



Stockton-on-Tees  
BOROUGH COUNCIL

Stockton-on-Tees Borough Council

# **Preliminary Flood Risk Assessment**

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## **Executive Summary**

Stockton on Tees Borough Council produced this PFRA report to meet their statutory duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations 2009.

The purpose of the PFRA report is aimed at providing a strategic assessment of flood risk from local sources including surface water, groundwater, ordinary watercourses and canals. This report is a high level screening exercise using readily available data held by Stockton on Tees Borough Council and partnering organisations. The report looks at historical past flood events and considers the potential future flood events that may have a significant consequence on human health, economic activity and the environment including cultural heritage.

National methodology was used by the Environment Agency which was set out by Defra to identify indicative flood risk areas across England. Ten indicative flood risk areas have been identified across England. Stockton on Tees Borough Council does not have an indicative flood risk area as defined by legislation and will not be required to produce the flood hazard maps, flood risk maps and flood risk management plans.

## 1.0 Introduction

This document produced by Stockton on Tees Borough Council reports the research carried out towards the Preliminary Flood Risk Assessment (PFRA). The PFRA is a high level risk assessment of flooding in the Borough of Stockton. Stockton does not have any 'significant' flood risk areas as defined by the legislation, however all authorities are required to produce a Preliminary Assessment Report.

There are two new pieces of legislation; Flood Risk Regulations which came into force on 10<sup>th</sup> December 2009 and the Flood & Water Management Act 2010 (FWMA) which gained Royal assent on the 8<sup>th</sup> April 2010. These are the main drivers behind the research and preparation of the PFRA report. Under the new legislation Stockton Borough Council has been designated as a Lead Local Flood Authority (LLFA) and has a number of statutory duties and responsibilities to manage flood risk in the Borough.

The Flood Risk Regulations 2009 transpose the requirements of the EC Floods Directive (the Directive) into domestic law in England and Wales. The implementation of the provisions places duties on the Environment Agency (EA) and LLFAs to prepare a number of key documents which are required by the Regulations. Stockton Borough Council is only required to produce a PFRA report. LLFAs that have a significant flood risk area are required to produce the following additional documents;

- Flood Hazard Maps and Flood Risk Maps; and
- Flood Risk Management Plans.

The PFRA will form part of Stockton Borough Councils Local Flood Risk Management Strategy. LLFAs are required to prepare the local strategies under the Flood and Water Management Act 2010. The local strategy will set out how Stockton Borough Council will manage flood risk across its study area.

Under the Flood Risk Regulations 2009, Stockton Borough Council does not have a significant flood risk area and therefore is only required to produce a PFRA report within the timescale listed in figure1.

**Figure 1.**

<b>Action</b>	<b>Responsibility</b>	<b>Date</b>
<b>Prepare Preliminary Assessment Report and issue to the Environment Agency.</b> The PFRA focuses on local flood risk from surface water, ground water, ordinary watercourses and canals.	<b>LLFA</b>	<b>22 June 2011</b>
<b>Flood Risk Areas identified in the PFRA</b> Stockton Borough Council has no significant flood risk areas in accordance with National criteria.	EA	22 Dec 2011

The PFRA report considers past and potential future flooding within Stockton Borough which has significant harmful consequences for human health, economic activity and the environment. LLFAs are required to consider the following local flood sources for this report;

- Surface water;
- Ground Water;
- Ordinary watercourses; and
- Canals.

The Environment Agency are responsible for flooding associated with the sea, main rivers and reservoirs. This report will not consider flooding sources which are the responsibility of the Environment Agency unless it is considered that it may contribute to flooding from one of the local flood sources.

## **1.1 Study Area**

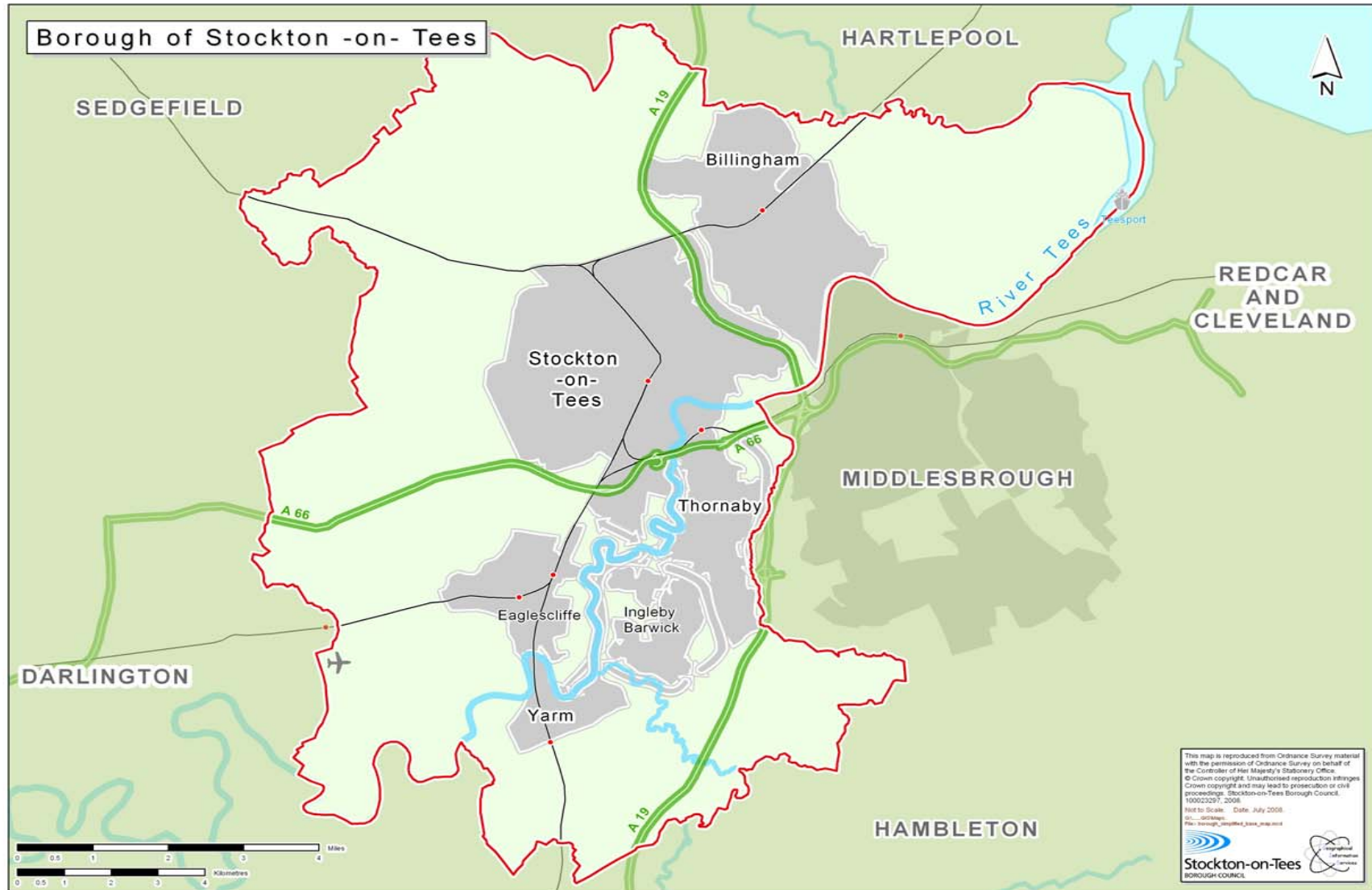
The study area comprises of the Borough of Stockton on Tees located in the north east of England and covers an area of 20,390 ha and has a population of 187,100. Stockton Borough is one of the five Borough Councils that are within the Tees Valley and lies east of Darlington and west of Middlesbrough.

The north of Stockton Borough boundary is located at Tees Mouth coastline and the eastern part of the borough follows the Tees Estuary. The eastern part of the Borough is highly urbanised and is joined to Middlesbrough. Further west, the Borough is more rural but relatively flat, with a few smaller towns and villages dispersed across this area. The main urban area is Stockton Town which is joined by Billingham to north and Thornaby-on tees to the south.

The River Tees is the main watercourse in Stockton Borough. The Tees rises on the eastern slopes of Cross Fell, which is the highest peak in the Pennines and flows west to east through Stockton borough and is fluvial until reaching the Tees Barrage.

The Borough of Stockton (figure 2) is located in the Tees Valley and the study area falls across the Northumbrian River Basin District.

Figure 2 – Stockton Borough Council Boundary





## **2.0 Lead Local Flood Authority Responsibilities**

### **2.1 Introduction**

The new legislation requires LLFA's to undertake a number of new statutory duties and responsibilities to manage flood risk in their areas. The PFRA report is just one responsibility that Stockton Borough Council is required to undertake as their new role as LLFA.

Sir Michael Pitt published his final report in June 2008, 'Learning lessons from 2007 floods', which called for urgent and fundamental changes in the way the country is adapting to the increased risk of flooding. The report states that Local Authorities should play a major role in the management of local flood risk, taking the lead in tackling problems of local flooding and co-ordinating all relevant agencies. Stockton Borough Council as the designated LLFA is therefore responsible for leading local flood risk management across the Borough of Stockton.

Partner organisations hold the local knowledge and technical expertise which is essential for Stockton Borough Council to fulfil their duties as LLFA. Therefore, it is crucial that Stockton Borough Council works alongside these organisations to ensure effective and consistent management of local flood risk.

## **2.2 Forums**

Stockton Borough Council participates in a number of forums along with partners and other Tees Valley Authorities. These forums include;

### **TV Flood Risk Group**

Stockton Borough Council currently chairs the Flood Risk Group for the Tees Valley. The group is attended by a representative from each Tees Valley Authority, Environment Agency, Northumbrian Water, Emergency Planning Unit and Tees Valley Unlimited. The group is set up to discuss flood risk at a strategic level, emerging legislation and partnership working.

### **NWL Liaison Meetings**

Stockton Borough Council attends quarterly NWL liaison meetings where representatives from the following areas attend, flood risk management, development services, spatial planning, building control and environmental health. The purpose of the liaison meetings is to inform us of any major works programmed by NWL and we provide an update of any potential major developments within the borough.

### **Local Resilience Forum, (LRF)**

The Local Resilience forum (LRF) is responsible for emergency planning and civil contingencies across; Hartlepool, Stockton, Redcar and Cleveland and Middlesbrough. The LRF undertakes risk assessments and production of the community risk register of hazards that may lead to a flood risk.

### **Northumbria Regional Flood and Coastal Committee, (NRFCC)**

Lead Cabinet Member attends the NRFCC on behalf of Stockton Borough Council. There are regular internal meetings where the cabinet member reports any actions/updates to the Built and Natural Environment Manager.

### **Informal Meetings**

Stockton Borough Council also attends and holds frequent informal meetings with the Environment Agency and Northumbrian Water. To discuss emerging legislation and new duties required by Stockton Borough Council.

## 2.3 Additional Responsibilities

The Flood and Water Management Act (FWMA) 2010 requires Lead Local Flood Authorities to undertake a number of new statutory duties and other related functions to manage flood risk in their areas. A large proportion of the new statutory duties commenced in April 2011 however some areas of the legislation are still emerging and are to be enacted.

The key responsibilities emerging from the FWMA 2010 includes;

**Investigation** – LLFA's will be required by law to investigate and record details of significant flooding incidents within their area. This investigation is to be "to an extent that it considers necessary or appropriate", the results of the investigation must be published.

**Asset Register** –The LLFA "must establish and maintain a register of structures or features which, in the opinion of the Authority, are likely to have an effect on a flood risk within its area". Each of these 'flood risk features' must have information regarding ownership and state of repair.

**Power to Request Information** – Under the FWMA 2010 LLFA's and the EA may request a person to provide information in connection with flood risk management.

**Designation of Features** – The FWMA 2010, Section 30 Schedule 1 provides the power for 'designating authorities' to formally designate features or assets which form flood and coastal risk management systems but which are not maintained or operated by those responsible for managing the risk. The Authority has the power to provide consent to the alteration, removal or replacement of a feature. There is also an enforcement element to this process, where action can be taken against anyone contravening the Act; for example altering a feature without consent.

**Sustainable Urban Drainage** - The FWMA 2010 removes the automatic right for a developer to connect to the existing drainage systems for the disposal of surface water, therefore in order to dispose of surface water, sustainable urban drainage would need to be considered. When schedule 3 of the legislation commences a sustainable urban drainage approval body will be required to consider drainage applications.

**Local Strategy for Flood Risk Management** – LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in its study area.

## **3.0 Methodology and Data Review**

### **3.1 Introduction**

The PFRA is prepared in accordance with the final guidance from the Environment Agency which was published in December 2010. The PFRA is a high level risk assessment that identifies areas where the risk of flooding is considered to be significant and warrants further investigation. The closer investigations will include the production of flood risk maps, flood hazard maps and flood risk management plans. The latter stage does not apply to Stockton, as there are no 'significant' flood risk areas.

### **3.2 Data Collection**

In order to prepare the PFRA a large amount of information gathering was conducted from a variety of sources. Stockton Borough Council contacted a number of organisations to share data for the preparation of the PFRA, these included; NWL, Cleveland Fire and Rescue Services, Cleveland Police, Emergency Planning, Environment Agency, Planning department, highways department.

The available data sources and information collated by Stockton Borough Council to prepare this PFRA report are listed below;

#### Stockton Borough Council Data

##### ***Stockton Borough Council: Strategic Flood Risk Assessment, (SFRA)***

JBA Consulting was commissioned to undertake a review of the existing Tees Valley Strategic Flood Risk Assessment (SFRA) published in 2007. The level 1 SFRA for Stockton-on-Tees Borough Council was prepared in accordance with current best practice, Planning Policy Statement 25 Development and Flood Risk (PPS25). A level 2 SFRA follows on from volumes I, II and III which formed the level 1 SFRA. The Level 2 SFRA provides an assessment of flood risk at key development and regeneration locations within the borough of Stockton-on-Tees. The level 1 & 2 SFRA were both published in June 2010.

***Surface Water Management Plan, (SWMP)***

The surface water management plan is currently being prepared by Stockton Council. A large data collection exercise was conducted in order to prepare the SWMP. The collated data from various sources helped to prepare this PFRA report.

***Highways Flooding Reports***

A number of highway officers held varied information on past flood events. The information was collected by officers during their general duties.

***Direct Services Reports***

Direct Services have kept records of all flooding incidents reported by members of the public on an internal system. The information recorded varies most have very little detail about the flooding incident while some records have a response provided from the technician who attended the incident giving more detail about the event.

***Indicative Flood Map***

The indicative flood map identifies national flood risk areas, based on the definition of 'significant' flood risk described by Defra. Stockton Borough Council has no significant flood risk areas.

***Flood Map (River and the Sea)***

The flood map is a multi-layered map which provides information on areas that could be affected by flooding from river or the sea. It provides information on flood defences and for the major defences it shows the areas that will benefit from those flood defences. The multi-layered map provides the following data;

- Flood zone 3 - Areas of land at risk of flooding  
The natural flood plain ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or 0.5% or greater annual probability of tidal flooding.
- Flood zone 2 – Areas of land at risk of flooding  
The natural flood plain ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.
- Flood defences  
The Flood Map displays the location of linear raised flood defences such as embankments and walls.
- Flood storage areas  
Flood storage areas, land designated and operated to store flood water are shown in a separate polygon layer.
- Areas that benefit from flood defences  
Land that may benefit from the presence of major defences during a 1% fluvial or 0.5% tidal flood event. These are areas that would flood if the defence were not present, but may not flood because the defence is present. Areas benefiting from flood storage areas may be remote from the flood defence structure.

### ***Flood Map for Surface Water***

The Flood Map for Surface Water shows areas where surface water would be expected to flow or pond. The map includes two rainfall events, one with a 1 in 30 and the other with a 1 in 200 chance of occurring in any year.

### ***Areas Susceptible to Surface Water Flooding***

The map shows areas susceptible to surface water flooding. The map provides three bandings from 'less' to 'more' susceptible to surface water flooding. The 'more' band will be useful to help identify areas which have a natural vulnerability to:

- flood first;
- flood deepest;
- and/or flood for relatively frequent, less extreme events (when compared to the other bands).

### ***Area Susceptible to Ground Water Flooding (AStGWF)***

Areas Susceptible to Groundwater Flooding is a strategic scale map showing groundwater flood areas on a 1km square grid.

### ***National Receptors Dataset***

The national receptors dataset is a database of social, economic, environmental and cultural receptors including residential properties, schools, hospitals, transport infrastructure and electricity substations.

### ***Historic Flood Map***

The Historic Flood Map shows the combined extents of known flooding from rivers, the sea, and groundwater.

### ***Tees Catchment Flood Management Plan***

The Tees CFMP aims to reduce risk of flooding from rivers, groundwater, sewers and the sea to people, property, and the built and natural environment by supporting and implementing government policies.



## Northumbrian Water

Northumbrian water have provided two datasets; however there is a data sharing protocol in place due to its sensitivity.

### ***Sewer Flooding Location (Pipe Length)***

The dataset provides sewer flooding location where properties are on the DG5 sewer flooding (1 in 10, 2 in 10 and 1 in 20 year) registers. The pipe length reference where hydraulic incapacity has been identified in storm conditions has also been provided.

### ***Extreme Events***

The dataset provides locations where past extreme flooding events have occurred.

## Cleveland Fire & Rescue Services

### ***Historic Flooding Records***

Cleveland Fire and Rescue Services have provided information on recorded past flooding incidents. The information varied however the majority of the records included precise geo-referenced locations and some records included actions carried out by the duty officer.

## Cleveland Police

### ***Historic flooding records***

Cleveland Police have provided information on past flooding incidents that they have recorded, however the data provided varies and with very little detail of the incident recorded.

## British Waterways

### ***British Waterway's canal network***

British Waterways provided detailed GIS information on their canal network, including the location of canal centrelines, sluices, locks, culverts, etc. British Waterways did not have any records of historic breaches or overtopping events that have occurred within the Borough's boundary.

### **3.3 Data Quality**

The historic flood records and information collated from all sources was found that the quality of data varied. The majority of the flood records and information did not hold a detailed account of the flooding incident. However the majority of the records held by Cleveland Fire and Rescue Services included precise geo-referenced locations.

### **3.4 Data Storage and Restrictions**

The data can be accessed and shared through the councils Geographical Information System (GIS). The data can be viewed by a series of maps through GIS.

All data is stored on a secure server which is backed up daily and can be easily restored if an emergency occurred. The server has restricted user permissions and can only be accessed by those with necessary permissions. Stockton Borough Council has entered an agreement with partner organisations and must adhere to these data security measures to ensure that sensitive data is held in a secure manner.

The Environment Agency licenses some of its data and includes the following disclaimer;

*“We do not promise that the information supplied to you will always be accurate, complete or up to date or that the information will provide any particular facilities or functions or be suitable for any particular purpose”.*

## **4.0 Past Flood Risk**

### **4.1 Flooding Sources**

Stockton Borough Council collated all the data and information collected from partner organisations and the council's internal services. The flooding events across the Borough of Stockton came from a variety of flood sources; however the source of flooding was unknown or not recorded in many cases. LLFAs must consider specific sources of flooding as part of the PFRA report, a summary of each source of flooding considered is included below.

#### ***Surface water flooding***

Surface water runoff is rainwater (including snow and other precipitation) which is on the surface of the ground and has not entered a watercourse, drainage system or public sewer. Surface water flooding generally occurs when heavy rainfall exceeds the capacity of local drainage networks and water flows across the ground. In the preparation of the PFRA, Stockton Borough Council has obtained information on surface water flooding incidents from a number of sources.

#### ***Groundwater flooding***

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

#### ***Flooding from Drainage Systems***

Flooding from drainage systems occurs when the flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity and it becomes blocked or it cannot discharge due to a high water level in the receiving watercourse.

#### ***Canals and Ordinary Watercourses***

Flooding from an ordinary watercourse occurs when it cannot accommodate the volume of water draining from surrounding land. British Waterways provided detailed information on their canal network. The natural tidal limit of the Tees previously extended to Low Worsall. The Tees Barrage now maintains upstream water levels at around mean high water throughout the tidal cycle.

## **4.2 Historic Flood Events**

This section identifies areas that have suffered from past flooding events that have had significant harmful consequences for human health, economic activity, cultural heritage and the environment. The maps included in Annex 6 (Summary maps for past floods), identifies areas where past flooding incidents have occurred. The map has been produced using 1km by 1km grid squares therefore if one or many incidents have occurred within a grid square then this is highlighted to represent a past flood incident area.

### **Yarm on Tees**

An intense storm hit Yarm on 31<sup>st</sup> January & 1<sup>st</sup> February 1995 and flooding was caused by surcharge from surface water drainage system serving the Town Centre. The flooding affected gardens, car parks, the Skinnery Housing Site and the High Street but did not affect any properties. Cleveland Fire and Rescue Service managed to contain the flood water at acceptable levels within Yarm High Street.

### **Lustrum Beck**

Lustrum beck has a record of flooding dating back to 1771 with the worst flood occurring on the 29<sup>th</sup> of March 1979 which included substantial flooding of land, residential and commercial properties. Further floods occurred in April, June, October, and November 2000 all of which affected properties along Hartburn Avenue and the area around Browns Bridge. It was reported that properties along Darlington Road, Burnside Grove, Oxbridge Lane, Bishopton Road, Wrensfeld Road, the Adult Training Centre, Newtown Methodist Church, Kingdom Hall and Wrensfeld School were also affected by flooding during the severe event in November 2000.

Lustrum Beck is classed as a Main River and is the responsibility of the Environment Agency. However, given the number of housing developments creating additional surface water run off built over the years on floodplain land that would have once stored much of the floodwater it was agreed to be appropriate to include this area within the PFRA report.

### **Halidon Way, Billingham**

Over recent years there have been several instances of flooding in and around Halidon Way in Low Grange, Billingham. The most notable of which was the event which occurred in March 1979, resulting in 68 dwellings being flooded, some to depths in excess of 1 metre.

Following the 1979 event, a number of works were implemented to reduce the impact and risk of repetition. The work comprised the construction of a new trash screen at the entrance to the culverted section of Cowbridge Beck, sealing the pedestrian subway on Neasham Avenue and constructing an earth bund around the perimeter of the Billingham Campus playing field.

During heavy rainfall in 2003, several properties of Halidon way, Billingham suffered from internal flooding. It was reported that the flooding seemed to originate from two areas surface water run-off from within the curtilage of Oakdene School, other water running off Neasham Avenue down into Halidon way.

### **Leven Bridge, Low Lane (A1044)**

In November 2004, the River Leven burst its banks from continuous heavy rainfall and flooded carriageway and nearby houses including Cross Keys (PH). Leven Bridge was closed by police on the night of the 2/3 November due to water flowing across the road. This past extreme event is included in the PFRA report due to the event having a significant harmful consequence for human health. The River Leven is classed as Main River and is the responsibility of the Environment Agency.

### **Fairfield, Stockton on Tees**

An intense storm hit the Borough of Stockton on Tees on the 21<sup>st</sup> July 2010; one area hit particularly badly was Fairfield, where several properties suffered from internal flooding. The area affected by flooding included Victoria Road, Blackburn Close, and Logan Drive. It was reported that the flooding occurred due to the drainage exceeding its capacity within the area.

In September 2009, surface water flooding across Stockton Borough occurred along with drainage exceeding its capacity in several places across the Borough. One area hit hard which included internal flooding was Fairfield. It was reported that properties on Victoria Road, Logan Drive, Blackburn Close suffered flooding.

Stockton Borough Council are aware that Northumbrian Water are currently carrying out works to alleviate the flooding within the area. However, at the time of writing this report the works were not complete.

### **Port Clarence**

In March 1999 substantial flooding occurred due to heavy rain and peak flows unable to pass through Holme Fleet culvert, which is located to the north of Port Clarence. It was reported that the culvert was blocked at the time by material which had entered the access chambers.

On the 8<sup>th</sup> November 2000 between 2-4am an intense storm hit the area of Port Clarence where approximately 16 properties suffered from internal flooding with flood water reaching ground floor level. The properties affected included Holly Terrace, High Clarence, Palm Terrace and Laburnum Grove, Port Clarence. There were also a number of properties that suffered flooding to their gardens within the Port Clarence area. It was reported that the flooding occurred due to Holme Fleet Beck bursting its banks due to heavy rainfall.

Following these events Stockton Borough Council desilted the culvert and improvements were made to the inlet. In spring 2006 a pre-feasibility study was completed and concluded that the risk presented from tide locking of the outfall is insignificant. It was concluded that future operations and maintenance activities along Holme Fleet should be focussed on keeping the culvert free from blockage. In April 2005 Holme Fleet Beck was classified as Main River and became the responsibility of the Environment Agency.

### **4.3 Consequences**

The consequences of flooding can have a positive and/or negative outcome. Wildlife and agricultural areas may have a positive benefit from flooding as it may result in more fertile land and habitats for wildlife. The severity of a flood will impact on the consequences for human health, economic activity, infrastructure, the community and environment. The Flood Risk Regulations require consideration of significant harmful consequences on:

- Human Health;
- Economic Activity;
- Environment (including cultural heritage).

This definition of 'significant' has been defined by legislation and areas with more than 30,000 people at risk of surface water flooding have been designated as Indicative Flood Risk areas. Further information regarding the criteria for Indicative flood risk areas is provided in section 6.1.

The Tees Valley Authorities agreed that flooding is deemed locally significant if one of the following is affected by flooding:

- 5 or more residential properties;
- 2 or more businesses;
- 1 or more critical services;
- 1 or more transport links (Impassable for 10 Hours or more).

The records listed in Annex 1 (Past Floods) are what Stockton Borough Council considered to be locally significant and not in line with the definition of significant provided by Defra.

## 5.0 Future Flood Risk

### 5.1 Summary

The EA have produced and released a number of datasets to assist LLFAs to prepare their PFRA report. The following datasets have been released to help LLFAs to identify potential future flood risk areas;

#### Flood Map (River and the Sea)

- Flood Zone 3 identifies the natural flood plain as having a 1% or greater annual probability of fluvial flooding or 0.5% or greater annual probability of tidal flooding.
- Flood Zone 2 identifies the natural flood plain ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.

#### Flood Map for Surface Water

- **Flood Map for Surface Water (1 in 30)** The map shows the 1 in 30 year probability of a rainfall event that produces flooding greater than 0.1m depth.
- **Flood Map for Surface Water (1 in 30 deep)** The map shows the 1 in 30 deep year probability of a rainfall event that produces flooding greater than 0.3m depth.
- **Flood Map for Surface Water (1 in 200)** The map shows the 1 in 200 year probability of a rainfall event that produces flooding greater than 0.1m depth. Stockton Borough Council has 9,200 residential properties that could be affected along with 2,000 non residential properties.
- **Flood Map for Surface Water (1 in 200 deep)** The map shows the 1 in 200 deep year probability of a rainfall event that produces flooding greater than 0.1m depth. Stockton Borough Council has 1,500 residential properties that could be affected along with 300 non-residential properties.



### **Areas Susceptible to Surface Water Flooding (AStSWF)**

- **AStSWF (Less)** The map shows areas which are 'less susceptible' to surface water flooding. Stockton Borough Council has a potential 14,500 properties that could be affected along with 3,500 non residential properties.
- **AStSWF (Intermediate)** The map shows areas which have a 'intermediate susceptibility' to surface water flooding. Stockton Borough Council has a potential 3,300 residential properties that could be affected along with 900 non residential properties.
- **AStSWF (More)** The map shows areas which are more susceptible to surface water flooding.

### **Area Susceptible to Groundwater Flooding (AStGWF)**

- **AStGWF** The map shows places where emergence is more likely to occur.

Stockton on Tees Borough Council considered the above scenarios produced by the EA to determine potential future flood risk. Following a discussion with our partners, details provided in section 5.2, it was agreed that Areas Susceptible to Surface Water Map best represents the Borough's local conditions and will be considered for future flood risk management. Stockton on Tees Borough Council's surface water management plan is currently being prepared and therefore no specific detailed locations for future flood risk areas have been identified.

Stockton Borough Council's indications of areas that may be susceptible for future flood risk are taken from the Areas Susceptible to Surface Water Map produced by the EA identifying the main source of flooding as surface water run off caused by natural exceedence. The map only provides a general indication of areas which may be more likely to suffer from surface water flooding.

The areas below have been identified in the risk assessment as having a higher risk of possibly being affected by Surface Water Flooding;

- **Yarm on Tees** – Several residential properties and non residential properties could be affected by surface water flooding. Annex 7 includes a map showing the areas with the three bandings from 'less' to 'more' susceptible to surface water flooding.

- **Fairfield** – Several residential properties and non residential properties could be affected by surface water flooding. Annex 7 includes a map showing the areas with the three banding from 'less' to 'more' susceptible to surface water flooding.

## **5.2 Locally Agreed Surface Water Information**

The Environment Agency made available two national datasets showing surface water flooding to LLFA's:

- Areas Susceptible to Surface Water Flooding (AStSWF)
- Flood Map for Surface Water (FMfSW)

### **Areas Susceptible to Surface Water Flooding**

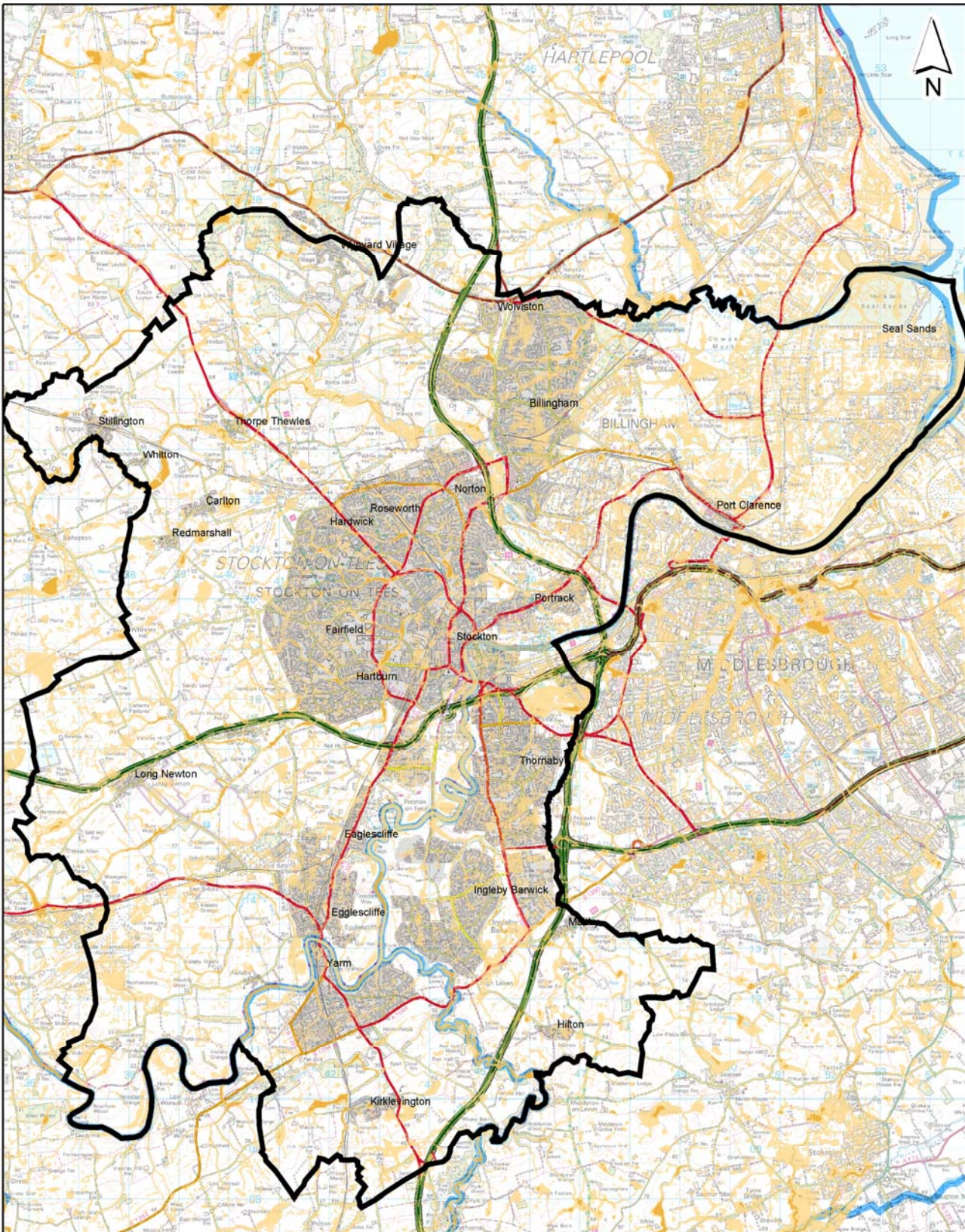
The AStSWF dataset contains one rainfall event and the map shows areas susceptible to surface water flooding with three susceptibility bandings; less, intermediate and more. The map has been produced using a simplified method that excludes, underground sewerage, drainage systems, smaller over ground drainage systems and buildings. The map only provides a general indication of areas which may be more likely to suffer from surface water flooding.

### **Flood Map for Surface Water**

The FMfSW contains two rainfall events, divided into two depth bandings; 1 in 200 rainfall and 1 in 200 rainfall deep, as well as 1 in 30 rainfall and 1 in 30 rainfall deep. The FMfSW was developed using 5m by 5m grids. The elevation data was processed at a 2m resolution to produce a bare earth digital terrain model (DTM) before buildings were re-added with an arbitrary height of 5m. It does not show flooding that occurs from overflowing watercourses, drainage systems or public sewers caused by catchment wide rainfall events or river flow.

Both maps were reviewed with an EA representative and it was agreed that Areas Susceptible to Surface Water flooding best represents Stockton Borough Council (figure 3). This will be considered for future flood risk management. Annex 2 (Future Floods) reports details of potential future floods and consequences.

**Figure 3 – Area Susceptible to Surface Water Map**



 <p><b>Stockton-on-Tees</b> BOROUGH COUNCIL</p>	<p>Development &amp; Neighbourhood Services Corporate Director: P Dobson</p> <p>Head of Technical Services: Richard McGukin Kingsway House, West Precinct, Billingham. TS23 2NX Telephone: (01642) 393939</p>	<p>Areas Susceptible to Surface Water Map for Stockton on Tees Borough Council.</p>
<p>© Crown Copyright and database right 2011 Ordnance Survey 100023297</p>	<p>Date: May 2011</p>	<p>Scale: 1:100,000</p>

### **5.3 Impacts of Climate Change and Long term Developments**

#### ***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%.

#### ***Key Projections for Northumbria 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 10% (very likely to be between 0 and 23%)
- Precipitation on the wettest day in winter up by around 11% (very unlikely to be more than 24%)
- Relative sea level at Tynemouth very likely to be up between 7 and 38cm 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 13%

Increases in rain are projected to be greater near the coast than inland.

### ***Implications for Flood Risk***

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

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

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

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.

### ***Adapting to Change***

Past emission means some climate change is inevitable. It is essential we respond by planning ahead. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term, sustainable benefits.

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

### ***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."

In Wales, Technical Advice Note 15 (TAN15) on development and flood risk sets out a precautionary framework to guide planning decisions. The overarching aim of the precautionary framework is "to direct new development away from those areas which are at high risk of flooding."

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

#### **5.4 Relevant Local Information**

Stockton Council developed a Local Climate Impacts Profile of Stockton on Tees for inclusion in its Climate Change Action Plan 2009-2020. Predictions within the Profile are drawn from the North East Climate Change Adaptation Study, which uses EARWIG (the Environment Agency Rainfall and Weather Impacts Generator) developed for the Environment Agency by Newcastle University and University of East Anglia, and uses a 5km resolution which provides a much more detailed projection for local regional areas.

Predictions for the Stockton area suggest that by the 2050s, we could experience 1.5°C to 2.5°C increase in temperature and up to 20% more winter rainfall and 30% less summer rainfall.

Although projected average annual rainfall shows a decrease of around 8.6%, it is expected that rainfall will become increasingly seasonal, with greater winter rainfall and a reduction in summer rainfall. Winter rainfall could increase by 12.7% Average summer rainfall could decrease by 33.2%

Much of winter precipitation could be delivered by intense events. Flash flooding might become more frequent and flooding of the River Tees flood plain might worsen. The continuous rise in sea level will lead to higher risk of coastal erosion and flooding.



## 5.5 Future Major Developments

There are a number of new and proposed major developments within the Borough of Stockton on Tees listed below.

Northshore Development	(E) 445757 (N) 519138
Queens Park North Development	(E) 444581 (N) 520249
Bowesfield North Phase 1 & Phase 2	(E) 444440 (N) 516910
Boathouse Lane Development	(E) 444630 (N) 518150
Tall Trees Hotel Development	(E) 441224 (N) 510541
The Rings, Ingleby Barwick Development	(E) 443659 (N) 514499
Wynyard Park Development	(E) 444045 (N) 526549
Finchale Avenue Development	(E) 445687 (N) 524083

## **6.0 Identification of Flood Risk Areas**

### **6.1 Overview**

Defra developed the criteria for assessing whether the risk of flood is 'significant' as required by regulation 14 of the Flood Risk Regulations 2009.

Defra identified National Flood Risk thresholds using 1 Kilometre grid squares where 'local flood risk is an issue'. The 1 km grid square identifies were;

- > 200 people or;
- > 1 critical service (i.e 2 or more) or;
- > 20 non-residential properties;

might be flooded to a depth of 0.3metres by a rainfall event, with a chance of 1 in 200 of occurring in any given year. Where 5 or more 1km grid squares are touching within a 3km by 3km (9Km<sup>2</sup>) grid, these are joined to create a cluster. Where a cluster identifies more than 30,000 people at risk of flooding, it has been designated an Indicative Flood Risk Area.

The Borough of Stockton has 4 1kilometre grid squares spread across the authority's boundary with none of them touching. Stockton Borough Council has no Indicative Flood Risk areas in accordance with the criteria produced by Defra.

The Tees Valley has a total of 19385 people at risk of flooding from surface water run off along with 118 Critical Services and 2063 non-residential properties. Therefore this will not be reported to the EU by the EA under the Flood Risk Regulations 2009.

## **7.0 Next Steps**

### **7.1 Lead Local Flood Authority**

It is proposed that Stockton Borough Council will be the Lead Flood Authority for the Tees Valley and may undertake a number of roles for Middlesbrough Council, Redcar & Cleveland Borough Council and Darlington Council under a lead authority arrangement. This is in the early stages with the exact details still to be agreed however the proposal is expected to include;

- Investigation of flooding incidents;
- Asset Register of flood risk features;
- Designation of Features, that mitigate the risk of flooding;
- Sustainable Urban Drainage;
- Consent to work on ordinary watercourses.

### **7.2 Future Data Management**

Stockton Borough Council as Lead Local Flood Authority have a responsibility to investigate future flooding events that meets the Tees Valley's locally agreed criteria as detailed in section 4.3. Stockton Borough Council must also continue to collect and store future flood risk data and information.

Stockton Borough Council have produced a geo-database to record future flooding incidents to ensure all information is documented consistently. The Flood Risk Management Team will be responsible for recording and keeping the geo-database up to date. The data will be used to produce future assessments and reviews.

## 8.0 References

**British Waterways** (2011) email correspondence regarding canal network.

**Defra / WAG** (2010) Selecting and reviewing Flood Risk Areas for local sources of flooding – Guidance to Lead Local Flood Authorities. Available from <http://www.defra.gov.uk/environment/flooding/documents/research/flood-risk-method.pdf>

**Defra** (2010) Surface Water Management Plan Technical Guidance.

**Environment Agency** (2010) Preliminary Flood Risk Assessment – Final Guidance (Report – GEHO1210BTGH-E-E), Available from <http://publications.environment-agency.gov.uk/pdf/GEHO1210BTGH-e-e.pdf>

**Environment Agency** (2010) Preliminary Flood Risk Assessment – Annexes to the Final Guidance (Report GEHO1210BTHF-E-E), Available from <http://publications.environment-agency.gov.uk/pdf/GEHO1210BTHF-e-e.pdf>

**Environment Agency** (2008) – Tees Catchment Flood Management Plan.

**JBA Consulting** (2010) Stockton on Tees Borough Council, Level 1 Strategic Flood Risk Assessment.

**JBA Consulting** (2010) Stockton on Tees Borough Council, Level 2 Strategic Flood Risk Assessment.

**The Pitt Review** (2008) Learning lessons from 2007 floods.

## **Annex 1: Records of Past Floods and their significant consequences**

## **Annex 2: Records of Future Foods and their significant consequences**

**Annex 3: Records of Flood Risk Area and its rationale**

NOT REQUIRED

## **Annex 4: Review Checklist**



**Annex 5: GIS layer of Flood Risk Area(s)**

NOT REQUIRED

## **Annex 6: Summary Maps for Past Floods**

## **Annex 7: Summary Maps for Future Floods**