Catchment: in this instance catchment refers to the area of land in which rainfall is eventually collected into the River

Ref 6 – Pitt Review: Sir Michael Pitt was asked by Ministers to conduct an independent review of the flooding emergency that took place in June and July 2007. The Government asked that the process be both thorough and independent; a fair assessment of what happened and what we might do differently.

Ref 7 – Pitt Review Executive Summary, Page 10. The full document can be accessed here:

Ref 8 – SWAMP Technical Guidance

Ref 9 – Return period – A return period also known as a reoccurrence interval is an estimate of the interval of time between events.
Annex 1 Records of Past Floods and their Significant Consequences

Refer to Annex 1 Spreadsheet attachment with the report

Annex 2 Records of Future Floods and their Significant Consequences

Refer to Annex 2 spreadsheet attachment

Annex 3 Records of Flood Risk Areas and Rationale

Null return for Stoke-on-Trent

Annex 4 Review Checklist

See Annex 4 spreadsheet attachment
Appendix A Areas Susceptible to Surface Water Flooding (1\textsuperscript{st} Generation)

Environment Agency Mapping
Areas Susceptible to Surface Water Flooding

Legend:
- Stoke Boundary
- More
- Intermediate
- Less
Appendix B Flood Maps for Surface Water (1:30yr and 1:200yr, two depths 0.1, 0.3m)

Environment Agency Mapping
Flood Map for Surface Water - 30 Years

Legend:
- Stoke Boundary
- > 0.3m
- > 0.1m
Appendix C Areas Susceptible to Groundwater Flooding

Environment Agency Mapping
Appendix D Risk Areas for Flooding

Environment Agency Mapping