Environment Agency

managing flood risk

Tyne Catchment Flood Management Plan

Policies and measures for managing flood risk Ouseburn policy unit

Revision 2: February 2012

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Introduction

I am pleased to introduce the policy appraisal for the Ouseburn policy unit. This document provides the evidence for the preferred approach for managing flood risk, from all sources, within this policy area over the next 50 to 100 years and the measures required to implement this approach.

The Tyne CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (Sumps).

The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

Since the publication of the Tyne CFMP in 2009, significant improvements have been made to our understanding of flood risk, particularly our understanding of surface water flooding. As well as this, the introduction of the Flood and Water Management Act (2010) has altered the roles and responsibilities for managing risk and emphasised the need for a local approach to managing risk.

In response these changes we have worked in partnership to ensure our policies for managing flood risk within the Tyne CFMP area reflect the needs of local communities and the wider catchment. As such we have revised the policies for the Lower Tyne area and updated the list of measures needed to ensure flood risk is managed effectively,

As we all work together to achieve our objectives, we will continue to monitor and listen to each others progress, discuss what has been achieved and consider where we may need to update parts of the CFMP. As such this document remains 'live'.

As recognised by the Act, we cannot reduce the risk of flooding by ourselves. We will continue to work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to manage flood risk in the future. To ensure this CFMP provides the 'right' solution to managing flood risk we have worked with others including Newcastle City Council, North Tyneside Council, Gateshead Council, South Tyneside Council, Northumberland County Council, Northumbrian Water Limited, and Natural England.

This is a summary of the adopted long term policy for managing risk and the measures required to ensure risk managed in accordance with this approved approach. If you would like to see the full evidence base which sits behind this document an electronic version can be obtained by emailing **enquiries@environment-agency.gov.uk** or alternatively paper copies can be viewed at any of our offices in the North East.

David Dangerfield

Yorkshire & North East Director

Revision History

Revision reference	Date published	Ammendments
Revision 1	Jan 2012	Initial comments from consultation
Revision 2	Feb 2012	Updated format of Policy Appraisal, and completeion of consultation comments
Revision 3	May 2012	Updates following further consultation and Quaility Review

Phil Welton
Area Flood Risk Manager

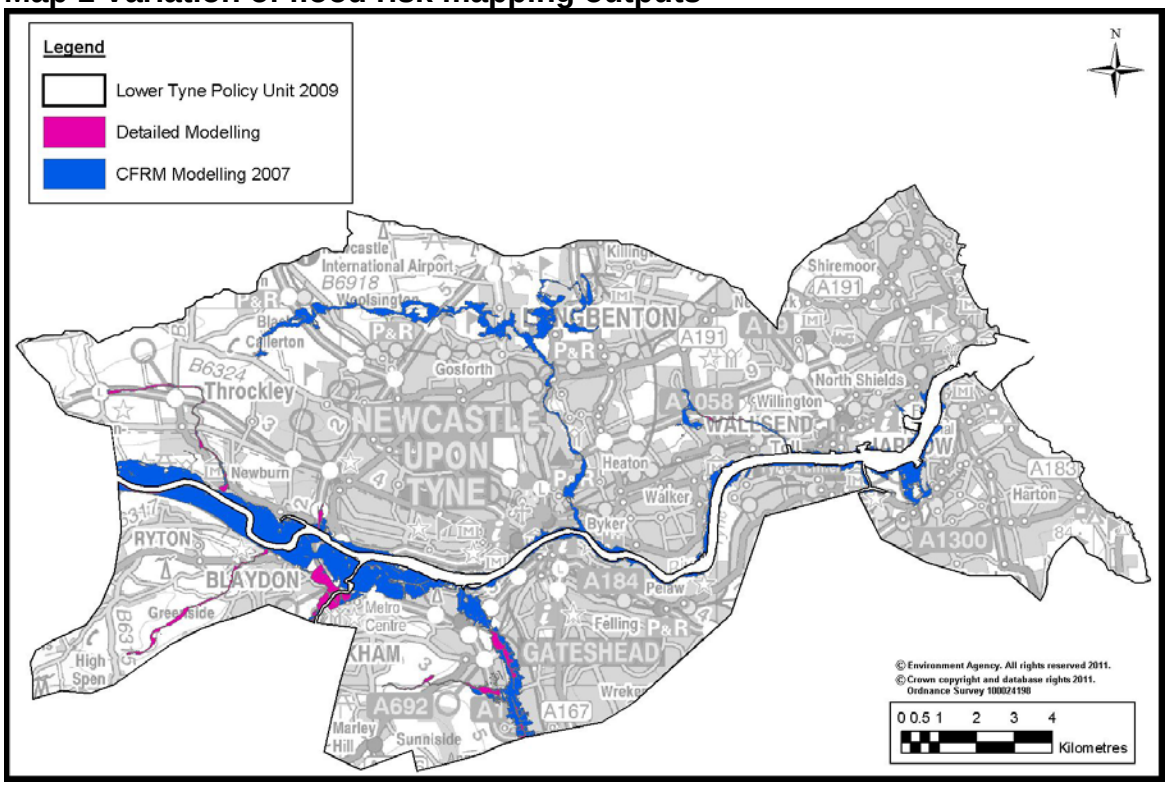
Contents

1 Background

The 2009 published Tyne CFMP recommended that further detailed studies were undertaken within the Lower Tyne policy unit area "to identify the true level of flood risk in the policy unit where this is not known, and implement recommendations". This recommendation was based on the recognition that strategic J-Flow modelling carried out by the CFMP had overestimated the fluvial flood extent due to limitations in the models ability to understand channel capacity. Since this recommendation was made, a number of detailed studies have been published which provide a more detailed understanding of fluvial flood risk, including:
River Tyne Reaches 3-11 Mapping Study (Scotwoods Bridge to the confluence of the North and South Tyne), 2008. Gateshead Councils SFRA, which incorporated 2-D modelling

As expected, and illustrated in Map 1, the fluvial flood extent within this policy unit area is less extensive to that shown in the 2009 CFMP and shows limited flood risk –even at a 1000 year event1. This is due to the much greater conveyance within the river channel than assumed in the methodology use in the original modelling (this reach of the River Tyne is very wide, between 100 and 400m, and up to 17m deep). As well as this, our understanding of surface water flood risk has been significantly improved – a gap highlighted in the 2009 Tyne CFMP - following the publication of first and second generation surface water mapping (Areas Susceptible to Surface Water and Flood Map for Surface Water respectively), Preliminary Flood Risk Assessments by all Lead Local Flood Authorities and Surface Water Management Plans.

Map 1 Variation of flood risk mapping outputs



The River Tyne, as well as the lower reaches of the Don, Derwent and Team, responds slowly to fluvial flooding (lead time is between six and 12 hours with flood duration typically less than 12 hours). In these locations risk is dominated by tides and is likely to be influenced by rising sea levels due to climate change. In contrast the River Ouseburn area responds quickly to rainfall, particularly during periods of heavy rainfall when surface drainage may be inadequate. Tidal flood risk in this location is limited. As such our responses to managing these risks will vary. In response, the Lower Tyne policy unit has been split into two separate policy units: River Ouseburn and the Lower Tyne Tidal.

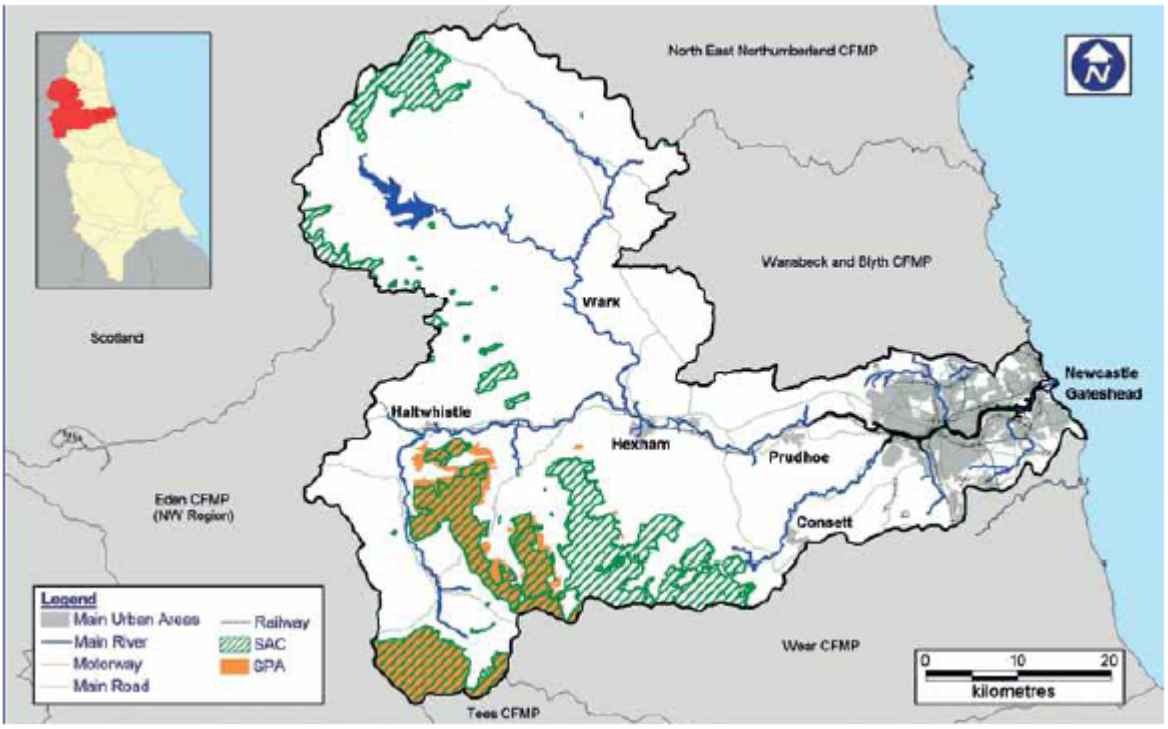
[1] Environment Agency, River Tyne Reaches 3-11 Mapping Study (2008)

2. Catchment perspective

Catchment overview

The Tyne catchment lies in the northeast of England, covering an area of 2,300 square kilometres. It rises in the Northumbrian Pennines and flows eastwards across relatively impervious geology, mainly consisting of Carboniferous Limestone covered by drift and boulder clay, before entering the North Sea at Tynemouth. Main rivers include the Allen, Derwent, North Tyne, Rede, South Tyne and the Tyne. There are three distinct parts of the Tyne catchment. The headwaters drain remote moorland and flow through narrow, steep valleys. Within the upland area of the North Tyne, Rede and Derwent there are regionally important water supply reservoirs including Kielder and Derwent Reservoirs. These reservoirs can affect flood flows and are able to maintain river flows in the Tyne, Wear and Tees rivers via water transfer infrastructure. The middle catchment contains fertile agricultural plains with a string of towns along the watercourses including Haydon Bridge, Hexham and Corbridge. The lowest parts of the catchment are covered by urban development including Newcastle and Gateshead.

Map 1 Location and extent of the Tyne CFMP area



The catchment has a population of just below one million. The River Tyne is an important sea port with the Tyne Dock and Ferry Port located in the lower estuary. Despite the rapid growth in industry, much of the area upstream of this conurbation is still high quality agricultural land. There are a number of regionally important transport routes to the east, including the East Coast Mainline from London to Edinburgh, main roads (A1, A19, A68 and A69), the Tyne Dock and part of Newcastle International Airport.

The Tyne catchment has a wealth of environmentally and culturally recognised sites. Much of the uplands lie within the North Pennine Area of Outstanding Natural Beauty (AONB). In addition there are 87 Sites of Special Scientific Interest (SSSI), all or part of nine Special Areas of Conservation (SAC) and two Special Protection Areas (SPA). There is a rich cultural heritage, including 530 Scheduled Ancient Monuments (SAM), part of the Hadrians Wall World Heritage Site, 14 Registered Parks and Gardens and two Registered Historic Battlefields.

The River Tyne drains a total catchment area of approximately 2,890 km², rising in the Northumbrian Pennines and flows eastwards across relatively impervious geology, mainly consisting of Carboniferous Limestone covered by drift and boulder clay, before entering the North Sea at Tynemouth. The Tyne catchment as a whole is predominantly rural, consisting of moorland and forestry in the upper catchment and arable farming further downstream. Figure 2 shows the Tyne catchment, with its topography and key urban areas as well as the proposed Ouseburn policy unit.

The proposed Ouseburn policy unit is not typical of the lower Tyne area. The Ouseburn is a small fluvial sub-catchment which discharges into the River Tyne at the Ouseburn Barrage. The catchment responds rapidly to precipitation and is dominated by fluvial flows.

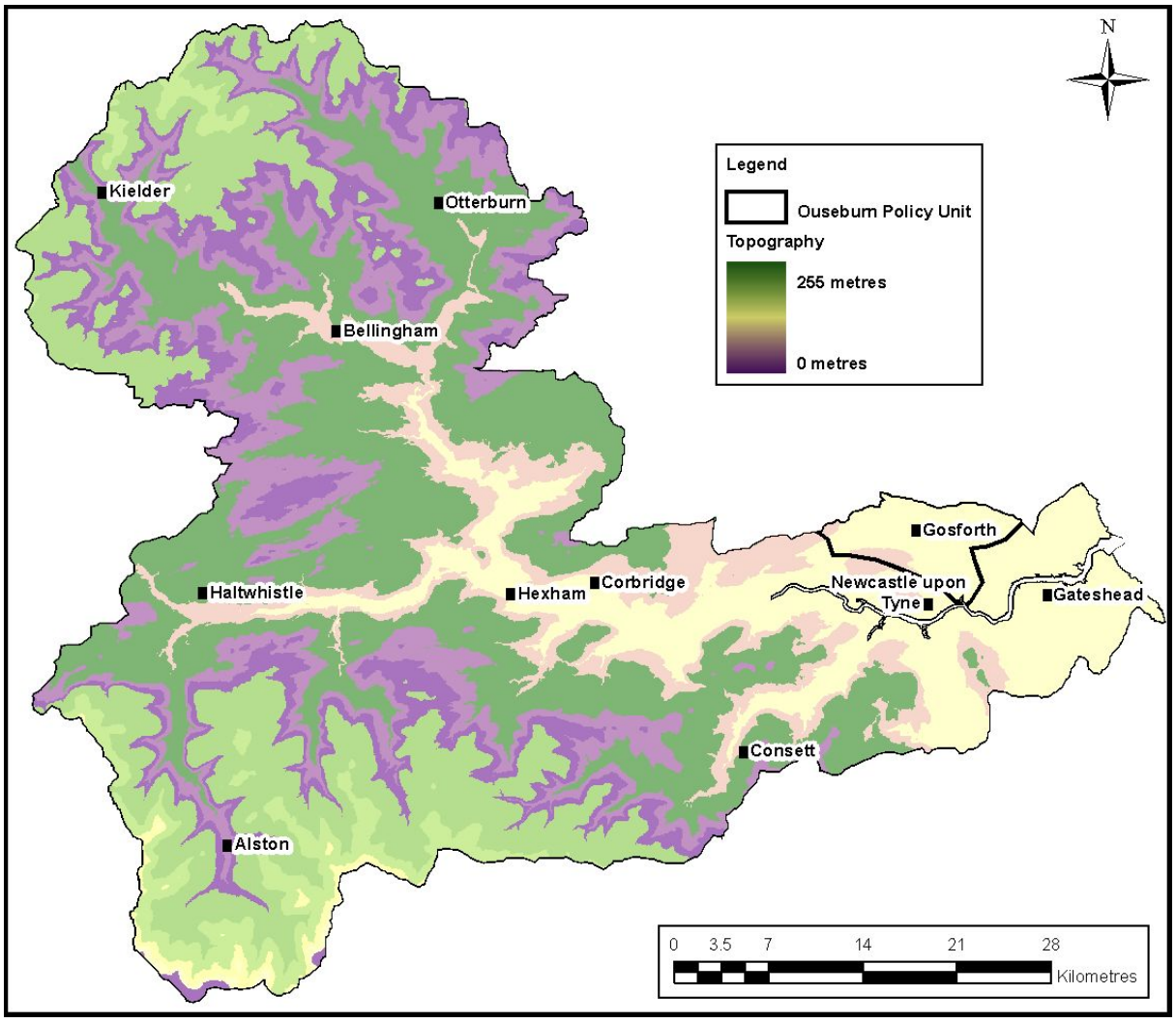


Figure 1: Catchment perspective of the proposed Ouseburn policy unit

3. Characteristics of Policy Unit

Form 1: Characteristics of the policy unit

This form summarises the physical, natural and historic character of the policy unit. Detailed mapping can be viewed in Appendix 1.

Physical environment

Infrastructure:
46% of the policy unit area is urbanised and covers a number of large residential areas within the Newcastle-upon-Tyne District including Kingston Park, Gosforth, Killingworth and Long Benton. To the north west of the policy unit lays Newcastle International Airport. Analysis of NPD3 suggests that there are 63,795 residential properties within the policy unit, this equates to approximately 146,729 people (residential x 2.3). As well as this there are 3,923 non-residential properties (commercial).

Agriculture:
Around half of the policy unit is rural with approximately 29km^2 (2687ha) of grade 1-3b agricultural land. This is located within the upper area of the policy unit. Outside of this grade the remaining land is classed as non agricultural including golf courses, public open spaces and sports areas.

Main river:
There are around 50km of river within the policy unit of which 29.24km are classified as main river. The Ouseburn begins with 2 small tributaries located around 2km to the west of the Railway Line at Callerton and Whorlton Hall. These 2 tributaries combine just before the small settlement of Woolsington. Furthermore, there is a third short (approximately 2.2km) main river tributary known as the Harey Dene which has its source near Low Newbiggin Farm and joins the Ouseburn downstream of Woolsington. Upstream of Woolsington three rural ordinary watercourses flow into the Ouseburn.

Downstream of the confluence of Harey Dene and the Ouseburn, a number of ordinary watercourses enter the Ouseburn system prior to the three remaining main river tributaries, Gosforth Letch (3.3km), Long Benton Letch (1.7km) and Forest Hall Letch (3.7km). All three of these tributaries were en-mained during Phase A of the Critical Ordinary Watercourse review.

From Haddricks Mill Roundabout, the Ouseburn flows away from the highly urbanised area and into Jesmond Dene: a steep sided valley and woodland area. After Jesmond Vale the watercourse becomes culverted for a section of approximately 1.3km before it emerges again at Byker Bridge which is the tidal limit. From here it flows along the Ouseburn Valley before discharging into the River Tyne at the Ouseburn Barrage.

Natural environment

Inland Designations

- Gosforth Park SSSI (May 2011: 100% favourable).

This site covers 0.37km^2 and contains a shallow man-made lake with associated reed swamp, herb-rich fen, willow carr, broad-leaved woodland and remnants of heathy grassland.

There are no European designations within the policy unit.

Water Framework Directive

Figure 6 shows the extent of the water bodies in the policy unit that are shown as “Highly Modified”. This is the length of the Ouseburn. The ecological status of the Ouseburn (tidal and none) is shown as Moderate. Details of the Water bodies within this Policy Unit are set out below.

Name of water body	ID Reference	Reason for Failure	Current Ecological status	Summary of outstanding Mitigation
Ouse Burn from Source to Tyne	GB103023075780	Fish: Poor Inverts: Poor Macrophytes	Moderate	• Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone • Retain marginal aquatic and riparian habitats (channel alteration) • Sediment management strategies (develop and

				revise) • Appropriate techniques to align and attenuate flow to limit detrimental effects of these features (drainage) • Increase in-channel morphological diversity
Wallsend Burn (Trib of Tyne)	GB103023075760	n/a	good	

The following text is a summary of the issues with each Waterbody and conclusions available so far from the investigation process to establish the priorities for each waterbody.

Ouseburn (Source to Tyne): Water body is failing for a number of reasons. Physical modification problems will be mitigated but only as part of a wider plan for this water body that integrates the solutions to all of the problems. Fish passage is not such an issue as the series of weirs in Jesmond Dene are likely to be based around what were naturally occurring waterfalls.

Wallsend Burn: This water body is at good ecological potential. It is possibly at good ecological status too as there is no associated mitigation measures with the HMWB designation. The 'good' judgement has been arrived at by expert judgement rather than sampling

We need to ensure that the required mitigation measures (to help bring the Water bodies up to Good ecological potential as required under the Directive) can still be met and won't be hampered by FCRM activities, In addition we should be aim to achieve these measures and part of our projects were it is possible/appropriate.

Historic environment

There are a number of important historic features within the policy unit including:

- a length of the Hadrian's Wall World Heritage Site (designated in 1987) and its associated buffer zone.
- 171 listed buildings (3 Grade I, 127 Grade II and 40 Grade II*).
- 16 scheduled monuments (including historic coal workings, chapels and enclosed settlements).
- 4 Registered Parks and Gardens covering 1.7km^2 (3 Grade II and 1 Grade II*)

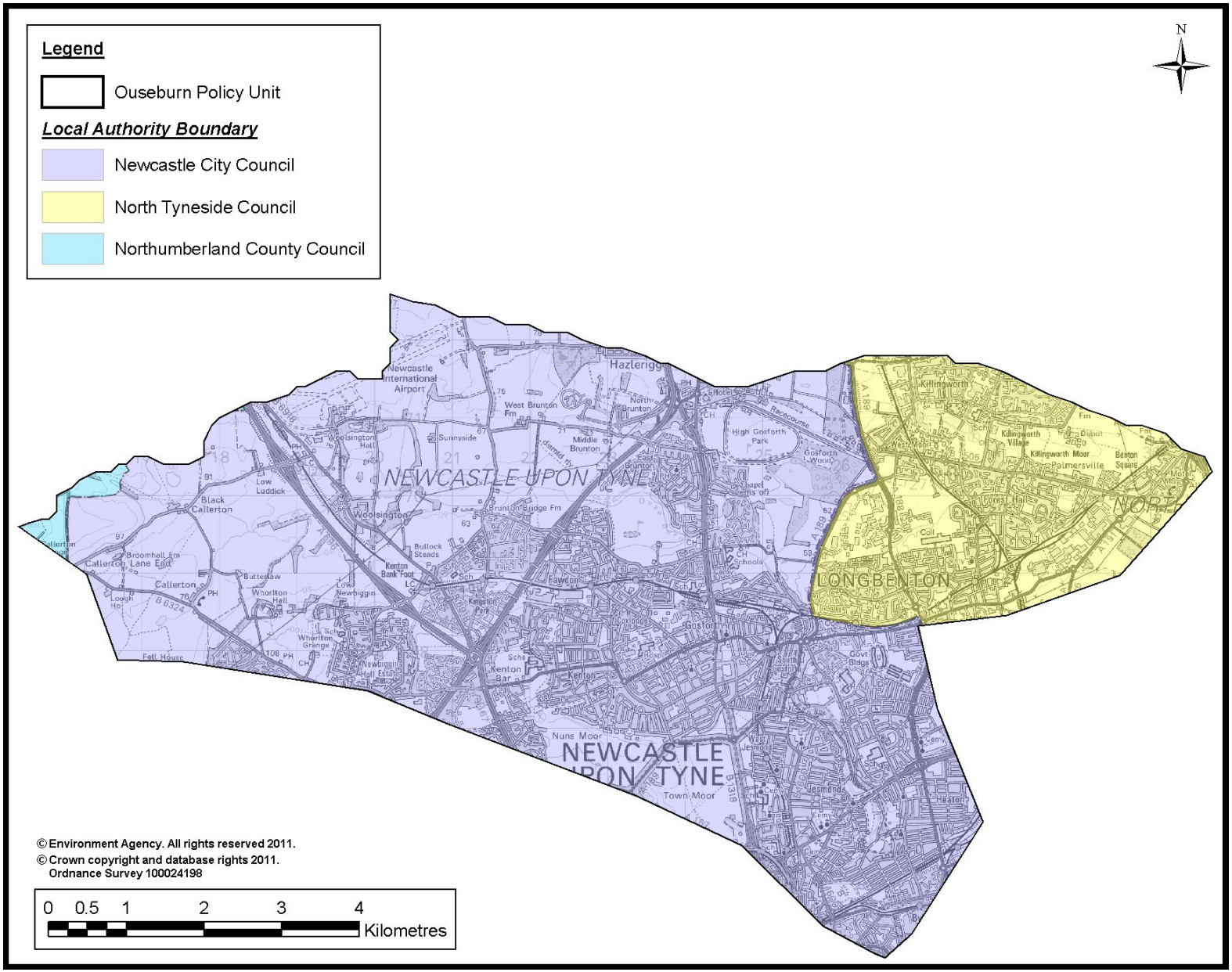


Figure 2: The Ouseburn policy unit

Form 2: Assessment of CURRENT flood risks

There have been a number of flood events within the policy unit however incidents over the last 30 years have been of relatively low return periods, in the order of 4% - 50% AEP. The most severe events occurred in 1900 and 1903 which were estimated to be in the region of at least 1% AEP. In December 1978 and March 1979 Dentsmire Bridge was closed, the Gosforth and City of Newcastle golf clubs were inundated, properties at Milford Gardens and Fairway Close suffered minor flooding and allotments upstream of Salters' Bridge were flooded. Minor flooding occurred in the same locations in April 1992 and May 1993. Also affecting Woolsington downstream of the Metro bridge (house gardens in Dukes Meadow) and the recently completed Metro station at Newcastle Airport was flooded as a result of a pump failure.

In November 2000 flooding occurred on the Ouseburn, from upstream of the A1 to Three Mile Bridge, including part of the grounds of the City of Newcastle Golf Club. Basement flooding to the flats at 'Little Dene' adjacent to Crag Hall Dene in Gosforth was also reported. The November 2000 event however, was most marked by the flooding on the Great North Road at Melton Park. This was caused by blockage of the culvert screen carrying the Gosforth Letch beneath the carriageway.

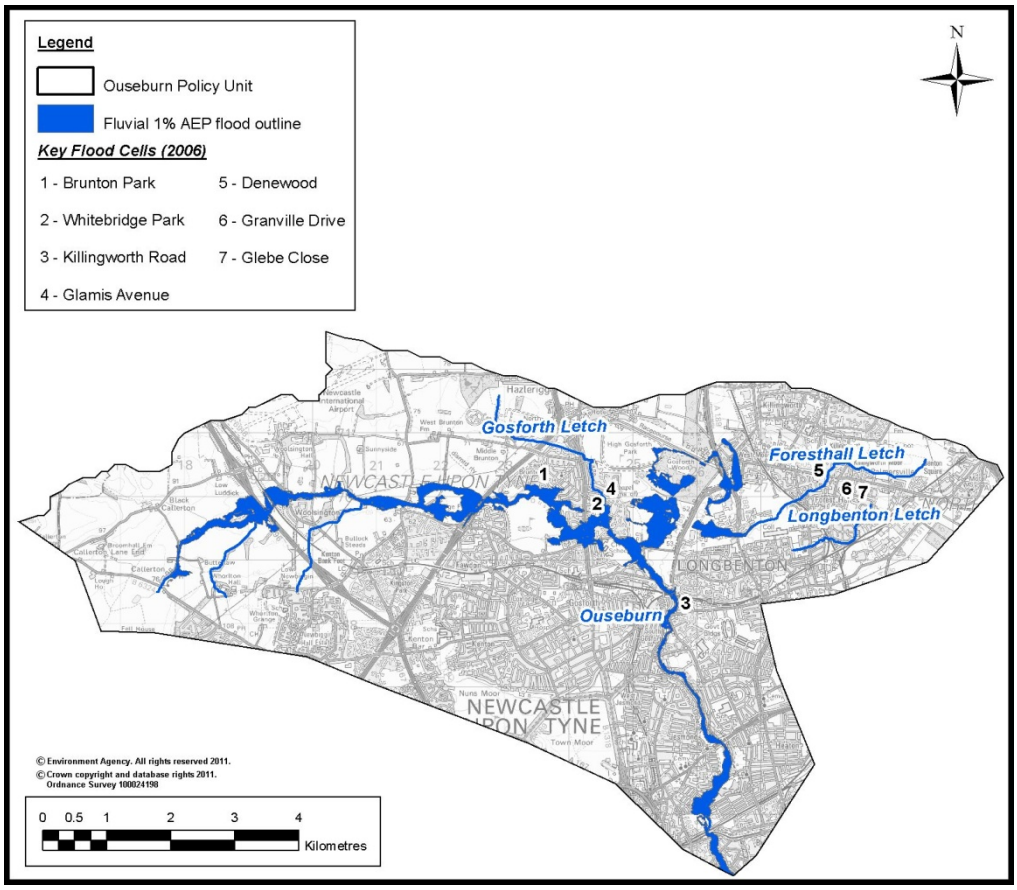
In June 2005 a large thunder storm tracked across the Gosforth Area and 84 properties were affected by flooding from the sewer network, with 24 families having to move out for a period of up to 2months.

This form summarises the risk of flooding from all sources. More detailed quantified data can be found in Form 3.

Fluvial flooding: Undefended 1% AEP

Fluvial flood risk dominates the policy unit. Risk is located throughout the policy unit. Work carried out as part of the pre-feasibility study in 2006 identified seven key flood cells. These are Brunton park, Whitebridge Park, Killingworth Road, Glamis Avenue, Denewood, Granville Drive and Glebe Avenue. This indicates that the highest level of fluvial flood risk is associated with the following watercourses:

- Gosforth Letch.
- Forest Hall Letch.
- Ouseburn.
- Longbenton Letch.

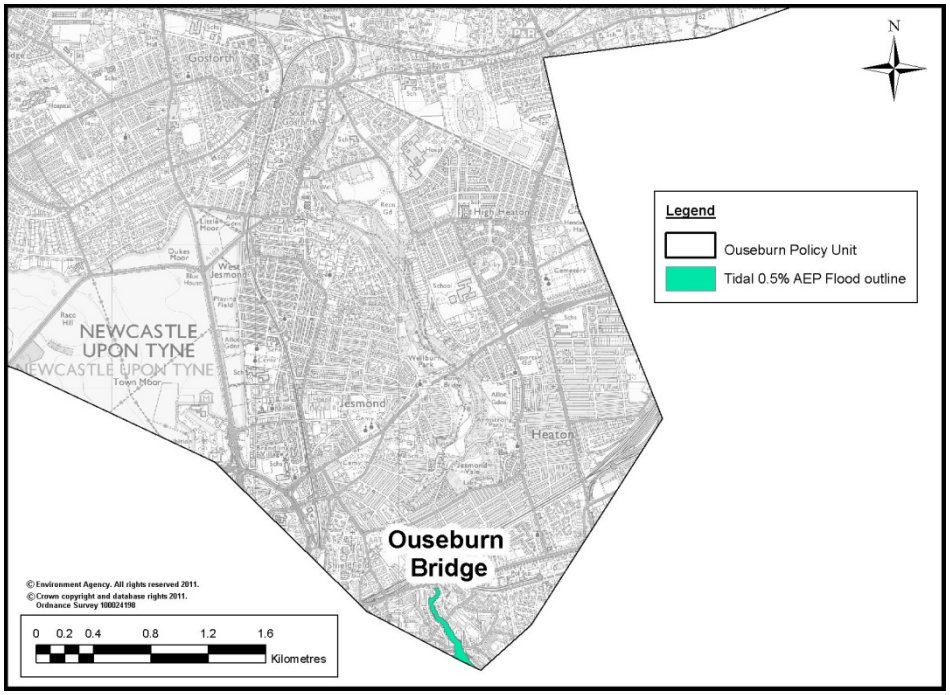


There are 1140 properties at risk during a 1% AEP event, of which 1022 are residential and 118 non residential. This equates to 2350 people. 2.55km of the road network is at risk (A road and B Road). No critical services are at risk of fluvial flooding. A small area of Gosforth Park SSSI (0.13km^2) is at risk of fluvial flooding. This equates to 35% of the site. Water level management is important at this site, as well as water quality, therefore prolonged flooding may have a negative impact on the condition of this SSSI.

Tidal flooding: Undefended 0.5% AEP

Form 2: Assessment of CURRENT flood risks

The tidal extent of Ouseburn is at Byker Bridge therefore tidal flood risk is limited to this short reach (approximately 1km) of the Ouseburn. As a result tidal flood risk is minimal (0.03km^2). The main area of risk is downstream of Ouseburn Bridge where right bank flooding extends to Ouse Street, and downstream of Quayside Bridge along Mariners Wharf.



Modelling carried out by the original CFMP in 2009 suggested that no residential or commercial properties were at risk of tidal flooding within the policy unit. Analysis of more detailed mapping has extended the undefended 0.5% AEP tidal flood outline and suggests that 1 commercial property is at risk.

Just one critical service is at risk of flooding: an electricity sub station. No environmental designations are at risk of tidal flooding. As such the consequences of tidal flooding within the policy unit are minimal.

Surface water flooding

Surface water is generated by intense or prolonged rainfall. Surface water flooding may occur when heavy rain exceeds the capacity of local drainage networks and water flows across the ground. As would be expected, water then flows along natural depressions in the ground and ponds in low lying areas. Flooding has occurred from surface water within the policy unit. According to Newcastle City Council 23% of all historic flooding has been as a result of surface water. North Tyneside Council have also indicated that surface water flooding occurred during the June/ July 2005, July 2007 and September 2008 flood events.

Three Preliminary Flood Risk Assessments (PRFAs) have been developed within the policy unit area. These have identified, at a strategic level, areas at risk of surface water flooding. Two main data sources are available to determine the risk of surface water flooding; Areas Susceptible to Surface Water and Flood Map for Surface Water. It has been confirmed by the relevant LLFAs that Floodmap for Surface Water is more representative of surface water flood risk within the area.

A review of both Newcastle City's and North Tyneside's PFRA indicates that, within their entire administrative areas, during a 0.5% AEP surface water event 22,288 properties are at risk of surface water flooding. Of these 83% are at risk of shallow flooding (0.1m) whist the remaining 17% are at risk of deep flooding (0.3m or greater). More detailed analysis of this data suggests that 2,712 of these properties fall within the Ouseburn policy unit.

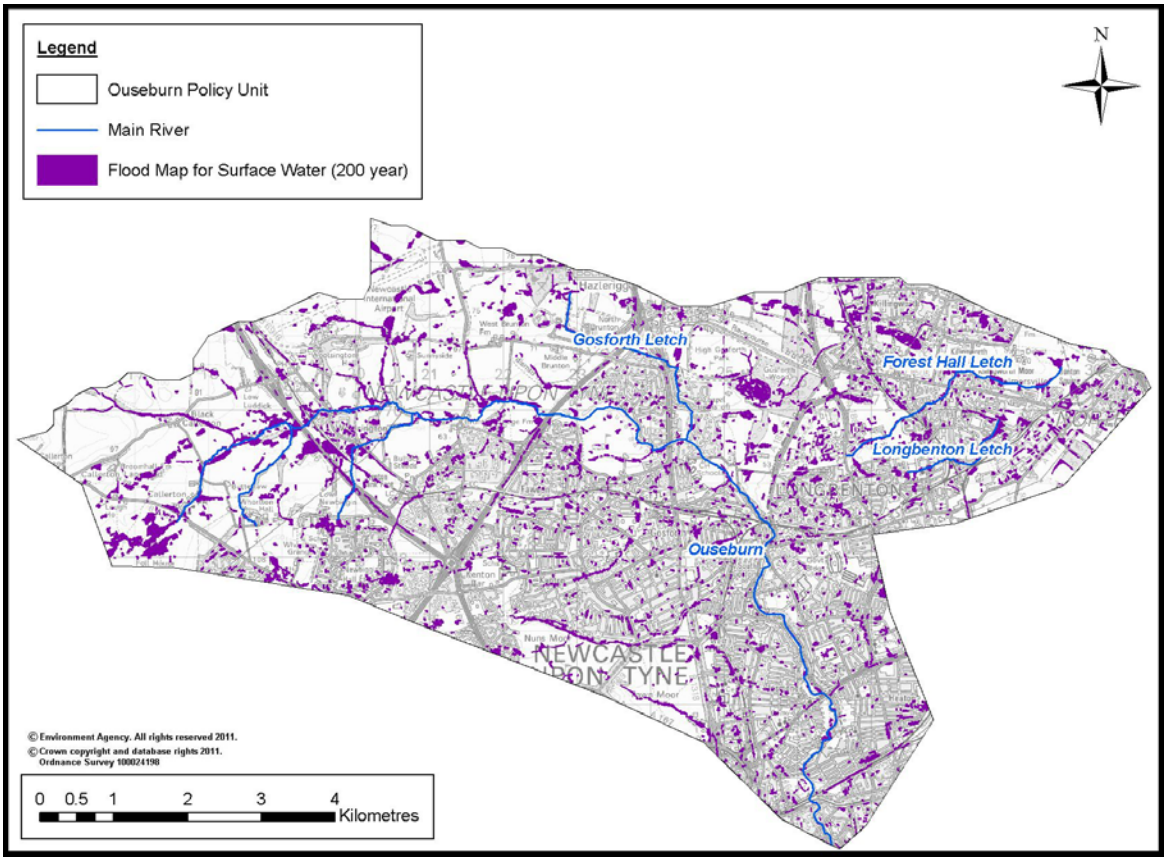
The role of the PFRA is to identify locations that are at risk of "locally significant" flooding. Within the LLFA areas (including Northumbria County Council) 32 locations have been identified within "locally significant" within the policy unit, in terms of surface water flooding in their PRFAs. In all instances "locally significant" has been defined by the LLFAs as areas of 1km^2 grid squares where risk exceeds at least one of the following indicators:

- 200 people;
- great than 1 critical service;
- greater than 20 commercial properties.

16 of these fall within the policy unit of which none are in Northumbria County Council, 15 in Newcastle City and one in North Tyneside administrative areas. No areas have been identified as Indicative Flood Risk Areas

Form 2: Assessment of CURRENT flood risks

– where 30,000 people are at risk within 5 1km^2 touching grid squares.



As noted above, there have been reported cases of surface water flooding and property damage within the urban area. The impact of development over time has had an impact on the rainfall run-off patterns, rates and volumes, consequently stressing the drainage infrastructure and its ability to cope with future expansion in some areas. As a result, a joint Surface Water Management Plan (SWMP) has been developed by Newcastle City and Gateshead Borough Councils[2]. The purpose of this SWMP is to further "*understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk*"[3]. As such this SWMP provides more detail as to the risk of surface water flooding within these two administrative areas. 14 strategic sites have been identified as at risk of surface water[4] as well as 4 mixed use sites. Only one of these is located within this policy unit.

Reservoir flooding

There are many reservoirs located within the Tyne CFMP area and as such there is a risk of reservoir flooding. In 2010 we completed a project to provide flood maps for each large raised reservoir registered under the Reservoirs Act 1975. Risk is confined to the downstream reach of the Ouseburn (up to Byker Bridge).

[2] http://www.newcastle.gov.uk/wwwfileroot/regen/ldf/NewcastleGatesheadSWMPVol1ScopingReport.pdf
[3] http://www.defra.gov.uk/publications/2011/06/10/pb13546-surface-water-guidance/
[4] http://www.gateshead.gov.uk/DocumentLibrary/Building/PlanningPolicy/Evidence/SurfaceWaterManagementPlanDraftOptionsReport.pdf

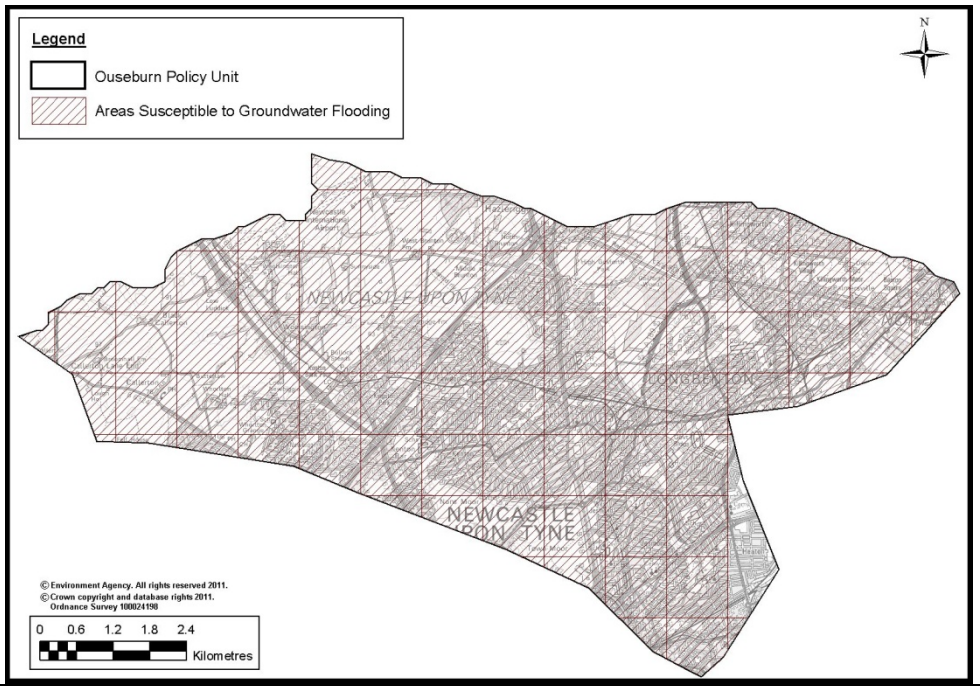
Form 2: Assessment of CURRENT flood risks

It should also be noted that this assessment is based on large reservoirs (those that hold over 25,000 cubic metres of water) and should only be used as a guide are not a prediction of what will happen. The likelihood of flooding from a reservoir is far lower than for other types of flooding. Legislation ensures that reservoirs are regularly inspected and that essential safety works are carried out. This means that there are very high safety standards for reservoirs in the UK which makes the likelihood of a failure very low.

Groundwater flooding

Areas Susceptible to Groundwater Flooding (AStGWF) is a strategic scale map showing groundwater flood areas on a 1km square grid. It was developed specifically for use in the PFRA. The data was produced to annotate indicative Flood Risk Areas to determine whether there may be a risk of flooding from groundwater.

This data has used the top two susceptibility bands of the British Geological Survey (BGS) 1:50,000 Groundwater Flood Susceptibility Map and thus covers consolidated aquifers (chalk, sandstone etc., termed 'clearwater' in the data attributes) and superficial deposits. It does not take account of the chance of flooding from groundwater rebound.



Form 2: Assessment of CURRENT flood risks

The above map suggests that the risk of groundwater indicative Flood Risk Areas cover the policy unit however further analysis of the three PRFAs within the policy unit suggests that the risk of groundwater flooding is minimal.

Sewer flooding

The main causes of sewer flooding are blockages, overloaded sewers, defects (i.e. collapsed sewers) and mechanical failure.

Northumbrian Water are currently carrying out a Sustainable Sewerage Study. The results of which should be used to provide additional information when it becomes available.

A review of LLFA evidence has identified a number of key issues. The completion of the local Water Cycle Strategy has identified significant issues surrounding the current sewer network. A review of PFRAs has identified a number of sewer flood risk areas. According to the North Tyneside PFRA, Northumbrian Water Limited have classified the risk of sewer flooding in the drainage areas within North Tyneside as low, medium or high. Only one of the seven areas classified as being at high risk of sewer flooding is located within this policy unit – Benton. However, works have now been completed by Northumbrian Water Ltd location to reduce the risk of flooding.

Newcastle City Council has identified, during the production of their SFRAs, the level of sewer flooding incidents listed in the DG5 register (the latest data being provided in September 2010).However, these are no longer considered relevant of consideration as Northumbrian Water have invested in the network to address these issues.

Mine water flooding

The abandonment and closure of coalfields, and the cessation of groundwater pumping, may result in the rebound of mine water levels and the flooding of abandoned workings. There are coal seams which outcrop in the lower areas of the river valley in the Jesmond area. The outcrops are below the superficial geology which can be quite thick in this area. There are many mineshafts in this valley area which give potential for rising mine water and contaminated discharges. The two main coal seams worked are the High Main and the Main.

The current levels of mine water and the status of mine water rise within the policy unit are unknown.

Canal flooding

There are no canals within the policy unit.

Other issues

Interaction

Vital evidence has been collected from the PFRAs within the policy unit. For example, the Newcastle City Council PFRA has noted from historic records that's 8 flooding events have resulted from two or more sources interacting. All events involved the sewer network. In some instances the sewer network interacts with the Ouseburn during high water levels. This restricts outfalls causing water to back up. In other cases, it has been noted that sewers cannot cope with the volume of surface water resulting in localised flooding. It has been estimated that surface water and interacting sources account for around 23% of all historic flooding within the Newcastle City Council administrative area.

Form 3: Summary of assets CURRENTLY at susceptible to flooding if undefended						
	Policy unit total	Summary of flood risk				
		Fluvial		Tidal		Flood Map for Surface Water
		1% AEP	0.1% AEP	0.5% AEP	0.1% AEP	
Physical environment						
Policy unit area (km^2)	64.56	3.03	3.71	0.01	0.03	3.85
Urban area (km^2)	29.75	0.96	1.21	0.01	0.03	1.59
Grade 1-3b agricultural land (km^2)	28.67	1.87	2.25	0	0	1.91
Population (residential x 2.3)	146,729	2350	2640	0	0	6,038
Residential properties	63,795	1022	1148	0	0	2,625
Non residential properties	3,923	118	125	1	1	87
Total properties	**67,718**	**1,140**	**1273**	**1**	**1**	**2,712**
Campsites	0	*No sites located within the policy unit*				
Gas & electricity assets	194	7	9	1	1	16
Hospitals, surgeries & health care centres	59	0	0	0	0	0
Fire, ambulance & police stations	10	0	0	0	0	0
Nurseries, schools, colleges & universities	114	0	1	0	0	5
Main road – motorway, A & B roads (km)	72.48	2.55	3.98	0	0.05	3.71
Railway (km)	0	*No sites located within the policy unit*				
Sewage treatment works	0	*No sites located within the policy unit*				
Landfill sites	1	0	1	0	0	1
CoMAH (top tier)	0	*No sites located within the policy unit*				
Natural environment						
SSSI (km^2)	0.37	0.13	0.17	0	0	0.10
SAC (km^2)	0	*No sites located within the policy unit*				
SPA (km^2)	0	*No sites located within the policy unit*				
Ramsar sites (km^2)	0	*No sites located within the policy unit*				
Historic environment						
SAMs	16	0	1	0	0	0
Registered Parks and Gardens (km^2)	1.70	0.18	0.21	0	0	4
Registered Battlefields	0	*No sites located within the policy unit*				
Listed buildings (all grades)	171	10	10	0	0	0
World Heritage Site	1	1	1	0	1	1
Economic						
Estimated Actual Property Damages (£)	n/a	125,226,720	139,836,504	109,848	109,848	297,907,776
Estimated Agricultural Damages (£)	n/a	104,365	125,573	0	0	106,597

Form 4: Current responses to flood risk

ROLES & RESPONSIBILITIES:

The Floods and Water Management Act (2010) identifies those organisations that are 'Flood Risk Management Authorities'. These are as follows (those in **bold** operate within the policy unit):

- The **Environment Agency**.
- a district council for an area for which there is no unitary authority.
- **Water Company**.
- **Lead Local Flood Authority** (LLFA).
- Internal Drainage Board.
- **Highways Authority**.

Environment Agency

The Environment Agency is responsible for flooding from main river, the sea and reservoirs. Main rivers within the policy unit are the Ouseburn, Harey Dene, Forest Hall Letch, Longbenton Letch, Gosforth Letch.

Lead Local Flood Authority (LLFA)

LLFAs are responsible primarily for non-main river and surface water. They are also responsible for identifying the risk of flooding from ground water and canal flooding. LLFAs within the policy unit are:

- Newcastle City Council.
- North Tyneside Council.
- Northumberland County Council.

Also, Newcastle City Council is responsible for outfalls into the Ouseburn from the B6918 Ponteland Road. This may also collect run-off from the Airport Metro line

Water Company

Water companies are responsible for sewer flooding. The operating water company in the policy unit is:

- Northumbrian Water Ltd.

Highways Authority

Runoff from highways is managed by the relevant Highways Authority. This is either the Highways Agency or the Local Authority. The Highways Agency is only responsible for the strategic road network. (trunk roads and motorways). In this Policy Unit they have outfalls into the Ouseburn from the A1 Western Bypass and A696 Woolsington Bypass. As such Local Authorities are responsible for all drainage issues related to roads in the policy unit.

Protection

Various flood alleviation works have been carried out over the past 30 years including channel improvements in the Upper Ouseburn and on Harey Dene. In the 1950s some channel straightening and de-silting took place at Woolsington. Woolsington Lake was partially de-silted in the early 1990s by the National Rivers Authority.

Current infrastructure includes:

- 3 raised man made defences (0.21km) consisting of 2 walls at Benton Cemetery and a flood bank upstream of Bridge Park. All are privately maintained.
- 4 flood defence structures, all of which are trash screens. Two located at the culvert entrances at Benton Cemetery and A188 crossing whilst a further 2 are privately maintained.
- Flood bypass channel and weir structure at Woolsingham. It has been suggested that this was installed to provide water to a small boating pond within a single property. The owner operates a sluice in order to divert high flows.
- Ouseburn Barrage was completed in 2009 and is operate by Newcastle City Council following receipt of a flood warning from the Environment Agency.
- 34 culverted channel assets (mainly road crossings – 2 go into adopted sewers) within the policy unit, 20 of which are maintained by the local authority with the remaining 14 being privately maintained.

It is estimated that the policy unit is defended to a 20 year standard of protection.

Prevention

MAIN-RIVER MAINTENANCE

We (the Environment Agency) maintain a total of 43.8km of river channel. This generally involves watercourses upstream of the A191 roundabout in South Gosforth. General watercourse clearance is carried out at different intervals. We also respond to reports of blockages and remove debris where necessary, where it may increase the risk of flooding. Our current maintenance regime is as follows:

- Upper Ouseburn: general watercourse clearance including brushing and trimming between Brunton Bridge and Woolsington lake once a year and maintenance of the sluice at the entrance to the bypass channel in Woolsington. Four bridges/culverts on the Harey Dene are monitoring and cleared as part of general watercourse clearance.
- Middle Ouseburn: channel inspections at varying intervals (6 – 36months).
- Lower Ouseburn: general watercourse clearance twice a year.

Form 4: Current responses to flood risk
The flood bypass channel, and its sluice, in Woolsington is no longer operated by the Environment Agency as it was found not to provide any flood defence function. Since 2005 around £177, 052 has been spent within the policy unit on FRM maintenance. This equates to around £29,508 per year

Forecasting & Warning

FLOOD WARNING

We (the Environment Agency) provide a flood warning service for areas at risk of flooding in the policy unit. We currently provide:

2 Flood Alerts. These are:

- Ouseburn & estuarine tributaries.
- Tyne estuary.

3 fluvial warning areas where Flood Warnings & Severe Flood Warnings can be issued. These are:

- Ouseburn at Woolsington & Brunton Park.
- Ouseburn at Whitebridge Park & South Gosforth.
- Ouseburn at Upper Brunton Park & South Gosforth.

1 tidal warning area where Flood Warnings & Severe Flood Warnings can be issued : Ouseburn at Byker.

Our flood warning service is communicated via Extended Warnings Direct (EDW) and Floodline Warnings Direct (FWD). EDW is an 'opt-out' flood warning service for homes and businesses at 'high-risk' of flooding. This has been achieved by using line phone records in the Emergency Service Databases (ESD) from telephony providers. FWD is a more specific service which allows customers to choose when, where and how (e.g. phone, text, email, fax) they want to be contacted. This is an opt in service. Registration on FWD (Flood Warnings and Severe Flood Warnings) is summarised below (June 2011):

Warning Area	Nº of properties in warning area	Nº at direct risk	Nº registered on FWD	% registered on FWD
Ouseburn at Woolsington & Brunton Park	109	58	66	61
Ouseburn at Whitebridge Park & South Gosforth	75	62	15	20
Ouseburn at Upper Brunton Park & South Gosforth.	43	30	12	28
Ouseburn at Byker	10	10	7	70

We are not able to forecast for surface water flooding however products from the Flood Forecasting Centre identify the risk of heavy rainfall. These can be used by LLFAs, as well as emergency services and utility companies, target the areas most likely to be affected by surface water flooding. The installation of the new radar station at High Moorsley has improved our forecasting accuracy for heavy rain.

MULTI AGENCY FLOOD PLANS (MAFPs)

The Civil Contingencies Act 2004 requires Category 1 Responders to have plans in place to respond to emergencies in order to reduce, control or ease the effects of an emergency. MAFPs are developed to enable the diverse range of organisations involved during a flood to work together effectively and manage the consequences of flooding, from whatever source it comes from and however long the flooding lasts. The Northumbria MAFP covers this policy unit and has been completed to a satisfactory level.

DEVELOPMENT AND FLOOD RISK

The policy unit is covered by 3 Level 1 SFRA's. Newcastle City and North Tyneside Council SFRA's were completed in 2006 in line with the principles of PPS25. Northumberland County Councils Level 1 SFRA was completed in 2010 and is broadly in line with the principles of PPS25. there are currently developing an SWMP and Water Cycle Study (WCS).

Newcastle has completed a more detailed Level 2 SFRA which has focussed on understanding the flood risks near their site allocations. This Level 2 SFRA's has improved our Flood Zones considerably and 2D hazard modelling and mapping has been produced.

Northumberland County Council are currently developing their Level 2 SFRA and have focussed on strategic development areas, such as Berwick, Blyth, Morpeth, and Hexham as site allocations have not been decided. All of these are outside of the Ouseburn policy unit area.

North Tyneside is currently developing their WCS and SWMP and these will be completed by the end of 2011. Northumberland County commissioned their SWMP and WCS and these will be completed by the end of Summer 2012. Newcastle are carrying out a joint SWMP with Gateshead and will be completed by end of summer 2012.

Form 5: Possible future levels of flood risk

Key factors that could drive future flood risk

CLIMATE CHANGE

We expect:

- inland flood risk to increase throughout the century as climate change influences rainfall patterns.
- significantly more rain to fall in winter and more of it to fall in short and heavy bursts. Heavier downpours are also likely in the summer.
- Sea level rise to increase coastal flooding and erosion, and changes in rainfall will have an impact on cliff stability.
- Increased flooding and coastal erosion will affect people, properties, infrastructure and the environment.

Sea levels are expected to increase along the north east coast by 2.5mm per year between 1990 – 2025. This will increase to 7mm per year between 2025-2055 and 10mm per year between 2055 – 2085. This is likely to have significant implications of tidal flooding within the policy unit, as well as tide locking both of the Ouseburn and any drainage systems that may outfall into the tidally affected section of the watercourse.

UKCIP 09 forecasts show a range of potential scenrios for increased rainfall and river flows. We have considered the central range estimate, which suggests a 15-20% increase in flow across the whole of the NE area by 2055. The higher range forecast for the Tyne shows an increase of up to 30/35% by 2055. The modelling available (both from the 2009 CFMP and the improved local level information) estimates an increase in flow of 20%, which is considered appropriate in light of the UKCIP evidence.

URBANISATION

Development generally reduces permeability. Without specific measures, the volume of water that runs off the site and the peak run-off flow rate is likely to increase. Inadequate surface water drainage can threaten the development itself and increase the risk of flooding to others. As well as this, inappropriate development can increase the risk of flooding by placing more people and property within the floodplain. Although significantly urbanised, the policy unit is under significant pressure of further development/redevelopment.

Future flood risk scenario

We have concluded that the main driver for future flood risk within the policy unit is climate change. This is due to our understanding of balance of tidal and fluvial dominance. As well as this the management of development through the effective application of planning guidance reduces the risk of increasing flooding through inappropriate development. As such our future scenario is based solely on the implications of climate change. To model this we have focused on fluvial and tidal risk. This risk has been determined as follows:

- Fluvial Risk: UKCIP 09 forecasts show a range of potential scenrios for increased rainfall and river flows. We have used considered the central range estimate, which suggests a 15-20% increase in flow across the whole of eth NE area by 2055. The higher range forecast for the Tyne shows an increase of up to 30/35% by 2055

- Tidal risk: Updated modelling of tidal issues and the combination risk in the policy unit has been used as the main driver for this update. Therefore this data has been used to populate the summary tables. However, this work did not produce a forecasted climate change output. We do aim to improve this understanding. In the meantime we have carried out an estimate of increased risk by increasing the detailed model output by the same proportion as Climate Change increase shown by the CFRM tool.

In addition, we should consider that: POL (Proudman Oceanographic Laboratory) level obtained for 1990 and adjusted for the years 2007, 2050 and 2100 by applying a sea level risk correlation of 0.043m, 0.22m and 0.75m respectively. This followings DEFRA guidance for climate change values[5]. For the Tyne, levels are as follows:

Return period	2007	2050	2100
Level (m AoD)	4.04	4.26	4.79

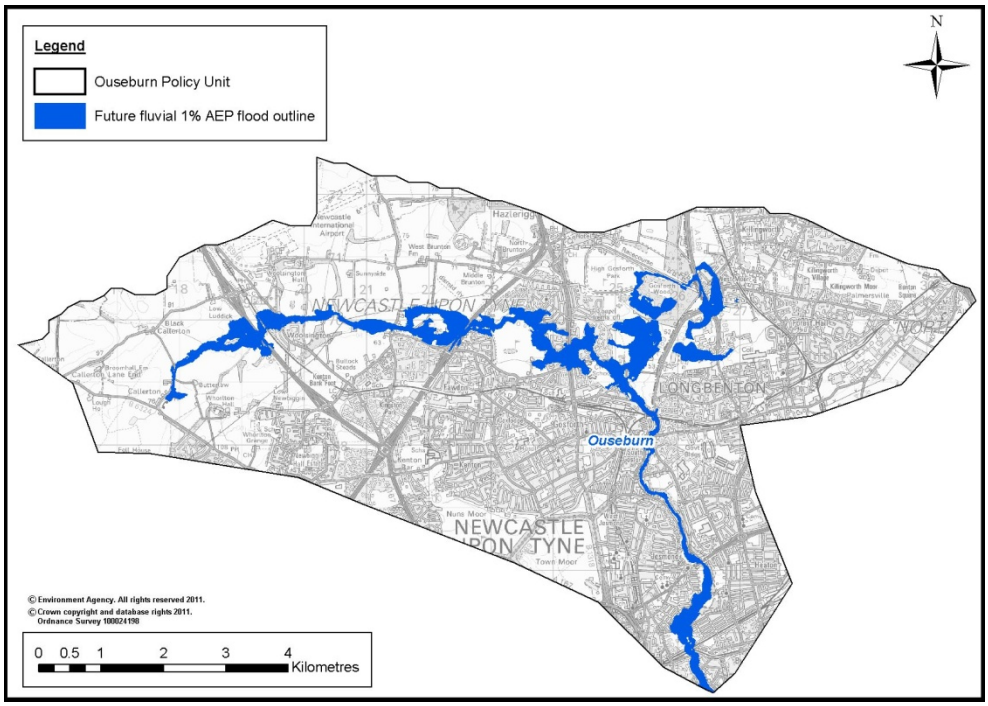
This understanding will be used to update this assessment and the progression of measures in future revisions.

[5] Flood and Coastal Defence Appraisal Guidance FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, DEFRA, October 2006.

Form 5: Possible future levels of flood risk

Fluvial flooding: Undefended 1% AEP

Fluvial flood risk is expected to increase due to climate change. Using the scenario noted above it has been possible to estimate the potential implications of climate change on fluvial flood risk.



It is estimated that in the future there will be 1273 properties at risk during a 1% AEP event, of which 1148 are residential and 125 non residential. This equates to 2640 people. This means that climate change could increase the risk of flooding to property by 12%.

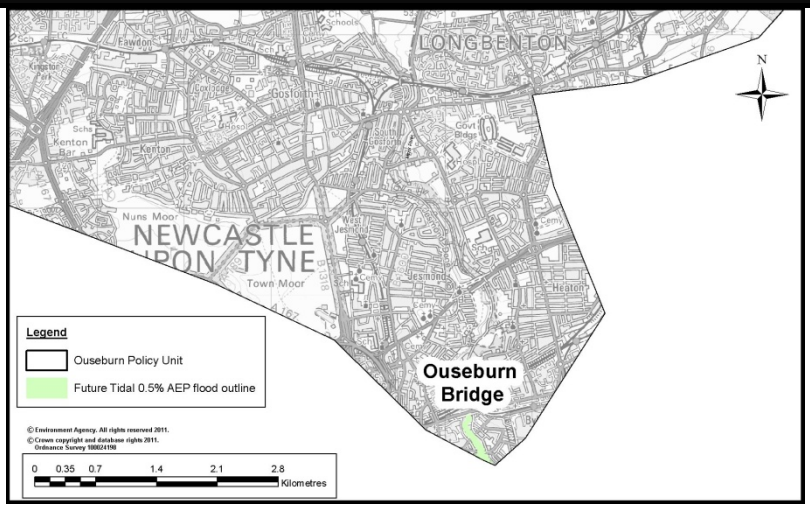
3.75km of the road network is at risk (A road and B Road). Eight critical services are at risk of fluvial flooding, these are all gas and electricity assets. A small area of Gosforth Park SSSI (0.15km^2) is at risk of fluvial flooding. This equates to 41% of the site. Water level management is important at this site, as well as water quality, therefore prolonged flooding may have a negative impact on the condition of this SSSI.

Tidal flooding: Undefended 0.5% AEP

Detailed mapping carried out in 2002 as part of the Ouseburn Flood Study[6] examined the effects of rises in sea level at a rate of 6mm per year. Sea level was predicted at a 200-year return period (0.5% probability) for the year 2050 and the steady-state model run with the 200-year (0.5% probability) flow in the Ouseburn. This concluded that the watercourse is so steep and incised that the flood extent differed little from that for the 100-year (1% probability) flood risk area at the design flow. The additional risk is at the quayside at the Ouseburn-Tyne confluence. This assessment corresponds with the mapping carried out by the Tyne CFMP in 2007.

[6] Ouseburn Flood Study: Final Report, Environment Agency, May 2002

Form 5: Possible future levels of flood risk



There is one property at risk during a 0.5% AEP event, of which none are residential and one is non residential. This equates to no people. There is 0.08km of road at risk of flooding as well as one critical service - a gas and electricity asset. There are no environmental designations at risk of flooding.

Areas susceptible to surface water flooding

Flood Map for Surface Water provides an assessment of surface water flood risk for a 1:200 annual chance rainfall event. This provides an assessment of where surface water flooding may occur in the future. Given the projected increase in precipitation due to climate change it can be assumed that surface water flood risk will increase in frequency.

Reservoir flooding

The risk of reservoir flooding is based on the maximum extent of flood outline if assets were to fail. The future risk and consequence of reservoir flooding within this policy unit is unlikely to increase in the future given the regulated maintenance of these assets. The consequences of reservoir flooding will therefore only increase if future development is located within those areas identified as susceptible to this source of risk or if more reservoirs where built within the Tyne catchment.

Groundwater flooding

Due to insufficient evidence for current risk no assessment of future risk has been made.

Sewer flooding

Due to insufficient evidence for current risk no assessment of future risk has been made.

Mine water flooding

Due to insufficient evidence for current risk no assessment of future risk has been made.

Canal flooding

n/a

Other issues

Interaction

As identified in current flood risk, issues have occurred due to the interaction of multiple sources of flooding. Climate change is expected to result in more intense localised rainfall. Interactions have been identified relating to limitations in drainage infrastructure, surface water and fluvial flooding. As the volume of surface water increases pressure on local drainage infrastructure is likely to increase leading to more frequent localised flooding. As such it can be concluded that the interaction between the local drainage infrastructure, surface water and fluvial flooding will intensify.

Form 6: Summary of assets susceptible to flooding due to climate change if undefended						
	Policy unit total	Summary of flood risk				
		Fluvial		Tidal		Flood Map for Surface Water
		1% AEP	0.1% AEP	0.5% AEP	0.1% AEP	
Physical environment						
Policy unit area (km^2)	64.56	3.51	-	0.05	-	3.85
Urban area (km^2)	29.75	1.12	-	0.04	-	1.59
Grade 1-3b agricultural land (km^2)	28.67	2.14	-	0	-	1.91
Population	146,729	2640	-	0	-	6,038
Residential properties	63,795	1148	-	0	-	2,625
Non residential properties	3,923	125	-	1	-	87
Total properties	**67,718**	**1,273**	**-**	**1**	**-**	**2,712**
Campsites	0	*No sites located within the policy unit*				
Gas & electricity assets	194	8	-	1	-	16
Hospitals, surgeries & health care centres	59	0	-	0	-	0
Fire, ambulance & police stations	10	0	-	0	-	0
Nurseries, schools, colleges & universities	114	0	-	0	-	5
Main road – motorway, A & B roads (km)	72.48	3.75	-	0.08	-	3.71
Railway (km)	0	*No sites located within the policy unit*				
Sewage treatment works	0	*No sites located within the policy unit*				
Landfill sites	1	0	-	0	-	1
CoMAH (top tier)	0	*No sites located within the policy unit*				
Natural environment						
SSSI (km^2)	0.37	0.15	-	0	-	0.10
SAC (km^2)	0	*No sites located within the policy unit*				
SPA (km^2)	0	*No sites located within the policy unit*				
Ramsar sites (km^2)	0	*No sites located within the policy unit*				
Historic environment						
SAMs	16	0	-	0	-	0
Registered Parks and Gardens (km^2)	1.70	2	-	0	-	4
Registered Battlefields	0	*No sites located within the policy unit*				
Listed buildings (all grades)	171	10	-	0	-	0
World Heritage Site	1	1	-	1	-	1
Economic						
Estimated Actual Property Damages (£)	n/a	139,836,504	-	109,848	-	297,907,776
Estimated Agricultural Damages (£)	n/a	119,433	-	55,810	-	106,597

Form 7: Possible opportunities for responding to flood risk

The information provided so far clearly identifies the level of flood risk within the policy unit along with the current management programme of these risks. This form identifies the potential approaches to managing flood risk that are possible in this policy unit. Those options identified will be taken forward in the appraisal of long term flood risk management policies, as identified in Form 8 for the Lower Tyne Tidal policy unit.

KEY

✗ *= no opportunity available*
✓ *= opportunity available*

Response type	Options	Opportunity	Evidence
Prevention			
Attenuation / retention	On-line storage (existing / new)	✗	River corridor is generally developed.
	Off-line storage (existing / new)	✓	2006 Atkins report identified opportunity of creating new pond storage areas.
	Floodplain storage/wetland creation (existing / new)	✗	River corridor is generally developed.
	SUDS - new / retrospective	✓	Large scale development has taken place and is planned.
	Infrastructure storage: Above ground (e.g. canal/STW)	✗	Urban policy unit. Opportunities are limited due to existing development of the riverside
	Infrastructure storage: Below ground	✗	Urban policy unit. Opportunities are limited due to existing development of the riverside
Rural land use change	Best farming practices	✓	Grade 1-3b agricultural land located in the upper reaches of watercourses. Significant areas also classified as non urban i.e. golf courses and public open space.
	Reduce upland grazing	✓	
	Agricultural Drainage	✓	
Water management infrastructure	Pumping (including surface water, groundwater, sewage water)	✓	Mine shafts are located within the policy unit resulting in risk of rising mine water. Surface water risk.
	Distribution networks (e.g. increase network capacity, change abstractions or discharges)	✓	34 culverted sections. Flooding in 2000 caused by blocked culverts.
Increased conveyance	River maintenance	✓	Significant maintenance carried out already.
	Dredging	✓	De-silting has taken place at Woolsington historically.
	Removal of flood plain obstructions	✗	Significantly development on the floodplain. Not feasible to remove.
	Removal of channel obstructions	✓	A number of bridges have been identified as pinch points.
	River re-engineering (e.g. restoration)	✗	River corridor significantly developed therefore limited restoration possible.
	Wetland creation	✓	2006 Atkins report identified opportunity of creating new pond storage areas. Possible opportunities in the upper reaches of watercourses.
	Diversion channels	✓	An old diversion channel is at Woolsington however the maintenance and operation of this asset is not clear.
	Defences (to restrict flood plain)	✓	Significant areas not currently benefiting from defences.
Protection			
Localised protection measures	Localised defences (e.g. around properties), including against groundwater	✓	Significant areas not currently benefiting from defences.
	Individual protection to properties, including against groundwater seepage	✓	In the upper reaches of the Ouseburn and on some non-main river tributaries a small number of properties are at risk. These are unlikely to gain funding for localised defences due to a low cost benefit ratio.
Preparedness			
Influencing &	Flood awareness	✓	Flood warning take-up for FWD is low.

Form 7: Possible opportunities for responding to flood risk			
Informing			Awareness following changes to the flood warning service and EDW will increase effective action.
	Flood warning & evacuation	✓	Emergency response plans, including community flood plans, may increase the success of effective action. Good coverage of flood warning areas.
	Planning Policy (future land use development)	✓	Future development is planned in the policy unit.
	Building Regulations (resilience)	✓	Future development is planned in the policy unit.
Monitoring/Survey	Data & Information	✓	Multiple flood risk management authorities. Joint approaches to management.
Studies	Analysis & Understanding	✓	Significant work already undertaken. Some gaps remain. Climate change projections.

Form 8: Relevance of catchment objectives	
Catchment objective (2009)	**Proposed policy unit objective (2011)**
Social objectives	
Reduce the number of people exposed to each category of flood hazard particularly high and extreme hazard.	SOC 1: Reduce the risk to life.
Ensure that critical infrastructure remains operational during flood events.	SOC 2: N/A
Reduce the social impact of flooding on communities at risk, especially in areas where there is a high proportion of properties and social assets at risk.	SOC 3: Reduce no. of people at risk of flooding and the impact on human health
Economic objectives	
Reduce the direct economic damages to property and agriculture from flooding.	ECON 1: Reduce the consequences of flooding on the urban economy
	ECON 2: Reduce the consequences of flooding on the rural economy
Ensure that FRM expenditure follows the level of flood risk in the catchment.	ECON 3: Ensure FRM expenditure is proportionate to the risk
Environmental objectives	
Maintain and where possible improve the ecological function of designated sites through FRM activities.	ENVI 1: Ensure flooding has no negative impact on Gosforth Park SSSI.
Protect heritage sites from the effects of flooding and where possible use FRM activities to enhance the landscape.	ENVI 2: Protect the historic environment from flooding.
Allow river channel processes to operate naturally within the catchment.	ENVI 3: Protect & improve hydromorphology & geomorphology in accordance with the objectives of the Water Framework Directive.
No adverse impact on water quality as a result of flooding.	ENVI 4: Protect & improve water quality in accordance with the objectives of the Water Framework Directive.

Policy Appraisal

The following table (Form 9) summaries the outcomes from the previous tables, to bring together possible opportunities to manage the risk (within existing constraints), the objectives we have set for the catchment and whether these would offer a loss or a gain under each policy choice. We have included data were we have it and it is useful to help decision making, The Option column is used to record our decision once the losses and gains are recognised.

Form 9	**Policy Appraisal**				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
Policy Option 1 No active intervention.	➔ Off-line Storage ➔ Rural Land use change	**Social** SOC_1: Reduce risk to life	Ceasing maintenance on flood management assets and river channels will increase the risk of asset failure. This will result in increased flood hazard and risk to life. Our flood warning service will cease under this policy choice. This will reduce people's ability to take effective action. This will increase the impact on property damages, insurance claims and human health particularly since the Ouseburn is a rapidly responding catchment.		**Not preferred option** No standard of protection will be provided within the policy unit if this policy is adopted. This will increase the risk to people and the business community as well as increase the hazard and consequences of flooding to an unacceptable level.
		SOC_3: Reduce no. of people at risk of flooding and the impact on human health	There will be an increase to number of people and property at risk This would result in a raise from 241 to 1,140 properties or 566 people to 2622 will be at risk of fluvial flooding (1% AEP) With the impact of Climate Change this will increase to 1,273 properties or 2928 people Increase localised rainfall (short and heavy bursts) will increase the potential for surface water flooding.		

Form 9	Policy Appraisal				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
			As set out above there will be an increase in the numbers of people at risk, and the hazard posed to those people through risk of failure and reduction in information available during a flood No investment to the drainage infrastructure is likely to increase the potential for sewer flooding.		
		Economic ECON_1: Reduce the consequences of flooding on the urban economy	This will result in • An increase in risk to 87 non-residential properties at risk of SW flooding • An increase in risk to 125 non-residential properties • An increase in risk to 3.75 km of Main road		
		ECON_2: Reduce consequences of flooding on the rural economy			
		ECON_3: Ensure FRM expenditure is proportionate to the risk	This policy unit houses a significant population. Surface water risk to residential properties in this policy unit is predicted to be approximately a third of the current number of homes at risk from other sources in the catchment, demonstrating the importance to focusing resource into this part of the catchment	There will be a reduction in Environment Agency spend on maintenance of £30,000 a year. (data on spend from other organisations is not available but can be assumed to be more than EA spend)	
		Environment ENVI_1: Ensure no negative impact on Gosforth Park	There will be an increase in risk to this site – affecting up to 0.15 km2 of the protected site.		

Form 9 Policy Appraisal					
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
		SSSI			
		ENVI_2: Protect the Historic Environment from flooding	Risk will increase to 1 Word heritage site, 10 listed buildings and 2 registered parks and gardens		
		ENVI_3.: Protect and improve Hydromorphology and geomorphology in accordance with the objectives of the Water Framework Directive	n/a	As a result of lack of maintenance the raised defences and engineered channels with eventually fail. A reduction in in-channel maintenance could help towards delivery of the WFD mitigation measures. Further work would however be required to ensure habitat improvements.	
Policy Option 2 Reduce existing flood risk management actions.	➔ Off-line Storage ➔ SUDS (new/retrospective) ➔ Rural Land use change	**Social** SOC_1: Reduce Risk to Life	Reducing the current maintenance regime will lead to a reduction in channel conveyance and increase the risk of culvert blockages and the affect of those 'pinch points' already identified. As per policy 1, increase localised rainfall (short and heavy bursts) will increase the potential for surface water flooding. This along with reduced investment to the drainage infrastructure is likely to increase the potential for sewer flooding.		**Not preferred option** The current 20 year SoP will reduce over time due to a reduction of maintenance on flood management assets and river channels. As well as this the flood extent will increase due to climate change.

Form 9	Policy Appraisal				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
			Flood warning will remain however no further improvements will be made, including awareness campaigns. FWD registration will remain moderate (60%).		
		SOC_3: Reduce no. of people at risk of flooding and the impact on human health	There will be an increase to number of people and property at risk This would result in a raise from 241 to 1,140 properties or 566 people to 2622 will be at risk of fluvial flooding (1% AEP) With the impact of Climate Change this will increase to 1,273 properties or 2928 people Increase localised rainfall (short and heavy bursts) will increase the potential for surface water flooding. This would see at least 2712 property (6038 people) at risk As set out above there will be an increase in the numbers of people at risk, and the hazard posed to those people through risk of failure and reduction in information available during a flood No investment to the drainage infrastructure is likely to increase the potential for sewer flooding.		

Form 9	**Policy Appraisal**				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
		Economic ECON_1: Reduce the consequences of flooding on the urban economy	This increase in risk will result in • No reduction in the risk to 87 no of non-residential properties • increase in the risk of flooding to 118 non-residential properties • increase in risk to 2.55km of Main road		
		ECON_2: Reduce consequences of flooding on the rural economy			
		ECON_3: Ensure FRM expenditure is proportionate to the risk	This policy unit houses a significant population. Surface water risk to residential properties in this policy unit is predicted to be approximately a third of the current number of homes at risk from other sources in the catchment, demonstrating the importance to focusing resource into this part of the catchment	There will be a reduction in Environment Agency spend on maintenance of £30,000 a year. (data on spend from other organisations is not available but can be assumed to be more than EA spend)	
		Environment ENVI_1: Ensure no negative impact on Gosforth Park SSSI	There will be an increase in risk to this site – affecting up to 0.13 km2 of the protected site.		
		ENVI_2: Protect the Historic Environment from flooding	Risk will increase to 1 Word heritage site, 10 listed buildings and 0.18 km2 of registered parks and gardens		
		ENVI_3.: Protect and improve Hydromorphology and geomorphology in accordance	n/a	As a result of lack of maintenance the raised defences and engineered channels with eventually fail. A reduction in in-channel	

Form 9 Policy Appraisal					
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
		with the objectives of the Water Framework Directive		maintenance could help towards delivery of the WFD mitigation measures. Further work would however be required to ensure habitat improvements.	
Policy Option 3 Continue with existing or alternate actions to manage flood risk at the current level.	• SuDs (new/ retrospective) • Best farming practices • River maintenance • Diversion channel • Individual property protection • Flood awareness • Flood warning & evacuation • Planning policy • Building Regulations • Data & Information	**Social** SOC_1: Reduce Risk to Life	There will be an increase to number of people and property at risk This would result in a rise from 241 to 1,140 properties or 566 people to 2640 will be at risk of fluvial flooding (1% AEP) This is an increase of 22% from present values Increase localised rainfall (short and heavy bursts) will increase the potential for surface water flooding. As set out above there will be an increase in the numbers of people at risk, and the hazard posed to those people through risk of failure and reduction in information available during a flood No investment to the drainage infrastructure is likely to increase the potential for sewer flooding.		**Not Preferred Option** If our current activities remain the same the SoP provided will reduce over time as climate change increases the risk and extent of fluvial flooding. This increases the numbers of residential properties at risk by 22%. Increasing risk from surface water risk from increasing storminess would add to these numbers. Therefore this Policy is not considered appropriate.
		SOC_3: Reduce no. of people at risk of flooding and the impact on human health			
		Economic ECON_1: Reduce the	This increase in risk will result in • increase in the risk of		

Form 9	Policy Appraisal				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
		consequences of flooding on the urban economy	• flooding to between 85 and 125 non-residential properties • increase in risk to 3.75 km of Main road Increase in the frequency of risk to 87 non-residential properties		
		ECON_2: Reduce consequences of flooding on the rural economy			
		ECON_3: Ensure FRM expenditure is proportionate to the risk			
		Environment ENVI_1: Ensure no negative impact on Gosforth Park SSSI	There will be an increase in risk to this site – affecting up to 0.17 km2 of the protected site.		
		ENVI_2: Protect the Historic Environment from flooding	Risk will increase to 1 Word heritage site, 10 listed buildings and 0.18 km2 of registered parks and gardens		
		ENVI_3.: Protect and improve Hydromorphology and geomorphology in accordance with the objectives of the Water Framework Directive	There will be no change in maintenance. This could affect our opportunity to improve HMWB ecological status	There will be no change in maintenance. This could affect our opportunity to improve HMWB ecological status	

Form 9	Policy Appraisal				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
Policy Option 4 Take action to sustain the current scale of flood risk into the future.	• SuDs (new/ retrospective) • Best farming practices • River maintenance • Diversion channel • Individual property protection • Flood awareness • Flood warning & evacuation • Planning policy • Building Regulations • Data & Information • Reduce upland grazing • Agricultural drainage • Offline storage (existing/ new) • Pumping • Distribution networks • Dredging • Removal of channel obstructions • Wetland creation • Analysis & understanding	**Social** SOC_1: Reduce Risk to Life	Under this policy the current SoP (20 year) will be maintained. However the flood extent will increase due to climate change. 667 properties (or 1534 people) will be at risk of fluvial flooding (1% AEP) in the future. This is an increase of 102%. Risk from surface water would remain high – with over 2712 properties (6038 people) at risk. Climate Change could see an increase in the frequency of flooding to these properties		**Not preferred option** *There is significant surface water*
		SOC_3: Reduce no. of people at risk of flooding and the impact on human health			
		Economic ECON_1: Reduce the consequences of flooding on the urban economy	Managing the impact of climate change will have a small impact as extent of flooding will still increase • 98 non-residential properties will be at risk of flooding • Reduction of surface water flooding will be limited, with up to 87 non-residential properties still at risk		
		ECON_2: Reduce consequences of flooding on the rural economy			
		ECON_3: Ensure FRM expenditure is proportionate to the risk	There will be an increase in expenditure to maintain the SoP in pace with Climate Change		

Form 9	**Policy Appraisal**				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
		<u>Environment</u> ENVI_1: Ensure no negative impact on Gosforth Park SSSI	Flood risk to these site will remain the same as existing		
		ENVI_2: Protect the Historic Envrionment from flooding	Flood risk to these site will remain the same as existing		
		ENVI_3.: Protect and improve Hydromorphology and geomorphology in accordance with the objectives of the Water Framework Directive	The length of defences and extent of maintained channel could increase. This could increase the extent to which rivers are modified and may lead to the loss of opportunity to improve the ecological status of the Ouseburn HMWB without careful mitigation or planning.		
Policy Option 5 Take further action to reduce flood risk.	➔ SuDs (new/ retrospective) ➔ Best farming practices ➔ River maintenance ➔ Diversion channel ➔ Individual property protection ➔ Flood awareness ➔ Flood warning & evacuation ➔ Planning policy ➔ Building Regulations ➔ Data & Information	**<u>Social</u>** SOC_1: Reduce Risk to Life		If SoP is increased to 75 year, 183 properties (or 423 people) will be at risk of fluvial flooding or 0 if SoP is raised to 100 years. There will also be a reduction of risk from SW sources	**Chosen Policy** **The only policy option where the gains are shown to outweigh the losses. This policy is required to help manage risk more effectively within this Policy Unit reducing the risk to 1140 homes from fluvial flooding as well as other from SW flooding.**
		SOC_3: Reduce no. of people at risk of flooding			
		<u>Economic</u> ECON_1: Reduce the consequences of flooding on the		• If SoP raised to 75 tear there will be 83 non-residential properties at risk • If SoP raised to 100 there will be direct risk from fluvial	

Form 9 Policy Appraisal					
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
	➔ Reduce upland grazing ➔ Agricultural drainage ➔ Offline storage (existing/ new) ➔ Pumping ➔ Distribution networks ➔ Dredging ➔ Removal of channel obstructions ➔ Wetland creation ➔ Defences ➔ Localised defences ➔ Analysis & understanding	urban economy		flooding • Risk from SW sources will also be reduced	
		ECON_2: Reduce consequences of flooding on the rural economy		• If SoP is raised to 75 years 0.04% of land remains at risk	
		ECON_3: Ensure FRM expenditure is proportionate to the risk	This will require additional investment		
		<u>Environment</u> ENVI_1: Ensure no negative impact on Gosforth Park SSSI		The impact of flooding on this site will reduce	
		ENVI_2: Protect the Historic Envrionment from flooding		The impact of flooding on the historic environment site will reduce	
		ENVI_3.: Protect and improve Hydromorpholog y and geomorphology in accordance with the objectives of the Water Framework Directive	The length of defences and extent of maintained channel could increase. This could increase the extent to which rivers are modified and may lead to the loss of opportunity to improve the ecological status of the Ouseburn HMWB without careful mitigation or planning. Depending on how this policy will be achieved, further investment may be		

Form 9 Policy Appraisal					
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
			required to ensure that the mitigation measures can still be achieved.		
Policy Option 6: Take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.	• Off-line Storage • SUDS (new/retrospective) • Rural Land use change • Wetland Creation • Diversion Channels • Influencing and Informing • Monitoring /Survey (Data and Information • Studies (Analysis and Understanding)	**Social** SOC_1: Reduce Risk to Life	There will be an increase to number of people and property at risk	Potentially there could be some reduction of risk/consequences locally, but would not reduce this sufficiently to be the only approach within the Policy Unit. Short term there could be some benefit, but this is expected to be superseded long-term by the impact of climate change.	**Not preferred option** Small scale opportunities for flood storage have been identified. Flood risk has been identified from numerous sources including the local drainage infrastructure. At present it is not possible to identify the possible capacity available for flood storage. As such this policy choice is not considered appropriate
		SOC_3: Reduce no. of people at risk of flooding and the impact on human health	This would result in a rise from 241 to 1,140 properties or 566 people to 2640 will be at risk of fluvial flooding (1% AEP) with the impact of climate change. This is an increase of 22% from present values Increase localised rainfall (short and heavy bursts) will increase the potential for surface water flooding. . As set out above there will be an increase in the numbers of people at risk, and the hazard posed to those people through risk of failure and reduction in information available during a flood No investment to the drainage infrastructure is likely to increase the potential for sewer flooding.		
		Economic ECON_1: Reduce the consequences of	This increase in risk will result in • increase in the risk of flooding to between 85 and 125 non-residential	Potentially there could be some reduction of risk locally, but would not reduce this sufficiently to be the only approach within the	

Form 9	Policy Appraisal				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
		flooding on the urban economy	• properties • increase in risk to 3.75 km of Main road	Policy Unit.	
		ECON_2: Reduce consequences of flooding on the rural economy			
		ECON_3: Ensure FRM expenditure is proportionate to the risk	No change	No change	
		Environment ENVI_1: Ensure no negative impact on Gosforth Park SSSI	There will be an increase in risk to this site – affecting up to 0.17 km2 of the protected site.		
		ENVI_2: Protect the Historic Environment from flooding	Risk will increase to 1 Word heritage site, 10 listed buildings and 0.18 km2 of registered parks and gardens		
		ENVI_3.: Protect and improve Hydro morphology and geomorphology in accordance with the objectives of the Water Framework Directive	There will be no change in maintenance. This could result in the loss of opportunities through multi-objective projects to achieve improvements and easily meet out mitigation measures for the Ouse burn HMWB, particularly as storage options are outside of the channel in this policy unit		

Form 9	Policy Appraisal				
Policy Unit Name: Ouseburn					
Policy Options:	**Possible approaches to managing risk** *(as identified in Form 12.6)*	**Objective**	**Losses**	**Gains**	**Option**
		ENV_4: No adverse impact on water Quality as a result of flooding	n/a no CoMAH, Landfill or sewerage works sites at risk		

SUMMARY OF POLICY APPRAISAL PROCESS

Form 10: Summary of preferred policy	
Preferred policy	Policy 5: Take further action to reduce flood risk
Justification	Our **vision** for the Ouseburn policy unit is that we develop and implement an approach to working in partnership to reduce the risk of flooding from both fluvial and surface water sources. To ensure FCRM is sustainable we need to ensure that an integrated approach is developed and multiple approaches to managing these risks are explored. By doing so the local economy will be safeguarded. There has been a long history of flooding within the policy unit which has raised concerns within the local community. Significant development proposals have been put forward including the possible expansion of Newcastle airport. This, if not carried out appropriately, has the potential to increase the risk of flooding and result in water quality issues. It is therefore vital that we work together to ensure all future developments within the policy unit are appropriate and reduce surface water runoff where appropriate. A number of locations have been studied in order to identify potential approaches to reducing fluvial and sewer flood risk. This includes Brunton Park, Redhouse Farm and Longbenton. By increasing the SoP at these locations to 1:75, it is estimated that fluvial flood risk to property will be reduced by 64 from 331. The risk of surface water flooding has been identified through the development of PFRAs and a more detailed SWMP for Newcastle Gateshead. In total 2,712 properties are located within areas identified as at risk of surface water flooding. One specific location under pressure for regeneration has been identified as at risk within the draft SWMP scoping report. This report suggests that to reduce this risk will cost around £120,000 (including 25 years maintenance). Given these complex flood risk mechanisms and the projected cost of managing this risk, it is important to manage risk sustainably, through integrated and co-ordinated flood risk management. There are considerable opportunities to manage flood risk from all sources including localised raised defences, increased sewer and culvert capacity, improved conveyance and sustainable development and regeneration. We need to work in partnership to ensure that all possible approaches to managing risk are identified and coordinated.
Risks, Uncertainties & Dependencies	n/a

Form 12: Requirements for further policy development and appraisal	
Is further policy development needed?	No
n/a	
Timescales for review	
n/a	

Form 13: Policy approval			
Upon completion of the consultation process and the integration of comments to this policy appraisal documentation this policy unit will undergo the approvals process. This form will be completed in due course.			
	Name	**Signature**	**Date**
Environment Agency			
CFMP Project Manager	Claire Brown	-	-
CFMP Project Executive		-	-
Area Flood Risk Manager	Phil Welton	-	-
Regional Programme Manager	Richard Davies	-	-
Lead Local Flood Authority Scrutiny Committee	TBC	-	-
RFCC chair	Frank Major	-	-
EA Regional Director	David Dangerfield	-	-

APPENDIX 1: CHARACTERISTICS OF THE POLICY UNIT

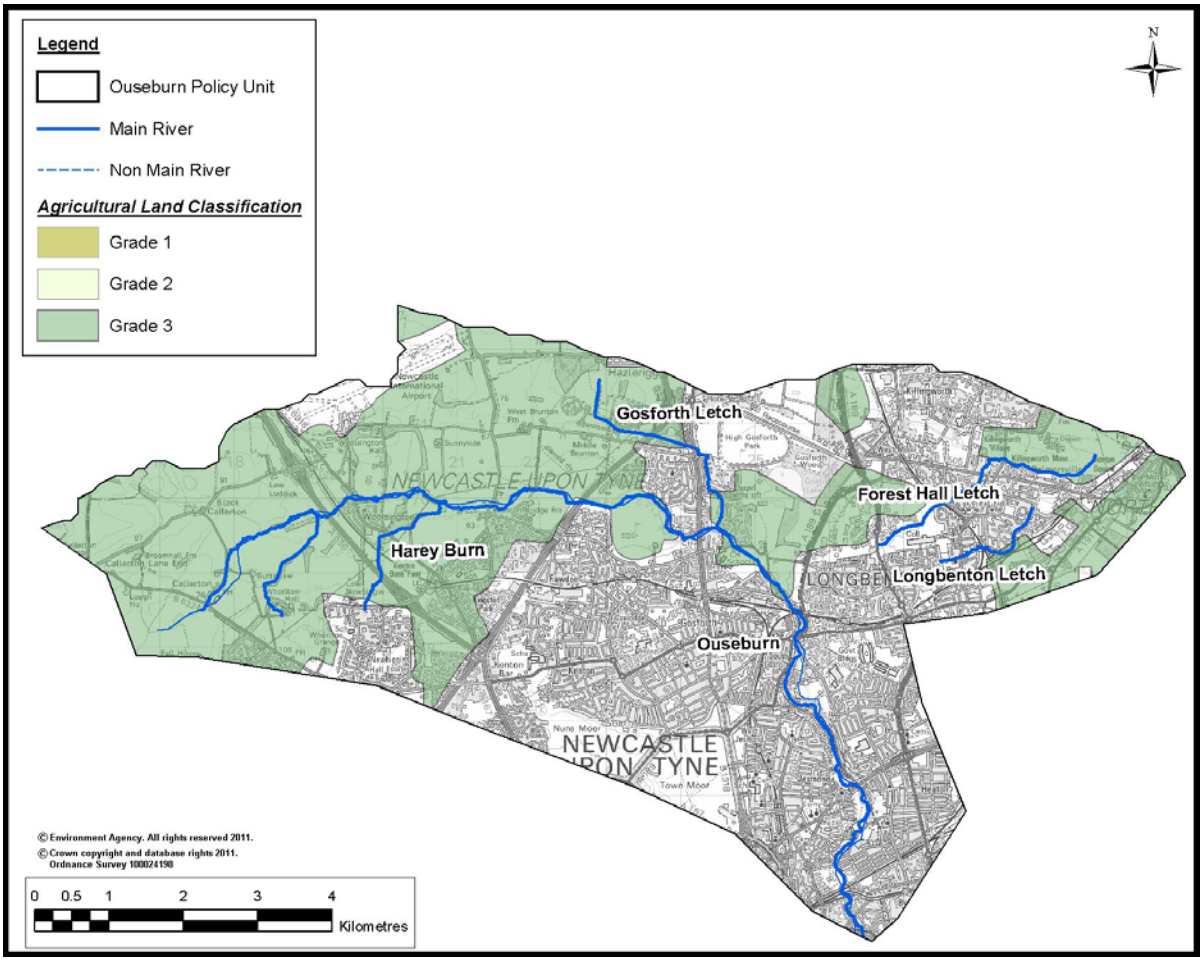


Figure 3: Physical characteristics of the policy unit

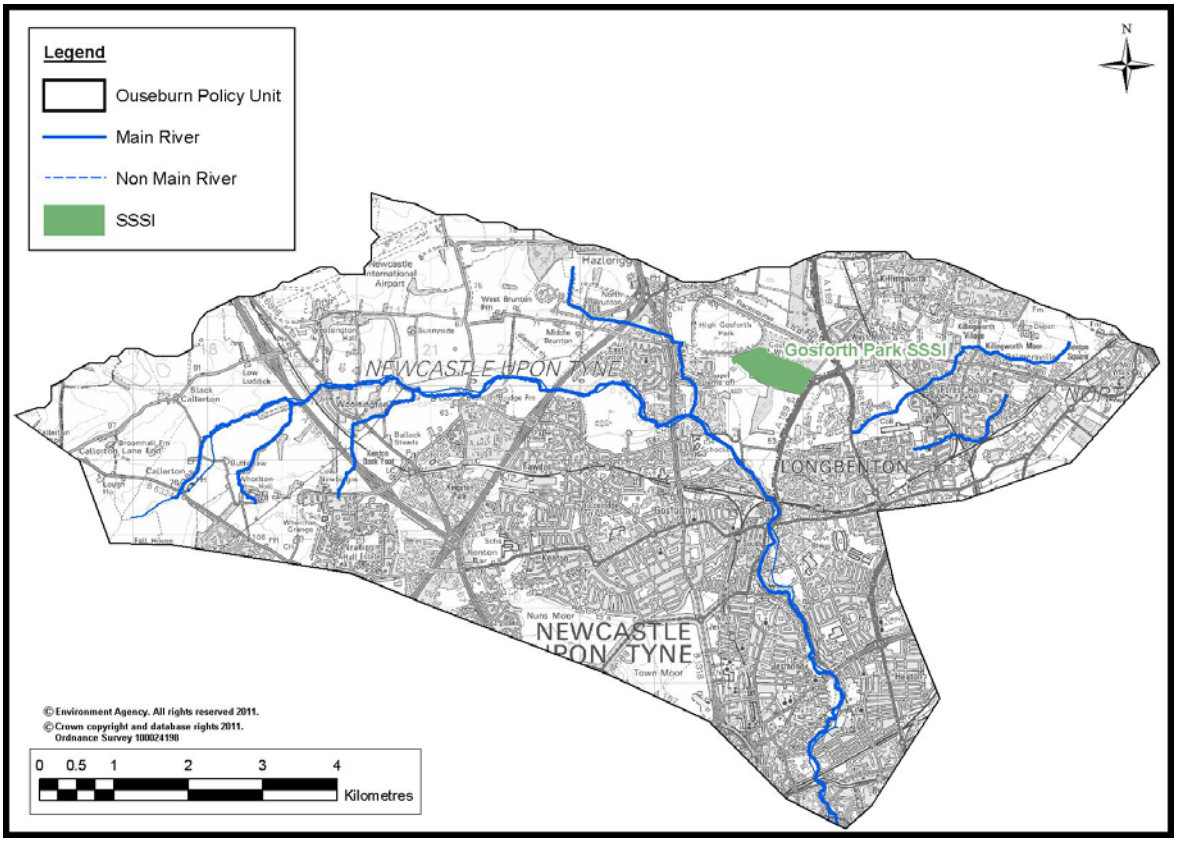


Figure 4: Natural characteristics

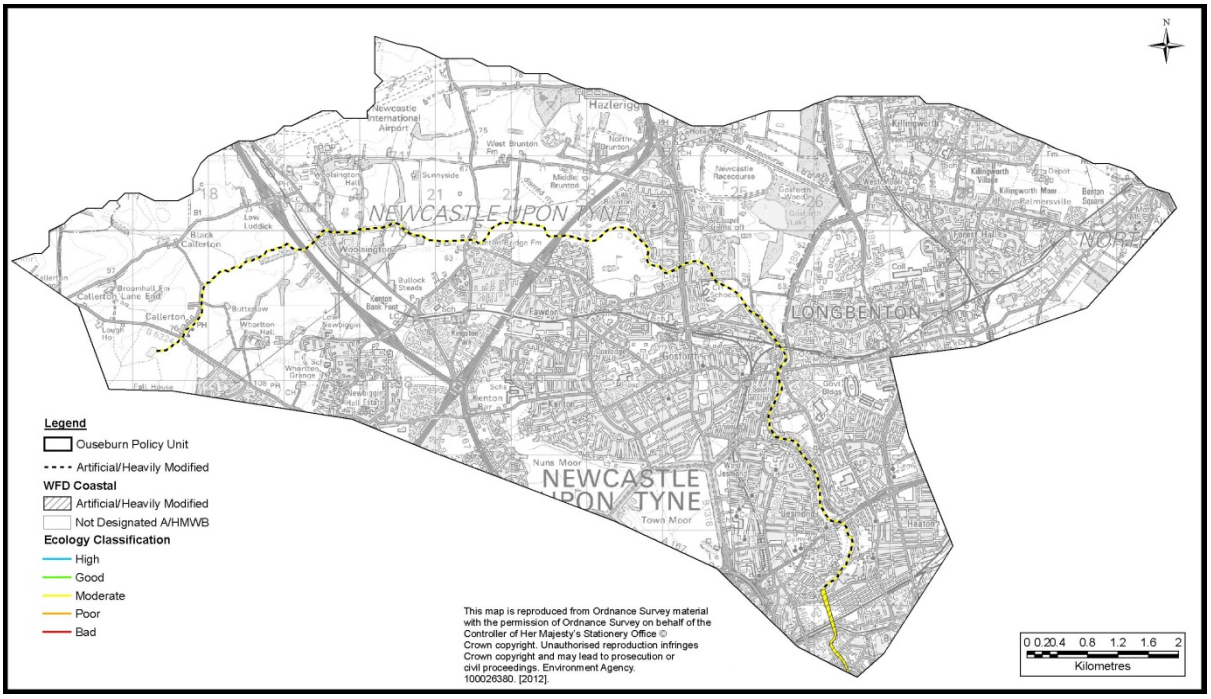


Figure 6: Water Framework Directive, Heavily Modified Water Bodies and Ecological Status

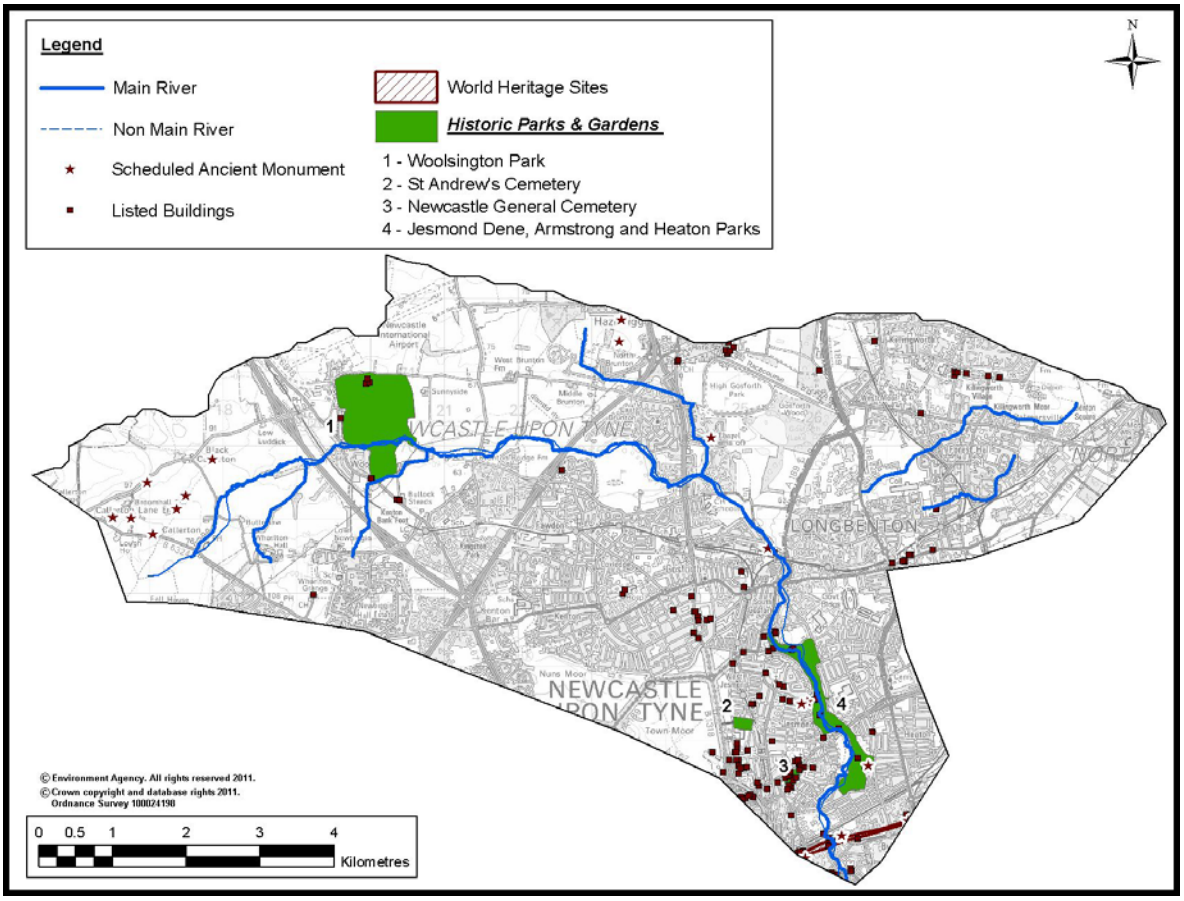


Figure 7: Historic characteristics