



JBA
consulting

Hartlepool Local Flood Risk Management Strategy

March 2016

Hartlepool Borough
Council
Civic Centre
Victoria Road
Hartlepool
TS24 8AY



JBA Project Manager

Charlotte Beattie
 JBA Consulting
 Bank Quay House
 Sankey Street
 WARRINGTON
 Cheshire
 WA1 1NN

Revision history

Revision Ref / Date Issued	Amendments	Issued to
v1-0 / 4 Internal Revisions		Not Issued
V4,.2 December 2015	Client review	Hartlepool Borough Council
V4.3 January 2016	Client review and internal consultation	Hartlepool Borough Council
V4.4 January 2016	Minor formatting changes and feedback from NW and Environment Agency.	Hartlepool Borough Council
v.4.5 January 2016	Minor changes	Hartlepool Borough Council
V4.6 March 2016	Final document	Hartlepool Borough Council

Contract

This report describes work commissioned by Hartlepool Borough Council. Matthew Williams, Charlotte Beattie and Rachel Brisley carried out this work.

Prepared by Matthew Williams BSc MSc
 Assistant Analyst

Reviewed by..... Charlotte Beattie BA MTPL MRTPI
 Chartered Senior Analyst

Technical Reviewed by _____ Samuel Wingfield BSc MRes
 MCIWEM C.WEM CEnv

Purpose

This document has been prepared as a draft Local Flood Risk Management Strategy for Hartlepool Borough Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Hartlepool Borough Council.

Copyright

© Jeremy Benn Associates Limited 2016

Carbon footprint

A printed copy of the main text in this document will result in a carbon footprint of 322g if 100% post-consumer recycled paper is used and 409g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Foreword

Vision: to work with others to ensure a strategic, long-term approach to deliver an effective approach to local flood risk management for Hartlepool BC.

Following flooding in 2007, the government commissioned a review (The Pitt Review, 2008), which recommended urgent changes in the way the country is adapting to the increased risk of flooding. A principal change was to establish greater clarity in the roles and responsibilities and an increased focus on addressing surface water flood risk through the enactment of the Flood and Water Management Act (2010). Under the Act, Hartlepool BC became a Lead Local Flood Authority.

To fulfil this role we now have new roles and responsibilities, duties and powers to enable us to manage flood risk from localised sources across Hartlepool and a duty to develop, maintain, apply and monitor a Strategy for local flood risk management that encompasses all sources of flooding.

As part of the development of this Strategy we have worked in partnership with all Risk Management Authorities who have responsibility for flood risk across Hartlepool and have consulted with our local communities.

This Strategy document has been subject to full public consultation and once approved by committee will form our Adopted LFRM Strategy.

Executive member for Neighbourhoods Services

Contents

Foreword	ii
List of Figures	1
List of Tables	1
Abbreviations	2
1 Introduction	3
1.1 Where is Hartlepool BC?	3
1.2 Why prepare a Local Flood Risk Management Strategy?	3
1.3 What types of flood risk have we considered?	4
1.4 What does the Strategy cover?	5
2 Working Together to Manage Flood Risk	6
2.1 Introduction	6
2.2 Risk Management Authorities.....	6
2.2.1 Hartlepool BC	7
2.2.2 Environment Agency	7
2.2.3 Northumbrian Water	7
2.2.4 Northumbria Regional Flood and Coastal Committee (RFCC)	7
2.3 Other Risk Management Authorities.....	8
2.3.1 Riparian Owners	8
2.3.2 North East Coastal Group	8
2.3.3 Other Roles.....	8
2.4 Governance and Scrutiny	8
2.4.1 Consultations	9
3 Flood Risk in Hartlepool	10
3.1 Introduction	10
3.2 Local Flood Risk	10
3.2.1 Surface Water Flooding	10
3.2.2 Critical Drainage Areas (2010)	11
3.2.3 Hartlepool Preliminary Flood Risk Assessment (2011)	12
3.2.4 Ordinary Watercourse or Non main river Flooding.....	13
3.2.5 Groundwater Flooding	14
3.3 Other Flood Risks:	15
3.3.1 Main River Flood Risk	15
3.3.2 Coastal Flood Risk.....	16
3.4 Flood Risk and Adapting to Climate Change	17
3.5 Local Flood Risk Areas.....	18
3.6 Actions undertaken since Surface Water Management Plan	19
4 Local Flood Risk Management Objectives	20
4.1 Introduction	20
4.2 National Context	20
4.2.1 The National Flood and Coastal Erosion Risk Management Strategy for England (NFCERM) (2011)	20
4.2.2 The National Planning Policy Framework (2012)	21
4.3 Local Context.....	21
4.4 Hartlepool Local Measures.....	21
4.4.1 Maintaining the Flow and Capacity of ordinary watercourses	23
4.4.2 Appraise and adopt a full range of costs and measures	23
4.4.3 Multiple Benefits towards Sustainable Development	23
4.4.4 Communication.....	23
4.4.5 Partnership and co-ordination	23

4.4.6	Establish and maintain an asset register.....	23
4.4.7	Natural Flood Management.....	24
4.4.8	Land Management, Land Use Planning, Infrastructure Investment and Agriculture.....	24
4.4.9	Sustainable Drainage Systems.....	24
4.4.10	Proportionate risk based approach to flood risk management duties.....	25
4.5	Wider Environmental Objectives.....	25
4.5.1	Water Framework Directive.....	25
4.5.2	The Northumbria River Basin Management Plan.....	26
4.5.3	Floods Directive.....	26
5	Strategic Environmental Assessment.....	28
5.1	Introduction.....	28
5.2	Screening and Scoping.....	28
5.3	Environmental Report.....	28
5.4	Habitats Regulation Assessment.....	29
6	Action Plan.....	30
6.1	Background Information.....	30
6.2	The Hartlepool Action Plan.....	31
6.3	The Action Plan.....	32
7	Funding the LFRMS.....	36
7.1	Flood and Coastal Resilience Partnership Funding.....	36
7.2	Local Levy.....	36
7.3	Surface Water Disposal Charge.....	36
7.4	Private Funding.....	36
7.5	Section 106 Contributions.....	37
7.6	Community Infrastructure Levy.....	37
7.7	Local Authority Funding.....	37
8	Monitoring and Review.....	38
8.1	Monitoring Measures.....	38
8.2	Review cycle.....	38
8.3	Limitations.....	38
9	References.....	39
	Appendix A: Local Flood Risk Priority Areas.....	I

I

List of Figures

Figure 1-1 Hartlepool and County Durham in the United Kingdom	3
Table 1-2 Structure of Hartlepool local flood risk strategy against the requirements of the Flood and Water Management.....	5
Figure 2-1: LFRMS responsibilities and duties as detailed in the Flood Water Management Act 2010	6
Figure 3-2 Hartlepool Wards and Corresponding Critical Drainage Areas (CDAs) (JBA Consulting, 2010a)	12
Figure 3-3 PFRA Final Significant Risk Areas and SWMP Action Areas	13
Figure 3-4 Hartlepool Ordinary Watercourses.....	14
Figure 3-5: Areas Susceptible to Groundwater Flooding in Hartlepool	15
Figure 3-6 Hartlepool Coastal Flood Risk.....	16
Figure 3-7 showing surface water ponding in Rural West Ward	21
Figure 3-8 Local flood risk areas identified by different flood risk assessments and plans	30

List of Tables

Table 3-1 Main rivers in Hartlepool.....	15
Table 3-2 Showing rank order of Hartlepool Wards by different types of assessments.....	18
Table 4-1: Criteria for flood investigations at Hartlepool	25
Table 6-1: Hartlepool LFRMS Action Plan.....	32

Abbreviations

Abbreviations	
AOD	Above Ordnance Datum
Astsfw	Areas Susceptible to Surface Water Flooding
BGS	British Geological Survey
CAMS	Catchment Abstraction Management Strategy
CC	Climate Change
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
DCLG	Department for Communities and Local Government
Defra	Department for Food and Rural Affairs
Dial	Drainage Impact Assessment
EA	Environment Agency
EC	European Commission
EU	European Union
FCERM GiA	Flood and Coastal Erosion Risk Management Grant in Aid
FRM	Flood Risk Management
FWMA	Floods and Water Management Act
GVZ	Groundwater Vulnerability Zone
HBC	Hartlepool BC
HRA	Habitats Regulations Assessment
IDB	Internal Drainage Boards
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
MWW	Middle Warren Watercourse
NAMD	North Area Main Drain
National FCERM	National Flood and Coastal Erosion Risk Management Strategy
NE	Natural England
NECG	North East Coastal Group
NPPF	National Planning Policy Framework
PA/IA	Priority Area/Intermediate Area
PF	Partnership Funding
PFRA	Preliminary Flood Risk Assessment
RBMP	River Basin Management Plan
RFCC	Regional Flood and Coastal Committee
RMA	Risk Management Authority
RRG	Repair and Renew Grant
SAB	SUDS Approval Body
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment
SMP	Shoreline Management Plan
SPA	Special Protected Area
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
TLSE	Test of Likely Significant Effect
ufmsfw	updated Flood Map for Surface Water
UKCP09	UK Climate Projections
WFD	Water Framework Directive

1 Introduction

This section explains why we have prepared a Local Flood Risk Management Strategy and sets out our high level responsibilities as a Lead Local Flood Authority. We outline the contents of the Strategy, the area it affects and why the Strategy is important to Hartlepool BC, our partners and stakeholders including other Risk Management Authorities and local communities.

1.1 Where is Hartlepool BC?

Hartlepool BC is a unitary authority with borough status located in the ceremonial County Durham in northeast England). The borough covers an area of approximately 98km² and has a population of approximately 92,590 people (2014) (Tees Valley Unlimited, 2015a). Hartlepool is generally low-lying and bounded to the east by the North Sea and shares its northern border with County Durham, and Stockton-On-Tees to the South.

Hartlepool is also a town in the east of County Durham within the Borough of Hartlepool on the North Sea coast, 12km north of Middlesbrough and 27km south of Sunderland. The borough also includes outlying suburban villages including Seaton Carew, Greatham, Hart Village and Dalton Piercy.

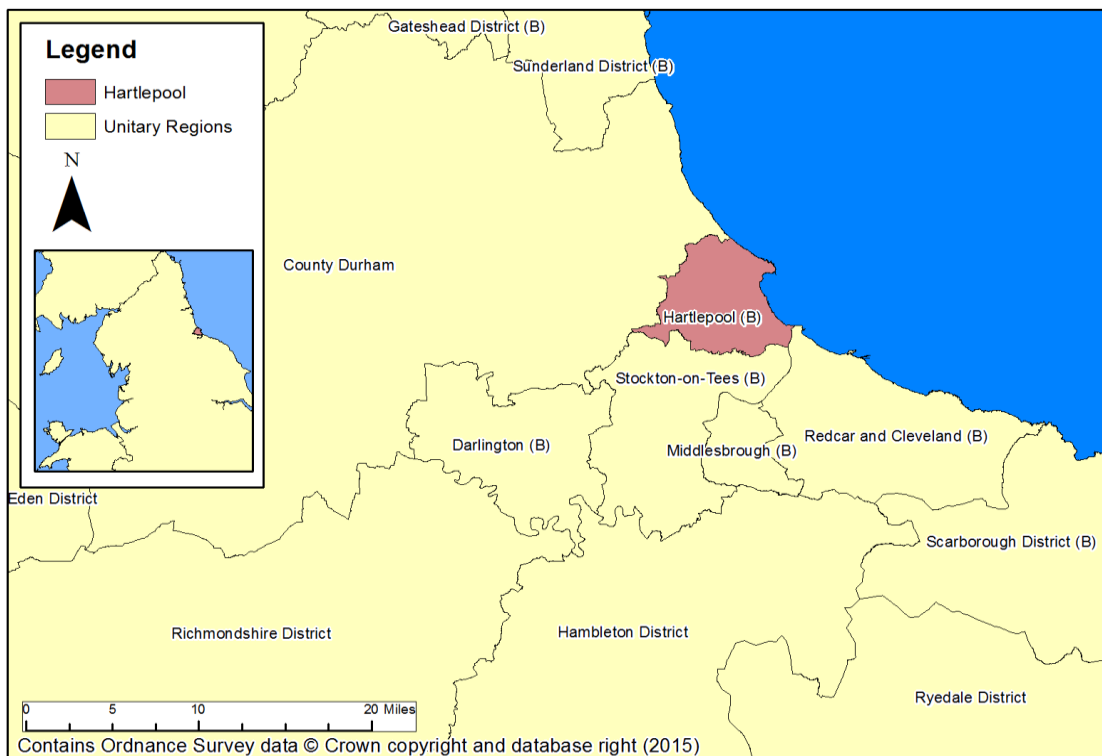


Figure 1-1 Hartlepool and County Durham in the United Kingdom

1.2 Why prepare a Local Flood Risk Management Strategy?

Widespread flooding in the summer of 2007 led to a Government commissioned review conducted by Sir Michael Pitt. This independent review, published in 2008 made significant recommendations for future flood risk management, calling for

an urgent and fundamental change in the way that the UK responds and adapts to increasing flood risk.

The Pitt Review recommended that the approach to flood risk management should be coordinated and consistent, incorporating communication with communities at risk and ensuring greater clarity in the roles and responsibilities of all Risk Management Authorities (RMAs). One of the most important recommendations from the report identified included increasing local authorities responsibility in the management of local flood risk by taking the lead in tackling problems of local flooding and co-ordinating all relevant agencies.

The requirements for a local flood risk management strategy (LFRMS) are set out in the Flood and Water Management Act 2010. This Act translates the European Floods Directive into UK legislation. These legislative requirements and the recommendations of the Pitt Review have informed the development of this strategy. The requirements of the Flood and Water Management Act 2010 required the establishment of Lead Local Flood Authorities (LLFAs) England which have the key role to:

“Develop, maintain and apply and monitor a strategy for local flood risk management in its area, where local flood risk refers to a flood from a) surface water runoff, b) groundwater and c) ordinary watercourses. Where ordinary watercourses includes a reference to a lake pond, or other area of water that flows from an ordinary watercourse.”¹

These requirements relate to the Flood Risk Regulations 2009, which require Councils as LLFAs to produce a preliminary flood risk assessment and hazard maps and a flood risk management plan where there is a significant flood risk area. The Hartlepool Preliminary Flood Risk Assessment was completed in 2011; it did not identify any nationally significant risk areas. However, a number of locally significant areas were identified using the criteria of risks to 200 properties, 20 businesses or one key infrastructure; this information has been used to inform the development of the local strategy.

It is a shared vision of Hartlepool BC to continue to strengthen existing partnerships and work towards an integrated plan system between now and cycle which is due to begin in 2021.

1.3 What types of flood risk have we considered?

Flooding can occur from a variety of sources, at different times and for different reasons. Whilst this strategy is focussed on local flood risk, it is important to understand the context of flood risk by different sources. This LFRMS includes an assessment of the risks from all sources of flooding, **including ‘local sources’ surface water (overland runoff), groundwater and ordinary watercourses** (Where water flows in channels and culverts that are not described on the Environment Agency Main River map).

The Strategy also includes the work and responsibilities of others such as the Environment Agency on Main Rivers, Internal Drainage Boards (where they exist-but not applicable to Hartlepool) and Water Companies, in relation to the drainage and sewer network. This approach is also consistent with Defra’s Partnership funding policy for investment in flood risk management solutions which encourages RMAs to consider the investment needs for all sources of flooding in the LFRMS.

¹ Section 19 Flood and Water Management Act
Hartlepool BC version 4.5

1.4 What does the Strategy cover?

The LFRMS must be consistent with the Environment Agency's National Flood and Coastal Erosion Risk Management Strategy (National Strategy). As LLFA, Hartlepool BC must consult RMAs and the public who may be affected by the strategy. This LFRMS takes into full account the legislative requirements of the Flood and Water Management Act 2010 set under section 9; the following table shows where each of the requirements are addressed in the Strategy:

Flood and Water Management Act Requirement	LFRMS Section
The risk management authorities in the authority's area:	2 – Roles and Responsibilities
The flood and coastal erosion risk management functions that may be exercised by those authorities in relation to the area;	2 – Roles and Responsibilities
The objectives for managing local flood risk (including any objectives included in the authority's flood risk management plan prepared in accordance with the Flood Risk Regulations 2009)	4 and 5– Objectives for Managing Local Flood Risk
The measures proposed to achieve those objectives	4 and 5-Objectives and Measures for Managing Local Flood Risk
How and when the measures are expected to be implemented	7-Implementation
The costs and benefits of those measures, and how they will be paid for	6, 7 and 9 Action Plan, Local Flood Risk Actions and Strategic Environmental Assessment
The assessment of local flood risk for the purpose of the strategy	3-Flood Risk in Hartlepool
How and when the strategy will be reviewed	8-Monitoring and Review
How the strategy contributes to the achievement of wider environmental objectives.	9- Strategic Environmental Assessment and Wider Environmental Objectives

Table 1-2 Structure of Hartlepool local flood risk strategy against the requirements of the Flood and Water Management Act 2010

2 Working Together to Manage Flood Risk

This section outlines who the key risk management authorities are and what roles they have in flood risk management.

2.1 Introduction

The Flood and Water Management Act 2010 (FWMA) forms a key driver for this strategy and has influenced the development of the draft. The Risk Management Authorities (RMA) responsibilities and duties as set out in the Flood and Water Management Act 2010 are shown in Figure 2-1.



Figure 2-1: LFRMS responsibilities and duties as detailed in the Flood Water Management Act 2010

2.2 Risk Management Authorities

The FWMA defines risk management authorities (RMAs) as key stakeholders, including the EA, the LLFA, Internal Drainage Boards (where they exist- and there are none within Hartlepool BC area), Highway Authorities and water companies. These RMAs are required to act in a manner consistent with the National Strategy and form effective partnerships to deliver effective flood risk management. The key risk management authorities for Hartlepool BC include

- Hartlepool BC as the Lead Local Flood Authority;
- Environment Agency;
- Highway Authority and Highways England; and
- Northumbrian Water;

2.2.1 Hartlepool BC

Hartlepool BC forms a Lead Local Flood Authority under the Flood and Water Management Act 2010. This is a role specific to the management of local flood risk “surface water runoff, groundwater and watercourse (non-main rivers) and the duties associated with both the Flood and Water Management Act 2010 and the Flood Risk Regulations 2009. The work undertaken closely relates to work across the Local Authority functions of Environment, Emergency Planning, Land Drainage, Planning and Regeneration and Highways.

Hartlepool is a unitary authority in the ceremonial county of County Durham, northeast England. It borders the non-metropolitan county of County Durham to the north, Stockton-On-Tees to the south along the line of the River Tees. It is centred on the town of Hartlepool and forms part of the Tees Valley area.

2.2.2 Environment Agency

The EA has a strategic overview role for all FCERM (Flood and Coastal Erosion Risk Management Strategy) and takes a lead responsibility for managing flood risk from the sea, main rivers and reservoirs. Main rivers are those watercourses, which appear on the Statutory Main River map held by the EA and Defra, for which the EA has permissive powers to carry out works intended to maintain, improve and defend against flooding and erosion. However, riparian owners (those who own land or property next to a river) retain the overall responsibility for maintenance of Main Rivers. The EA also has a key role to provide flood warnings and support to emergency responders, along with promoting sustainable development and protecting the environment.

2.2.3 Northumbrian Water

Northumbrian Water forms the statutory sewerage undertaker in Hartlepool BC. Northumbrian Water, the Environment Agency and Hartlepool BC form three significant partners of the Surface Water Management Plan. Northumbrian Water are involved in management and investments of the sewerage system and potential schemes, or options which could reduce surface water flows within the systems in particular ward areas identified. There are many potential causes of sewer flooding and these include, third party interference, exceptional weather, incapacity of the system, storm return periods urban creep or misconnections.

2.2.4 Northumbria Regional Flood and Coastal Committee (RFCC)

The Northumbria RFCC is a statutory body, established by the EA under the FWMA, which provides the vehicle for planning and managing the delivery of flood risk management priorities and investment in the Northumbria Area, stretching from the Tweed to the Tees Catchment.

There are twelve members of the Northumbria RFCC appointed by each of the LLFAs in the Northumbria area and six appointed by the EA, who all share the following responsibilities:

- Ensuring coherent plans are available for identifying, managing and communicating flood and coastal erosion risks across catchments and shorelines;
- Promoting investment in FCERM which is targeted, efficient and risk-based and therefore optimises value for money and local community benefits; and providing a link between all relevant bodies (the EA, LLFAs, other RMAs and relevant bodies) to bring about mutual understanding of flood and coastal erosion risks in the area.

2.3 Other Risk Management Authorities

Other risk management authorities, whilst not specifically listed in legislation, play a pivotal role in communication and management of local flood risks. These other risk management authorities can include riparian owners, wildlife trusts or groups and or significant infrastructure or land owners

2.3.1 Riparian Owners

Under common law, a riparian owner is someone who owns land or property next to a river, stream or ditch. Riparian owners who have a watercourse within or adjacent to any boundary of their property have a number of duties and responsibilities under the Land Drainage Act 1991. These duties include a duty to deal with and accept flow of water; a duty to not to affect the rights of others by passing on flow without obstruction, diversion or pollution; and a duty to maintain the banks and bed of the watercourse, through appropriate maintenance.

Further guidance on these responsibilities is available in the “Living on the Edge” document published by the Environment Agency and which is available from the Environmental Management section of the government website (<https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities>)

2.3.2 North East Coastal Group

The overall aim of the North East Coastal Group (NECG) is to provide sound advice and be a strong influence in optimising strategic and sustainable policies, plans and programmes to manage the risk from sea flooding and coastal erosion.

2.3.3 Other Roles

There is a wide variety of roles, trusts and organisations who aren't designated risk management authorities are involved in activities which affect the water environment, in terms of heritage, assets, wildlife and infrastructure. These can include;

- English Heritage
- Tees Rivers Trust
- Tees Valley Wildlife Trust
- National Trust
- Natural England
- Heritage Coast
- Marine Fisheries Agency
- Royal Society for the Protection of Birds
- Highways Authority and Highways England
- Network Rail
- PD Ports
- Met Office
- National Flood Forum

2.4 Governance and Scrutiny

The Lead Local Flood Authority functions of Hartlepool are led by the Environment directorate and Lead Member. Once the draft strategy has been out to consultation, it will be revised and forwarded to the Neighbourhood Services Committee in March 2016.

2.4.1 Consultations

A consultation and engagement plan for the strategy was drawn up at the start of the project and amended and monitored to reflect the drafting of the strategy.

The drafting of LFRMS included a number of consultation meetings with key internal departments of regeneration, planning, environment and emergency planning, within Hartlepool BC.

The draft strategy was also influenced by the drafting of the strategic environmental assessment and consultations and meeting with key stakeholders of Environment Agency and Northumbrian Water to determine if the assessment was required and the scope the Environmental Report.

The public consultation was held between January 19th and February 2016. Information on the consultation will be held on the Hartlepool BC website, and no consultation responses were received during this time.

3 Flood Risk in Hartlepool

This section outlines the different types of flood risks within and outside the Hartlepool BC scope as the LFRMS to provide a holistic overview of flood risks. It identifies those areas at highest risk which need to be addressed through the LFRMS.

3.1 Introduction

Flood risk can arise from a variety of sources acting separately or in combination. As an LLFA, Hartlepool is responsible for managing flood risk from **surface water, groundwater and ordinary watercourses**, however, flood risk from the sea and main rivers, which is the responsibility of the Environment Agency, has been outlined briefly to provide a holistic overview to flood risks.

Hartlepool recorded eighteen flooding investigations between 2014 and 2015 and the total estimated cost of these incidents was approximately £324,800. The causes of flooding were primarily highway flooding; in addition, records of local flooding impacted on properties, gardens, car parks and allotments, incidents are shown in Figure 1-2. No internal flooding to properties has occurred in the last twelve months and there is limited information available on the number, extent and impacts of historic events in Hartlepool.

3.2 Local Flood Risk

3.2.1 Surface Water Flooding

Surface water flooding is caused by intense rainfall leading to surface water runoff. The resulting water follows natural valley lines and ponds in low spots which often coincide with fluvial floodplains in low-lying areas. The flow paths generally follow roads and can go through or around developments. Surface water runoff can also exceed the capacity of the local drainage network and affect areas not obviously susceptible to flooding from the local topography.

Significant periods of heavy intense rainfall levels can impact on surface water, ordinary watercourse and groundwater flooding. Figure 3-1 shows surface water areas in relation to main settlements in and around the Hartlepool borough, and surface water flood risk predictions for the 1 in 30 year and 1 in 100 year events.

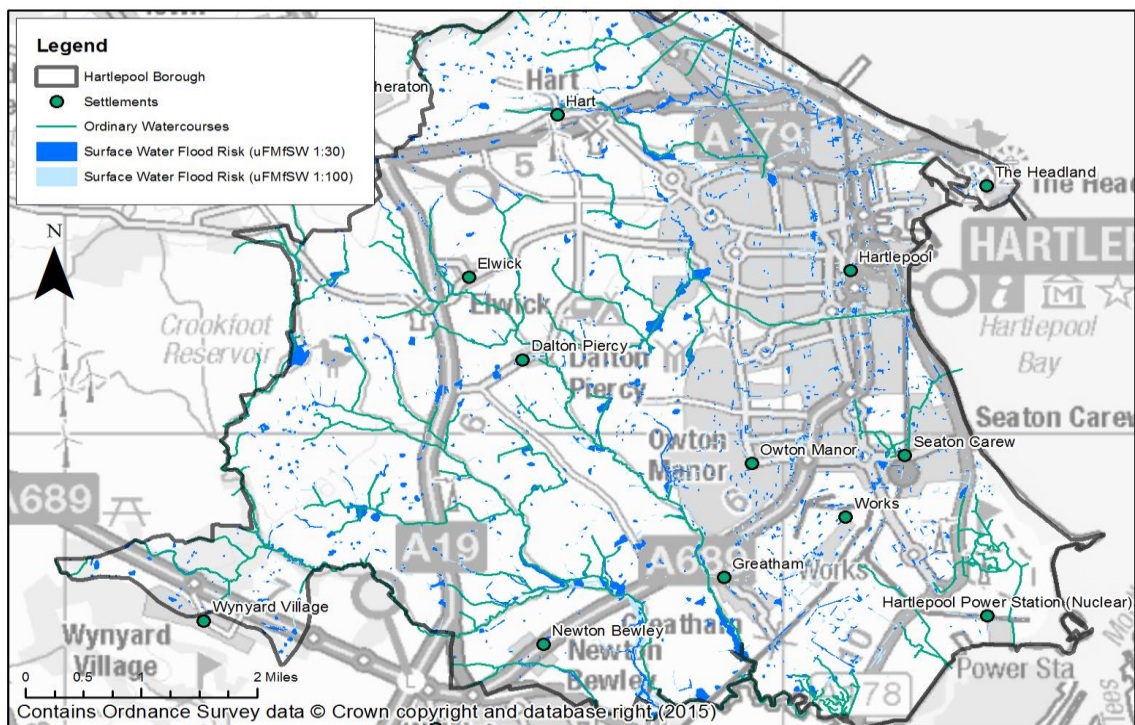


Figure 3-1 Surface water map of Hartlepool

3.2.2 Critical Drainage Areas (2010)

The Strategic Flood Risk Assessment (SFRA) for Hartlepool published in 2010 identifies a number of critical drainage areas (CDAs), which are relevant to the development plan and management system associated with planning and the proposed framework of objectives and measures for the LFRMS. These critical drainage areas are relevant to a holistic and sustainable approach to flood risk and drainage as a Lead Local Flood Authority, both in terms of flood risk schemes and future development and redevelopment schemes,

The CDAs and their corresponding wards are shown in Figure 3-2, and listed below:

- The Stell near Seaton (Seaton Ward, Foggy Furze Ward, and Fens and Rossmere Ward)
- Tunstall Farm Beck area around Stranton (Headland and Harbour Ward, Burn Valley Ward (negligible) and Seaton Ward)
- Tunstall Farm Beck area around West park (Rural West ward)
- Middle Warren Watercourse Area (De Bruce Ward, Headland and Harbour Ward, and Jesmond Ward) (JBA Consulting, 2010a)

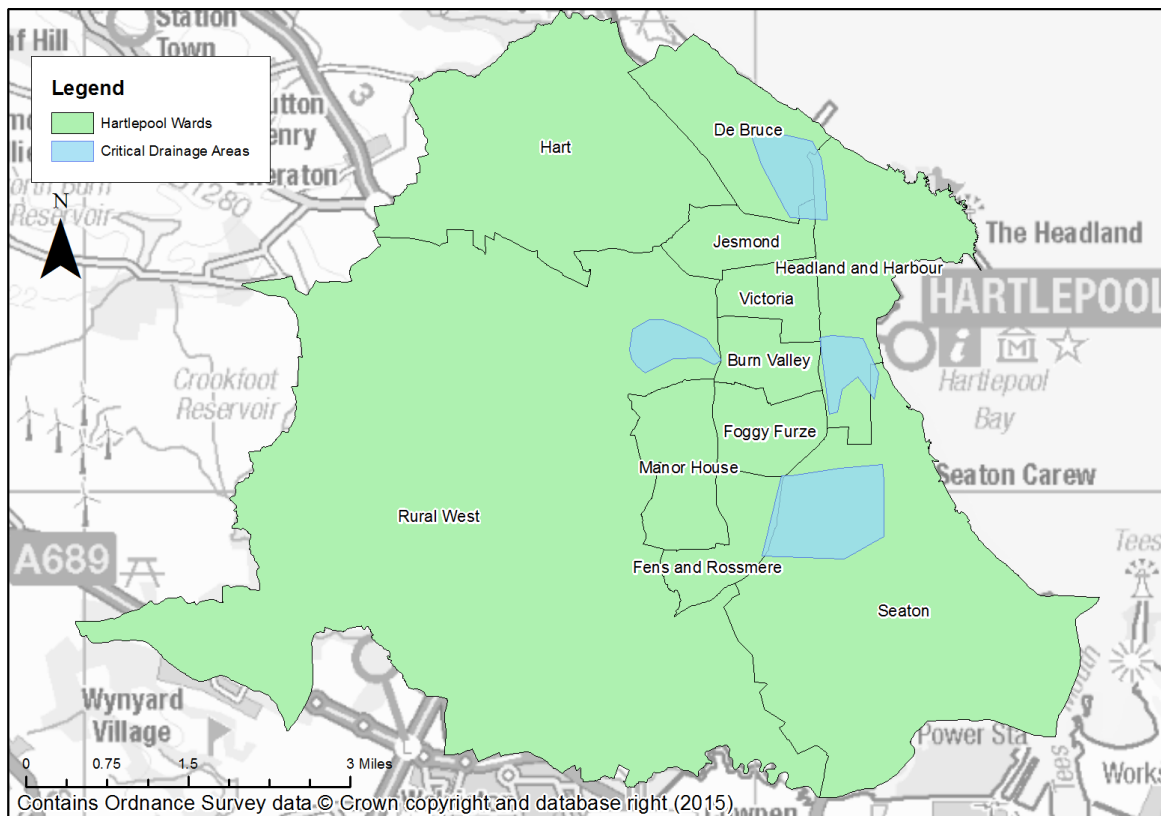


Figure 3-2 Hartlepool Wards and Corresponding Critical Drainage Areas (CDAs) (JBA Consulting, 2010a)

The CDA's show that there are potential implications for key infrastructure in Seaton, Rural West Headland and Harbour and the De Bruce Wards.

3.2.3 Hartlepool Preliminary Flood Risk Assessment (2011)

The Flood Risk Regulations 2009 require LLFAs to determine whether there is a significant risk in their area based on local flooding data. Significant risk is dependent on the consequences of flooding to human health, economic activity, and the environment (including cultural heritage).

To ensure a consistent approach nationally Defra and WAG defined an impact threshold in the 1% AEP event on a 1km grid square basis above which a site is classified as a significant risk area. The impact thresholds are:

- 200 people; or
- 20 businesses; or
- 1 critical service at risk.

In Hartlepool, there are 12 areas identified a significant risk of which exceed the thresholds listed above. These significant risk areas are shown in Figure 3-3 in relation to the Critical Drainage Areas and the eight priority areas of the Surface Water Management Plan and key towns within Hartlepool.

The flood risk areas were identified using guidance produced by Department of Environment, Food and Rural Affairs (Defra). The areas represent 'clusters' of areas where flood risk is an issue and where 30,000 people or more live. The results of the assessment identified 12 significant risk areas within Hartlepool. There are two locations where the grouping of these areas satisfies the clustering methodology. In both cases, the number of properties affected in the cluster is significantly below the 30,000 people at risk threshold to be classified as a Flood Risk Area. The findings of the PFRA were therefore that there are no Flood Risk Areas within Hartlepool.

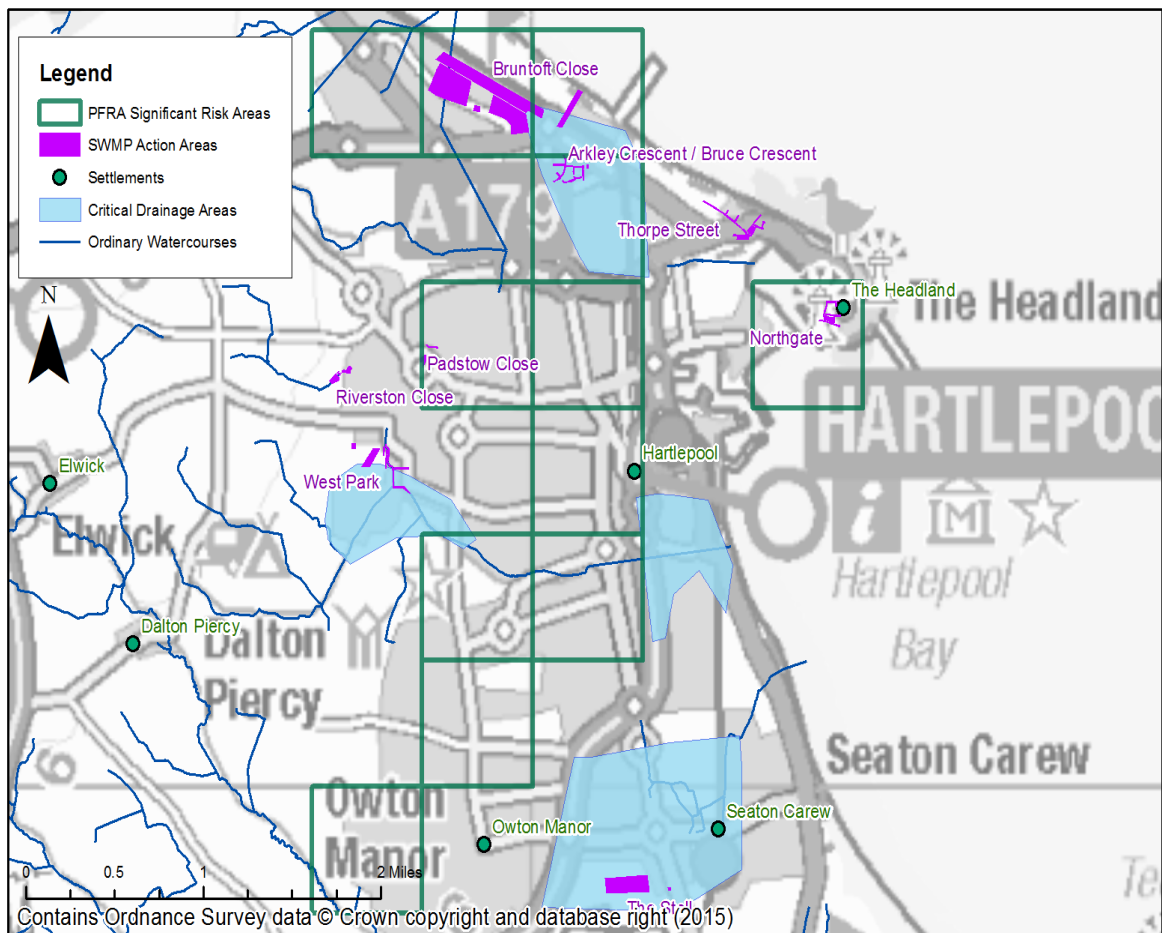


Figure 3-3 PFRA Final Significant Risk Areas and SWMP Action Areas

Figure 3-3 shows that four out of the eight SWMP action areas are within Preliminary Flood Risk Assessment (PFRA) significant risk areas. These priority areas are Arkley Crescent/Bruce Crescent, Bruntoft Close, Padstow Close and Northgate. It also shows that both assessments of critical drainage and surface water management plan, with exception of Seaton Carew closely relate to the PFRA assessment.

3.2.4 Ordinary Watercourse or Non main river Flooding

Flooding of watercourses is associated with the exceedance of channel capacity from high flows and local factors such as online structures and obstructions.

Hydraulic modelling was undertaken by the Level 2 SFRA for Middle Warren Watercourse and part of the Tunstall Farm Flood Alleviation Study (FAS). The non-main river watercourses run from West to East across the Borough, or North to South and closely relate to main settlements. Figure 3-4 shows the location of these watercourses across Hartlepool BC.

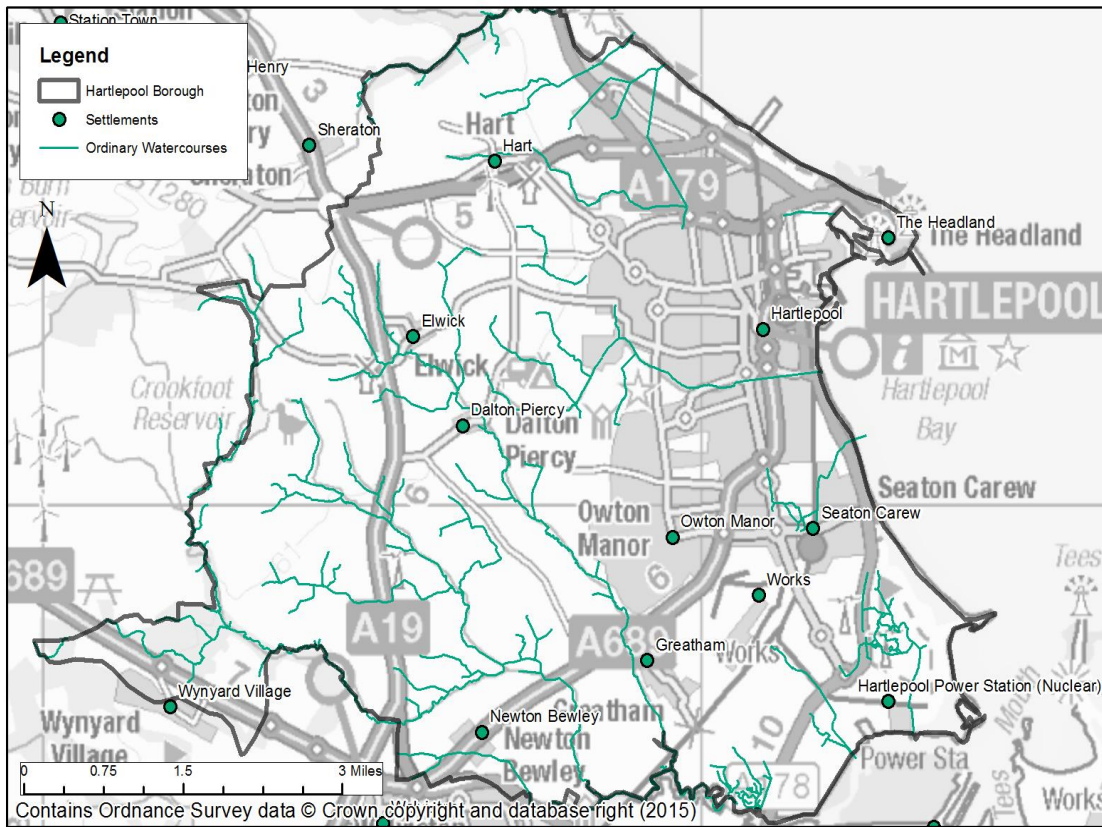


Figure 3-4 Hartlepool Ordinary Watercourses

3.2.5 Groundwater Flooding

The national Areas Susceptible to Groundwater Flood Map is a strategic scale map showing groundwater flood areas on a 1km square grid and whilst there are some limitations to the dataset. Figure 3-5 shows that much of Hartlepool town is at risk of groundwater flooding with a greater than 75% probability. This strategic mapping helps to identify a potential source of local flood risk, which may require further investigations or assessments. The white areas on the map depict areas where there is an absence of data.

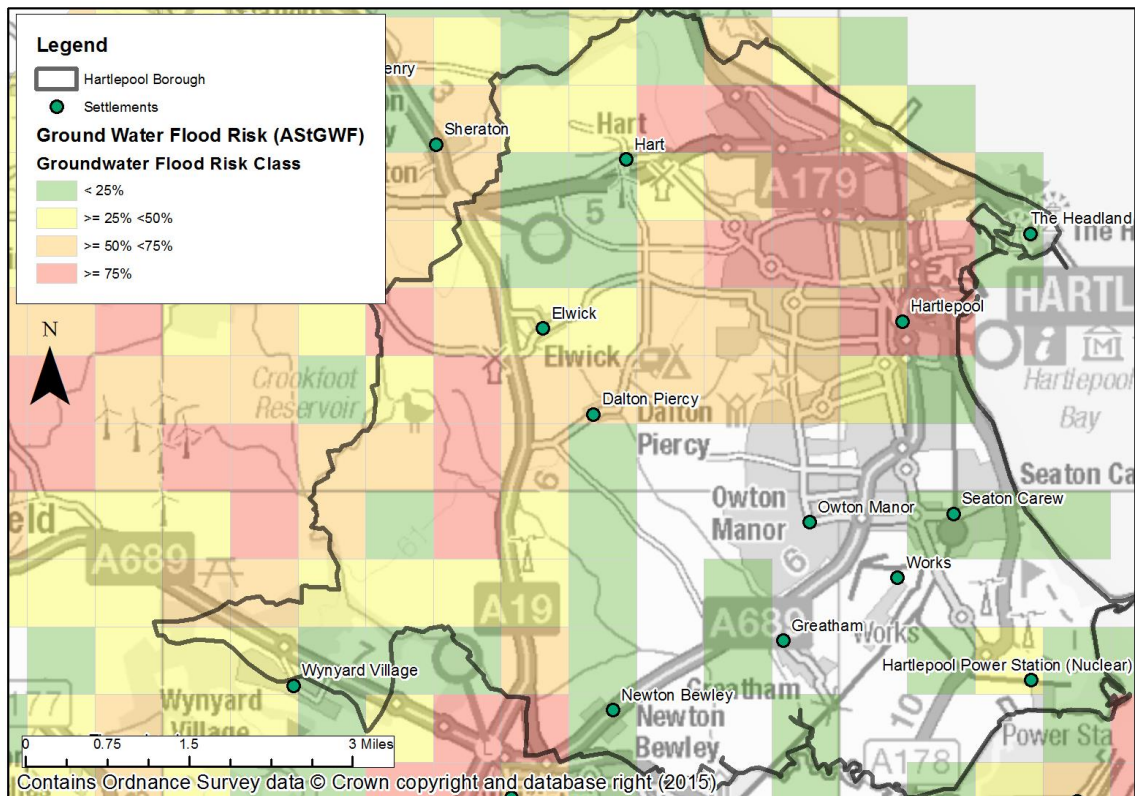


Figure 3-5: Areas Susceptible to Groundwater Flooding in Hartlepool

3.3 Other Flood Risks:

3.3.1 Main River Flood Risk

The management of flood risk from main rivers is the responsibility of the Environment Agency. It is important to understand wider flood risks in Hartlepool, because flood risks can occur due with different combinations of sources and risks. Table 3-1 lists and describes the main rivers in Hartlepool.

Table 3-1 Main rivers in Hartlepool

Main Rivers	Description
River Tees	It is located along the south-eastern boundary. Its catchment is of high conservation value, although the lower section and its estuary are predominantly urban and industrial.
Hart Beck	Hart Beck runs entirely within the borough and runs through the north of Hartlepool town.
Greatham Creek	It is located to the west of Hartlepool town, and runs south to the Tees estuary.
Claxton Beck	Claxton Beck runs south in the west of the borough until it meets North Burn.
North Burn	North Burn enters the borough in the west having arisen around Crookfoot Reservoir.

The Tees Catchment CFMP (Catchment Flood Management Plan) has four policy units, which cover the Hartlepool Borough; Tees Mouth to Ingleby, Greatham Beck, and Hartlepool. The CFMP identified that most floods on the Tees have occurred in winter, but summer and autumn floods have occurred. Historic river flooding has occurred within the policy unit for Hartlepool in 1684, 1753, 1704, 1837, 1869, 1881, 1918, 1963, 1968 and 1995. Most of the flooding in the Greatham Beck Policy unit occurred due to defence breaches in 1794, 1953, 1978, 1982 and 1983.

No additional flood mapping or modelling was completed for the strategy, as some mapping for Tunstall Farm Beck, in vicinity of Valley Drive and Burn Valley Beck where the watercourse enters the Stranton were re mapped as part of the SWMP.

The CFMP states that actual and potential flooding sources include the fluvial flooding on Burn Valley Beck, the Slake, sewerage system (in particular at High Tunstall), highway drainage system, tidal ingress, watercourses, overland flow, and culvert blockages. The flood flow is generated within the policy unit itself. The Slake, which drains into Victoria Harbour, is culverted for much of its length and is part of Northumbrian Water surface water drainage system. Recent GIS studies indicate that the Slake is not part of the NWL system and could be within the ownership of the old works or riparian ownership control.

3.3.2 Coastal Flood Risk

As with main rivers, the Environment Agency is responsible for the management of coastal erosion and tidal flooding. This information is provided for the purpose of highlighting wider flood risks and need for a holistic approach to flood risk management. Tidal flooding and coastal erosion form the most significant risks for Hartlepool BC and the Environment Agency.

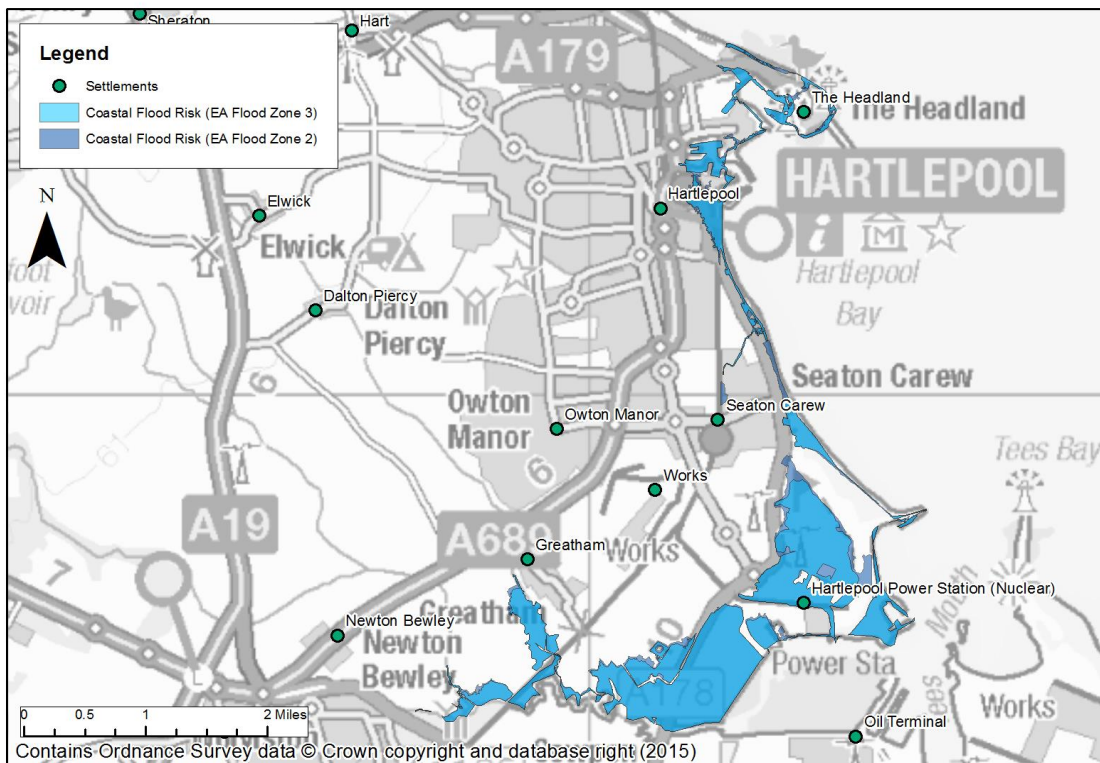


Figure 3-6 Hartlepool Coastal Flood Risk

A number of assessments and strategies on the coast of Hartlepool have been completed to date. These include the Shoreline Management Plan 2 and the Coastal Strategies which identify that the rate of erosion is likely to increase with sea level rise.

The River Tyne to Flamborough Head Shoreline Management Plan (SMP2) sets out detailed management to the north of Hartlepool and the Headland through to the Greatham Creek. It refers to detailed proposals being developed for North Sands and the need for a management plan for Seaton Dunes. There is an action plan and monitoring requirements that cover the three general areas: North

Hartlepool, Hartlepool Bay and Seaton Carew. There are three management areas identified in the SMP within Hartlepool; MA11, MA12 and MA13.

The Coastal strategy study splits the frontage into two distinct Management Units; termed the Northern Management Unit (NMU) and Southern Management Unit (SMU). Due to progressive lowering of the beach levels along the whole of the Northern Management Unit, the existing seawall foundations are regularly exposed and undermined. This area was subject to an investment scheme being delivered by the Environment Agency and Hartlepool BC.

The two strategies cover the full Hartlepool coastline and present long term, technically sound, environmentally acceptable and economically viable management options for the Hartlepool coastline over the next 100 years. The Strategies have been led by Hartlepool BC in consultation with the Environment Agency, Natural England and other key stakeholders. The Seaton Carew frontage protects 486 households within the 100 Year erosion envelope as well as a range of commercial properties, including hotels and shops.

There are a number of current schemes that have been developed from the strategies. These include the Headland and Structures Preliminary Options Study through partnership funding with the Environment Agency. The Seaton Carew strategy recommends managing the coastline as two Management Units with a series of phased works based on the residual life of existing structures. The two areas are the Northern Management Unit and the Southern Management Unit.

Northern Management Unit: The preferred coastal management option is to improve the defences within the next 5 years either by constructing a new sea wall, with a later addition of a low-crested rock revetment, or by immediate construction of a full height rock revetment. Both options have been demonstrated as viable. Increases in overtopping rates (due to future sea level rise) would be managed using promenade closures during storms.

Southern Management Unit: No works are proposed, and the recommended policy is to continue with “No Active Intervention”. The North Gare breakwater is a critical structure for the frontage, preventing loss of the dunes (which are designated as SPA and Ramsar) and beach to the north and protecting the shoreline to the south. Capital works are required to reinstate an effective structure. The recommended coastal management option is to provide a full height concrete armour layer to the existing structure within 10 years.

For the Seaton channel training wall (within MA13.4), the existing structure needs to be reinstated such that it effectively traps sand. Works would be undertaken within 10 years. No coastal protection works are proposed along the shoreline between the North Gare Breakwater and the Seaton Channel Training Wall, which would be managed under a “No Active Intervention” policy, provided the control structures be held (Environment Agency, 2011). Work started on site in March 2015 for the improvement of the coastal defences around the Headland. The work consists of the placement of rock armour and the installation of a new sea wall. The work once completed will protect over 500 homes from coastal erosion.

3.4 Flood Risk and Adapting to Climate Change

There is sufficient confidence in the technical quality of flood risk modelling and assessments to take account of flood risks and the impacts of climate change. Climatic changes can affect local flood risk in several ways. But impacts will depend on local conditions and vulnerability. The probability of wetter winters and more intense rainfall has the potential to cause more surface runoff, increasing localised flooding and erosion. These issues could increase pressure on drains,

sewers and water quality within the Borough. It is likely that storm intensity in summer could increase even in drier summers, so we should be prepared for the unexpected. There is the potential for rising sea or river levels, which may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

3.5 Local Flood Risk Areas

The **Action Plan** in section 6 and Appendix A identifies the priority local flood risk areas as Wards and proposed measures may be required in the short/medium term. These locations have been identified through reviewing the above existing assessments and plans. It is a high-level assessment, which outlines the potential measures and actions, or where more detailed investigations or option assessments are required. There are ten wards in Hartlepool and different assessments rank them differently. The three top priority wards identified through different assessments are shown listed below:

Priority wards by **SWMP areas** are:

- Seaton Ward
- Headland and Harbour Wards
- Rural West Ward

Priority wards by **Preliminary Flood Risk Assessment** are:

- Dee Bruce Ward
- Fens and Rossmere Ward
- Burn Valley Road Ward

Priority ward areas by **Critical Drainage Areas** are

- Seaton Ward
- Headland and Harbour Ward
- Burn Valley Ward

Table 3-2 shows the rank order of Hartlepool’s wards by different types of assessments:

Table 3-2 Showing rank order of Hartlepool Wards by different types of assessments

Hartlepool Wards	Preliminary Flood Area Rank	SWMP Priority sites Rank	Critical Drainage Areas Rank	Local Flood Risk Areas (Priority)
Seaton Ward	9	1	1	High
Headland and Harbour Ward	8	2	1	High
Rural West Ward	7	3	2	High
Manor House Ward	6	n/a	n/a	Low
Hart Ward	4	n/a	n/a	Low
Fens and Rossmere Ward	2	n/a	2	Medium
Foggy Furze Ward	10	n/a	2	Low

Burn Valley Ward	3	n/a	1	Medium
Victoria Ward	9	n/a	2	Low
Jesmond Ward	5	4	2	High
Dee Bruce Ward	1	5	2	High

For the LFRMS, the priority areas have been identified by overlaying the SWMP priority and intermediate areas against Wards. The list above highlights the top three wards identified by the SWMP. A list of priority ward areas has also been identified for the SFRA, the PFRA to identify areas of Local Flood Risk Priority. From combining the ranking of the different assessments, we are able to prioritise areas based on a combination of different flood risks defined as local, surface water run-off groundwater and non-main rivers.

It's important for Hartlepool BC and RMA's to understand where the priority areas are geographically and how they relate to population, infrastructure and business at risk. These priority areas are ranked low medium and high and could benefit from a range of local flood risk measures, which are appropriate to different levels and types of risks and agencies or authorities involved.

The prioritisation of measures and actions within the strategy and action plan has been drawn on the assessments undertaken in the SWMP, which is based on factors relating to the level of actual risk, to property, people key infrastructure and potential deliverability. This is a high level approach and does not propose a set of detailed costs and options. This framework approach allows open and transparent communication about where funding resources could be directed in relation to wider flood risks, and plans.

3.6 Actions undertaken since Surface Water Management Plan

There have been a number of projects which have been undertaken by Hartlepool BC since the publication of the Surface Water Management Plan. Details on how these relate to the local measures and proposed actions, is provided in section 6 and whilst current work being undertaken with FRM partners along the coastline are detailed in section 3.3.2. It is important to highlight a few of the projects undertaken, below.

Jesmond Ward

In 2014 Hartlepool BC installed property level protection to alleviate the risk of flood waters breaching the properties in Padstow Close. This project involved the installation of door barriers, air brick covers, non-return valves and other mitigation measures.

Rural West

Hartlepool BC have installed two highway gullies within the footpath and installed a raised kerb. The gullies will allow some of the overtopped water to re-enter the culvert before it can reach the property at Riverston Close.

There is an existing Hartlepool BC scheme for excavation and creation of an open cut drainage ditch, installation of headwalls and associated concrete pipework forming a culvert. Excavation and removal of existing highway drainage system and replace with 375mm diameter concrete pipe under an existing dual carriage way.

Hartlepool BC are involved in a scheme for installation of drainage channels and ACO drain to alleviate risk of flood waters breach the property at Thorn Tree Lane Seaton/Rural West Ward.

4 Local Flood Risk Management Objectives

This section sets out the local objectives we have developed and the outcomes we would like to achieve from our flood risk management work.

These objectives will allow us to set targets for managing flood risk and monitor progress of the LFRMS implementation.

4.1 Introduction

Hartlepool BC have developed a set of local objectives, using the guiding principles of the national strategy and the wider sustainability goals. These local objectives have been identified to enable a management of flood risks through a framework of measures which seek to strengthen the regeneration, planning policy and development management focus and service delivery with the Council.

4.2 National Context

The National Strategy for Flood and Coastal Erosion Risk Management Strategy for England (2011) and the National Planning Policy Framework (2012) form the two key policy documents, which need to be taken into account in the development of the LFRMS.

4.2.1 The National Flood and Coastal Erosion Risk Management Strategy for England (NFCERM) (2011)

This NFCERM strategy in England sets out **six 'guiding principles'** to assist LLFAs in their risk management activities:

- Community focus and partnership working;
- A catchment and coastal “cell” based approach;
- Sustainability;
- Proportionate, risk-based approaches;
- Multiple benefits; and
- Beneficiaries should be encouraged to invest in risk management.

It also states that risk effective flood risk management requires;

- An understanding of the risks of flooding and coastal erosion, working together to put in place long-term plans to manage these risks and **making sure that other plans take account of them;**
- **Avoiding inappropriate development** in areas of flood and coastal erosion risk and being careful to manage land elsewhere to avoid increasing risks;
- **Building, maintaining and improving** flood and coastal erosion **management infrastructure** and systems to reduce the likelihood of harm to people and damage to the economy, environment and society;
- **Increasing public awareness of the risk that remains and engaging** with people at risk to encourage them to take action to manage the risks that they face and to make their property more resilient;
- **Improving the detection, forecasting and issue of warnings of flooding, planning for and co-ordinating** a rapid response to flood emergencies and promoting faster recovery from flooding.

4.2.2 The National Planning Policy Framework (2012)

The core principles of the National Planning Policy Framework (NPPF) 2012 framework and practice guidance are based on achievement of sustainable development. This document is important and sets out how local plans and development management can deliver an effective management of flood risk infrastructure along to meet existing challenges and future needs.

Para 94 states that “Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand considerations”. It also states, in paragraph 100 that “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere...”. Paragraph explicitly states that “Local planning authorities should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast...”

4.3 Local Context

The Hartlepool LFRMS objectives have been drawn from the work undertaken by the Surface Water Management Plan (2012), the Strategic Flood Risk Assessment (2010) and the Preliminary Flood Risk Assessment (2011).

These local objectives for Hartlepool LFRMS are:

H1. Understand the areas that flood

H2. Manage the local flood risk in Hartlepool

H3. Enable people communities, businesses and local bodies to work more effectively together.

H4. Put communities at the heart of what we do and help Hartlepool residents during flood events, and recover as quickly as possible after incidents

H5. Promote sustainable solutions.



Figure 3-7 showing surface water ponding in Rural West Ward

4.4 Hartlepool Local Measures

Hartlepool local measures set out how we aim to meet the objectives of the national and LFRMS. These are drawn together from specific context of

Hartlepool's vision and the assessments and actions that have already been identified by the SWMP.

Effective flood risk management requires a combination of measures relating to investment in infrastructure and flood defences and non-structural measures. Measures can include raising awareness, and understanding of flood risk, the incorporate the development of flood risk policies and promotion of sustainable drainage systems.

Section 4.4. Local Measures

- 1. Maintaining the effective flood risk management approach to flood flow capacity of ordinary watercourse channels**
- 2. Appraise, adopt and monitor a range of full cost measures available to manage risks**
- 3. Multiple benefits minimise flood damage and make improvements, balance towards sustainable development objectives.**
- 4. Communication: Easily understood summaries, guidance and further information to raise awareness.**
- 5. Establish and maintain a register of assets or other features that help to manage flood risks.**
- 6. Costs and measures are clear and understood and reflect expected change and impacts of climate change**
- 7. Partnership and co-ordination of risk management activities to ensure prioritisation of capital investment.**
- 8. Establish and maintain a register of assets or other features that help to manage flood risks and maintenance regime of ditches and gullies**
- 9. Natural flood risk management measures, channel restoration, use of farmland to temporarily store water, reinstating wetlands, maintenance of river systems for water quality purposes, reduction in run off and diffuse pollution, aquifer recharge, provision or urban biodiversity, and green amenity spaces through use of SuDS.**
- 10. Linkages with land management activities, land use planning, infrastructure investment plans, regeneration and agriculture.**
- 11. Proportionate risk based approaches to local flood risk management duties as a Lead Local Flood Authority**
- 12. Using sustainable drainage systems in new developments and re-developments to manage surface water flood risk.**

4.4.1 Maintaining the Flow and Capacity of ordinary watercourses

Maintaining the flow of ordinary watercourses in terms of a flood management falls to lead authority of Hartlepool BC, landowners and riparian land owners.

Hartlepool BC has certain powers and provisions under legislation to carry out certain enforcement actions. These could relate to unauthorised works to an ordinary watercourse. Potential dredging options within watercourses are unlikely to be considered because of this method is not normal practice. The details of options for flood risk management schemes will be considered carefully at a more detailed stage of evaluation and environmental assessment.

There are certain types of works both temporary and permanent types of consent of Hartlepool BC and residents and developers wishing to carry out works on near, within or adjacent to a non-main river watercourse are encouraged to consult and further advice and guidance.

4.4.2 Appraise and adopt a full range of costs and measures

The strategy builds on approach which has been built by an appraisal and options, approach to previous assessments undertaken by the SWMP, the SFRA, PFRA and the Headland and Seaton Carew Strategies. This strategy does not have the detailed costs and measures, because it forms a strategic framework of local priority areas of local flood risk areas.

4.4.3 Multiple Benefits towards Sustainable Development

Multiple benefits and sustainable development approach to flood risk management can only be achieved through the development of a strategic framework. There are a number of key departments within Hartlepool BC “Lead Local Flood Authority” and each department or function can contribute to an effective flood risk management approach. The co-ordination of these benefits through a local strategy framework, can greatly benefit from a greater understanding and communication of risks, so that potential measures provide opportunities to deliver benefits to wider range of services or developments.

4.4.4 Communication

Communicating flood risks, communicating effectively to raise awareness of flood risks across the different roles and responsibilities of Lead Local Flood Authority is important. The website currently has limited information and we want to be able to communicate the level of risks, and provide enough information to direct you to sources of information on local flood risk management.

4.4.5 Partnership and co-ordination

The role of partnership across RMA’s is critical to success of effective flood risk management and Hartlepool BC has established a strong “business as usual” approach to collaboration and working partnerships. The Pitt Review (2008) clearly advocated the need for closer integration and partnership working and the level of collaborative work undertaken to date in Hartlepool, will continue to strengthen, making best use of the strategy framework of local measures.

The pre-planning and preparedness work led by the Emergency Planning Unit is critical to the planning of flood risks, the co-ordination of a multi-agency response and the recovery and resilience of the communities in Hartlepool will continue to form an important role within the strategy.

4.4.6 Establish and maintain an asset register

Hartlepool BC have an asset register of significant flood risk features as required by the FWMA. These features require a sufficient level of detail to build into a

detailed risk assessment and prioritisation of maintenance and investments. The building and maintenance of an effective easy to use asset register system should help to communicate the risks and investment requirements to manage flood risk.

Designation of features does not form a duty, but a permissive power and there has to be significant justification for a designation of a feature for flood risk management purposes. There are no designated features or record of designated features in Hartlepool BC.

4.4.7 Natural Flood Management

Hartlepool has already been involved in the naturalisation of flood channels and removal of culverted sections. This is important for a number of reasons relating to ecology and management of flood risk and the improvement of the water quality status of watercourses. The Council actively seeks to restore watercourses that have previously been culverted, because of the benefits to flood risk management.

Hartlepool BC has certain powers and provisions under legislation to carry out certain enforcement actions. There are certain types of works both temporary and permanent, which could require the written consent of the Lead Local Flood Authority. Residents and developers wishing to carry out works are encouraged to consult and seek advice of the Council.

4.4.8 Land Management, Land Use Planning, Infrastructure Investment and Agriculture

Planning and regeneration play a key role in the management of existing and future risks associated with local flood risk and surface water-run off. As land management activities, planning and new developments or regeneration proposals can significantly affect local flood risk to population and infrastructure. The strategic environmental assessment highlights the importance of integrating the delivery of local measures with the planning system to ensure sufficient investment is identified and a long term view to risks is managed to maximise benefits to urban and rural areas of Hartlepool. It is important that opportunities to improve the management of flood risk are co-ordinated and monitored through the use of measures and indicators so that flood risks are not transferred, increased or increased elsewhere. These are important to the sustainability of rural and urban developments that local flood risk measures are reflected in Local Development Plan policies and mechanisms for securing funds and investment required. The adoption of the supplementary planning guidance on SuDs promote this integrated approach required by objective H5 of this local strategy.

4.4.9 Sustainable Drainage Systems

The provisions for the adoption of sustainable drainage systems are set out in the FWMA and whilst this has largely been superseded by the implementation of planning procedural changes in March 2015 (for developments of 10 or more housing units or equivalent mixed use developments). The provisions of the FWMA still remain and there is a duty for planning and environmental departments to consider the design functions, assessments and adoption of sustainable drainage schemes. A positive planning approach to the management of surface water run off to new developments or redevelopments can ensure that local flood risks are not exacerbated and development is appropriate and sustainable. Development can positively contribute to management of surface water runoff and reduce previous uncontrolled greenfield run-off rates, creating a betterment of local flood risk.


Hartlepool BC in collaboration with the Tees Valley Authorities has recently developed a set of Local Standards for Sustainable Drainage. This set of standards was adopted in November 2015 and will help to promote a consistent

use and development of Sustainable Drainage Systems (SuDS) across the Borough.

4.4.10 Proportionate risk based approach to flood risk management duties

Flood risk issues, which are reported to Hartlepool, are prioritised on a risk to property and people basis. There have been no formal investigations under section 19 of the Flood and Water Management Act 2010 to date. Table 5-1 below illustrates the risk-based approach taken by Hartlepool BC to flood risk investigations.

Table 4-1: Criteria for flood investigations at Hartlepool

Priority	Incident	Formal Investigation and Reporting
	Flooding that has led to a risk to life. Internal flooding >1 property in one location	Always
	Flooding to critical and vulnerable services e.g. schools, electricity sub station	Always/Discretion – depending on the severity of the issues, risks and potential impact
	Flooding to priority highways making the road impassable for over 24 hours	Discretionary- depending on the nature of the incident
Depending on the nature and severity of the event, the council will investigate other flooding incidents at its discretion. The Council is unlikely to investigate minimal flooding to gardens.		

4.5 Wider Environmental Objectives

The principles of a strategy need to strongly adhere to the principles of sustainable development and the wider environmental benefits of flood risk management. The wider benefits and objectives relate to the Water Framework and the River Basin Management Plan and Flood Directive.

4.5.1 Water Framework Directive

The Water Framework Directive (WFD) (2000/60/EC) is the most substantial piece of EC water legislation to date and is designed to improve and integrate the way water bodies are managed throughout Europe. It came into force on 22 December 2000 and was transposed into UK law in 2003 via the Water Environment (Water Framework Directives) (England and Wales) Regulations 200361. Member States must aim to reach good chemical and ecological status in inland and coastal waters by 2015. It is designed to:

- Prevent deterioration in the classification status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- Aim to achieve at least good status for all waters. Where this is not possible, good status should be achieved by 2021 or 2027;
- Promote sustainable use of water as a natural resource;
- Conserve habitats and species that depend directly on water;

- Progressively reduce or phase out releases individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants;
- Contribute to mitigating the effects of floods and droughts.

The Water Framework Directive establishes new and better ways of protecting and improving rivers, lakes, groundwater, transitional (where freshwater and sea water mix) and coastal waters. In order to achieve this, in 2009 the Environment Agency, and revised Northumbrian River Basin Management Plans due for publication March 2016 will set out measures to protect and improve the water environment. There is a shared vision by risk management authorities 2021 and 2027, to ensure that the water bodies' status does not deteriorate from standards set in 2009 as part of the initial River Basin Management Plans.

It is important that measures to manage local flood risk do not cause deterioration of water bodies and should consider opportunities to improve water bodies in conjunction with local flood risk management.

4.5.2 The Northumbria River Basin Management Plan

This plan addresses the pressures facing the water environment in the River Basin Management Plan Districts and the actions that will address them. It has been prepared under the Water Framework Directive, and is the first of a series of six year planning cycles. The plan describes required measures to improve the water environment over the next 20 years and aims to achieve Water Framework Directive targets for 2015. It will include an assessment of river basin characteristics, a review of the impact on human activity, statuses of water bodies, and an economic analysis of water use.

The River Basin Management Plans, like the CFMP, are important documents relevant to the development of the LFRMS. The LFRMS should therefore not hinder their aims and objectives but has the potential to contribute to the achievement of them.

4.5.3 Floods Directive

EU Floods Directive (2007/60/EC) on the assessment and management of flood risks. The Directive requires EU Member States to assess if their watercourses and coast lines are at risk from flooding; to map the flood extent and assets and humans at risk in these areas; and to take adequate and coordinated measures to reduce this flood risk. In the UK this is being carried out in coordination with the Water Framework Directive. The aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity.

The Flood Risk Regulations (2009) requires a six yearly cycle of three stage assessments. The first cycle has required the

- Development of Preliminary Flood Risk Assessments (PFRA) Published 22nd December 2011 and are due to be reviewed by 2017;
- Hazard mapping for flood risk areas identified by PFRA were Published December 2013 and are due to reviewed by 2019;
- Publication of Flood Risk Management Plans by March 2016 and review by 22nd June 2021.

Hartlepool is not a significant risk area and is not required within this first cycle of the Flood Risk Regulations (2009) to prepare hazard maps or a flood risk management plan. The PFRA for Hartlepool (2011) did not identify a cluster of flood risk which exceeded 30,000 people threshold set by Environment Agency. It used a local threshold of significance which included 200 properties, 20 businesses or one key infrastructure to identify key areas of local flood risk.

5 Strategic Environmental Assessment

This section will explain the strategic environmental assessment undertaken alongside the development of the draft strategy.

5.1 Introduction

Strategic Environmental Assessments or SEA involves the appraisal of the potential environmental impacts of plans and programmes, including strategies prior to their approval and formal adoption. The local strategy is considered a statutory plan and so a strategic environmental assessment has been undertaken during the drafting of the local flood risk strategy in five stages.

The assessment of the LFRMS objectives and measures, in the environmental report, identified a number of areas where the LFRMS could be strengthened to ensure delivery of a sustainable approach. These areas are associated with social and financial aspects to managing flood risk within the Borough, and not directly aiming to implement FRM measures.

5.2 Screening and Scoping

The local strategy is considered a statutory plan and so a strategic environmental assessment has been undertaken during the drafting of the local flood risk management strategy.

The SEA Scoping Report for the LFRMS was issued to the statutory consultation bodies in November 2015. A number of comments were received on the scope of the assessment and assessment framework, which were incorporated into the preparation of this Environmental Report.

5.3 Environmental Report

The Environmental report details the assessment of the LFRMS objectives and measures. The assessment of the SEA objectives against three management options ('do nothing', 'maintain current flood risk management regime' and 'manage and reduce local flood risk') was undertaken. This identified the potential effects on the environment associated with these different management actions.

The 'do nothing' option is likely to result in a number of significant adverse effects, particularly in relation to people and property, and other environmental assets including historic sites and biodiversity, where increased flooding may create new pathways for the spread of invasive non-native species. Surface water and groundwater quality could also be adversely affected, with increased flooding of contaminated sites leading to greater impacts on water resources. Conversely, increased flood risk may result in greater connectivity between watercourses and their floodplains, offering opportunities for habitat creation to benefit a range of protected and notable species.

It was evident that by doing nothing or maintaining current levels of management, there are likely to be detrimental effects on the SEA objectives, which may be prevented by carrying out active flood risk management as proposed by the LFRMS.

5.4 Habitats Regulation Assessment

A Test of Likely Significant Effect (TLSE) (screening assessment) has been prepared in accordance with the requirements of the Habitats Regulations to determine whether the LFRMS is likely to have a significant effect on a European site (alone or in combination). The screening assessment concluded that the LFRMS is not likely to have a significant effect on any of the European sites shown in Appendix A of the Environmental Report.

Consultation with Natural England on the outcomes of the screening assessment was undertaken as part of the SEA scoping consultation exercise. Natural England confirmed that a TLSE is required.

Following development of the draft strategy objectives and measures, the screening assessment was reviewed to determine whether the LFRMS would be likely to have a significant effect on the European sites. The outcomes of this screening assessment are documented in Appendix A of this report. The screening assessment concludes that the LFRMS is not likely to have a significant adverse effect on a European site.

Consultation with Natural England on the outcomes of this assessment will be undertaken as part of the consultation process outlined in Section 7 of the Environmental Report.

6 Action Plan

The Action Plan is the primary tool for implementing the 'what' and 'how' of the local strategy.

6.1 Background Information

The action plan has been developed from the priority areas set out in the SWMP. The priority areas have been overlaid against both the critical drainage areas and locally significant areas identified by the preliminary flood risk assessment to identify key areas for the strategy in terms of wards and range of potential measures.

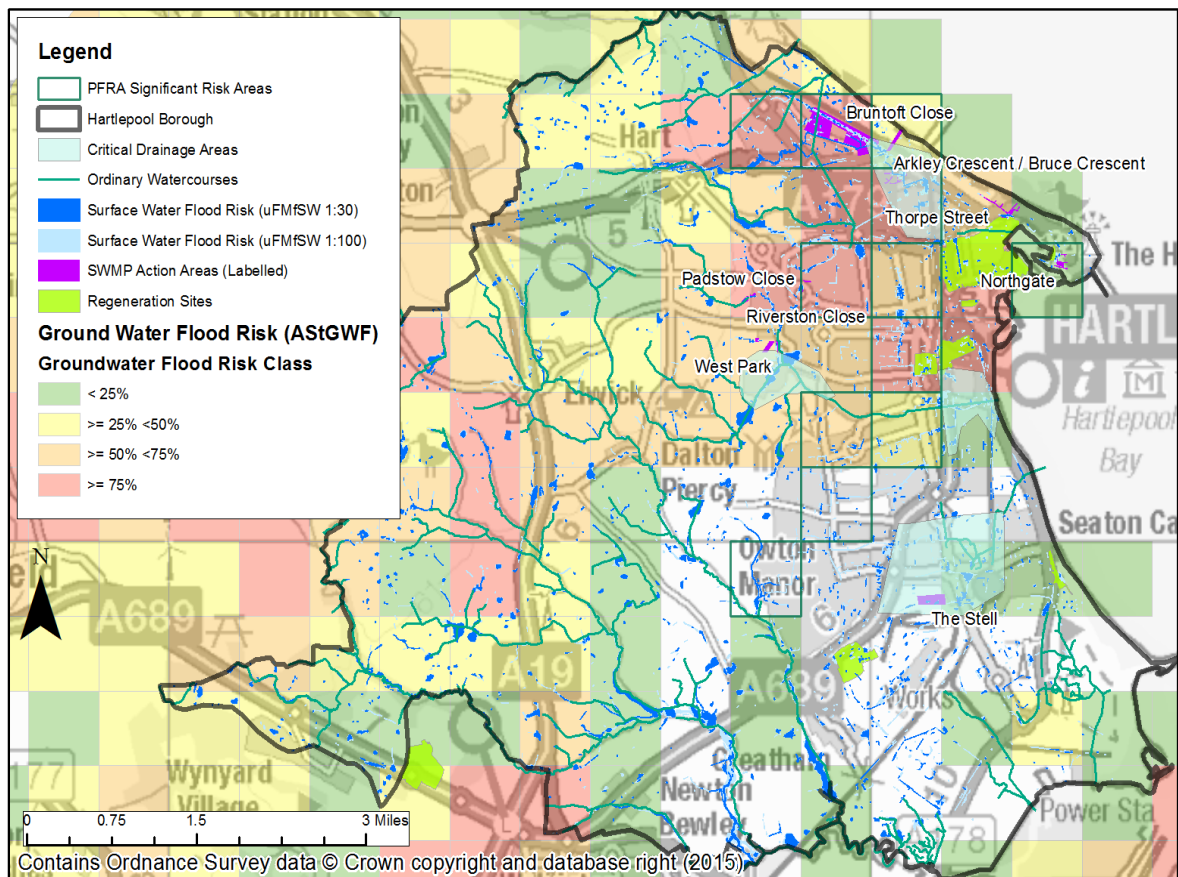


Figure 3-8 Local flood risk areas identified by different flood risk assessments and plans

The Surface Water Management Plan (2012) identified eight priority areas for flood risk management works and a long list of 37 intermediate sites. The priority sites include short and medium term scheme options and the intermediate sites identify medium and long-term options. The priority and intermediate sites form the focus of the LFRMS in terms of identifying and prioritising measures to reduce flood risk. Phase 3 of the SWMP identified a number of key hotspots and investigated these in detail.

A long list of options has been developed for the eight priority sites in conjunction with Hartlepool BC and Northumbrian Water. A high-level action plan within the SWMP was developed based on the findings of the long list of options and the detailed investigations. To date options that could be progressed by Hartlepool BC independently have been the more complex options requiring multiple

stakeholder input; these options are expected to be progressed in the medium to long term.

The proposed actions within this action plan for Hartlepool BC to deliver, have been developed across the Lead Local Flood Authority functions and with key stakeholders and RMA's.

The detailed costs and benefits attributed to the proposed options are provided within the Surface Water Management Plan. The strategic environment assessment undertaken using three scenarios identifies the adverse benefits of a "do nothing", the short to medium benefits of "maintaining a current flood risk management regime" and option of "manage and reduce flood risk which has the potential if designed and implemented for potential direct and indirect benefits.

6.2 The Hartlepool Action Plan

The prioritisation of measures and actions within the strategy and action plan will be based on a number of factors including the level of actual risk, to property, people, key infrastructure, and potential deliverability. The action plan for the purposes of this strategy is strategic and outlines the actions, or proposed actions and options within a range of measures.

The local flood risk priority areas have been identified through a ranking of the priority **SWMP areas**, in wards which has identified the top three as;

- Seaton Ward
- Headland and Harbour Wards
- Rural West Ward

The identification of local priority areas by wards helps to understand how these relate locally and the grouping of areas or sites within different areas. From the earlier figures it was clear that there was a strong correlation between the PFRA and SFRA and SWMP with the exception of Seaton Carew. The groundwater flooding maps also show a high probability of flooding within Hartlepool town centre. These two show that regeneration proposals and town centre development will need to strongly integrate within the strategy framework, and the range of measures need to be suitable for purpose and carefully monitored.

The overlaying of regeneration sites also shows a strong correlation and opportunity for new investment based approach to local flood risk management based on principles of sustainable development as shown in Figures in Appendix A. These figures also show the relationship between sites, priority areas and PFRA.

The action plan forms an iterative document which can be developed in partnership with other RMA's within the six years lifecycle of the strategy.

6.3 The Action Plan

Table 6-1: Hartlepool LFRMS Action Plan

		Actions							Timescales		
Priority Area or Intermediate Area SWMP	Area ID	Measures	SWMP Action Area	Hartlepool Ward	CDA	Regeneration Site	Overlapping SWMP Action Areas	SWMP Existing Actions	Short	M/L	RMA's
PA	1	1. Maintaining the effective flood risk management approach to flood flow capacity of ordinary watercourse channels 2. Appraise and adopt full range of whole life cost measures available to manage risks	The Still - Quick Win Site	Seaton	The Still near Seaton			The preferred approach at this site would be to increase the culvert capacity (Option 1)	X		HBC
PA	2	3. Multiple Benefits minimise flood damage and make improvements, balance towards sustainable development objectives. 4. Communication: Easily understood summaries, guidance and further information	Riverton Close - Quick Win Site	Rural West				Improved maintenance (Option 1). Provide upstream attenuation (large works) Option 3 and or Option 4-Local Resilience improve flood resilience to 'at risk' properties. Actions completed to date: HBC have installed two highway gullies within the footpath and installed a raised kerb. The gullies will allow some of the overtopped water to re-enter the culvert before it can reach the property.	X		HBC
PA	3	5. Establish and maintain a register of assets and features that help to manage flood risks 7. Partnership and co-ordination of risk management activities to ensure prioritisation of capital investment	Padstow Close - Quick Win Site	Jesmond				Receptor based with further preliminary assessment required. Option 3 Install connections into Surface Water Network and Option 4 Local Resilience improve flood resilience to 'at risk' properties. (Option 1: land drainage controls and control runoff from Newquay Close) Actions completed to date: HBC installed property level protection in 2014	X	X	HBC/ NWL
PA	4	7. Partnership and co-ordination of risk management activities to ensure prioritisation of capital investment	Bruntoft Avenue - Optioneering Investigation Site	De Bruce	Middle Warren Watercourse Area			Investigate and mitigate the blockage in the Brus Pumping Station CSO (Option 2) and removal of land drainage (Option 1-short term) and Progressive separation of surface water (Long term) dependant on findings of the analysis and if suggested that problems are likely to persist)	X	X	HBC/ NWL

PA	5	6. Costs and Measures are clear and understood and reflect expected change and impacts of climate change 8. Establish and maintain a register of assets or other features that help to manage flood risks and maintenance regime of ditches and gullies	Northgate - Optioneering Investigation Site	Headland and Harbour				Over a longer period, it may prove more beneficial to adopt Option 2-long term (Separation of Surface Water Network) if climate change effects will overwhelm the short-term benefits provided by Option 1 (Installation of Additional Gullies).	X	X	HBC/ NWL
PA	6	3. Multiple Benefits, minimise damage and make improvements, balance	Thorpe Street - Optioneering Investigation Site	Headland and Harbour		3 - Port Estates		All 3 options highlighted to provide long-term sustainable benefit in reducing flood risk in this location. All options should be progressed. Option 1 installation of additional gullies, Option 2 separation of highway drainage to outfall and Option 3 separation of surface water system to outfall. Phasing should be Option 1, Option 3 and Option 2. Further findings required for Option 1 (See section 8 SWMP) Actions completed to date: Hartlepool BC installed additional gullies in Thorpe Street and NWL have installed flap valve on sea outfall to prevent backflow.	X	X	HBC/ NWL
PA	7	3. Multiple Benefits, minimise damage and make improvements, balance	Bruce Crescent/Arkley Crescent - Detailed Investigation Site	De Bruce	Middle Warren Watercourse Area			Combination of Options 1 and 2 recommended. Option 1 Attenuation and eventual separation of surface water. Option 2 Installation of additional gullies. This is dependent on investigations of Brus Pumping Station.		X	HBC/ NWL
PA	8	9. Natural flood risk management measures, channel restoration, use of farmland to temporarily store water, reinstating wetlands, maintenance of river systems for water quality purposes, reduction in run off and diffuse pollution, aquifer recharge, provision of urban biodiversity, and green amenity spaces through use of SuDs. 10. Linkages with land management activities, land use planning, infrastructure investment plans, regeneration and agriculture. 12. Using sustainable drainage systems in new developments and re-developments to manage surface water flood risk	West Park - Detailed Investigation Site	Rural West	Tunstall Farm Beck Area around West park			Option 1 short term Improved watercourse maintenance (Confirmation of existing capacity and operation of local sewer network, confirmation of system discharges, survey of local channel, camera of key culverts and development of hydraulic model of watercourse. Option 4 - medium term- Increase local resilience. Option 3 -medium term- Management of overland flow paths. Option 5 - medium term Installation of additional gullies. Option 6 long term Separation of surface water network. Actions completed to date: Hartlepool BC have installed a surface water interception ditch in High Tunstall School field to prevent run -off to fields into adjacent gardens.	X	X	HBC
IA	1	2. Appraise and adopt full range of whole life cost measures available to manage risks	Redwood Close	Hart ward				Optioneering Investigation		x	HBC
IA	2	2. Appraise and adopt full range of whole life cost measures available to manage risks	Ravensworth Crescent	De Bruce				Optioneering Investigation		x	HBC
IA	3	2. Appraise and adopt full range of whole life cost measures available to manage risks	Hart Village	Hart ward				Optioneering Investigation		x	HBC

IA	4	2. Appraise and adopt full range of whole life cost measures available to manage risks	Bamburgh Road	Hart ward				Optioneering Investigation			HBC
IA	5	2. Appraise and adopt full range of whole life cost measures available to manage risks	Bruntoft Avenue	De Bruce	Middle Warren Watercourse Area		Bruntoft Close	Optioneering Investigation		x	HBC
IA	6	2. Appraise and adopt full range of whole life cost measures available to manage risks	Bruce Crescent/Arkley Crescent	De Bruce	Middle Warren Watercourse Area		Arkley Crescent/ Bruce Crescent	Detailed Investigation		x	HBC
IA	7	11. Proportionate risk based approaches to local flood risk management duties as Lead Local Flood Authority	Easington Road	Headland and Harbour, De Bruce, Hart Ward and Jesmond	Middle Warren Watercourse Area		Arkley Crescent/ Bruce Crescent	Quick win investigation	x		HBC
IA	8	2. Appraise and adopt full range of whole life cost measures available to manage risks	Thorpe Street	Headland and Harbour		3 - Port Estates	Thorpe Street	Optioneering Investigation		x	HBC
IA	9	2. Appraise and adopt full range of whole life cost measures available to manage risks	Jesmond Gardens	Jesmond				Optioneering Investigation		x	HBC
IA	10	2. Appraise and adopt full range of whole life cost measures available to manage risks	Powlett Road	Headland and Harbour, De Bruce and Jesmond		3 - Port Estates		Optioneering Investigation		x	HBC
IA	11	2. Appraise and adopt full range of whole life cost measures available to manage risks	Northgate	Headland and Harbour		5 - The Headland	Northgate	Optioneering Investigation		x	HBC
IA	12	12. Proportionate risk based approaches to local flood risk management duties as Lead Local Flood Authority	Worset Lane	Hart ward, Jesmond and Rural West ward				Quick win investigation	x		HBC
IA	13	2. Appraise and adopt full range of whole life cost measures available to manage local flood risks	Exmoor Grove	Jesmond				Optioneering Investigation		x	HBC
IA	14	12. Proportionate risk based approaches	Riverston Close	Rural West			Riverston Close	Quick win investigation	x		HBC
IA	15	12. Proportionate risk based approaches	Padstow Close	Jesmond and Rural West			Padstow Close	Quick win investigation	x		HBC
IA	16	2. Appraise and adopt full range of whole life cost measures available to manage local flood risks	Raby Road	Victoria and Jesmond				Optioneering Investigation		x	HBC
IA	17	2. Appraise and adopt full range of whole life cost measures available to manage local flood risks	Rillston Close	Rural West				Optioneering Investigation		x	HBC
IA	18	2. Appraise and adopt full range of whole life cost measures available to manage local flood risks	Murray Street	Victoria				Optioneering Investigation		x	HBC
IA	19	13. Proportionate risk based approaches to local flood risk management duties as Lead Local Flood Authority	Elwick Road - Devils Elbow	Rural West				Quick win investigation	x		HBC
IA	20	2. Appraise and adopt full range of whole life cost measures available to manage local flood risks	Elwick - The Green	Rural West				Optioneering Investigation		x	HBC
IA	21	2. Appraise and adopt full range of whole life cost measures available to manage local flood risks	West Park	Rural West	Tunstall Farm Beck Area around West park		West Park	Detailed Investigation.		x	HBC
IA	22	12. Appraise and adopt full range of whole life cost measures available to manage local flood risks	Valley Drive	Rural West	Tunstall Farm Beck Area around West park		West Park	Detailed Investigation. Actions completed to date: EA have installed new trash screens in 2015 to		x	EA

								improve the flow through culverted sections.			
IA	23	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Stranton	Burn Valley and Headland and Harbour	Tunstall Farm Beck Area around Stranton			Detailed Investigation		x	HBC
IA	24	12.Proportionate risk based approaches to local flood risk management duties as Lead Local Flood Authority	Dalton Piercy	Rural West				Quick win investigation	x		HBC
IA	25	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Kingsley Avenue	Foggy Furze				Optioneering Investigation		x	HBC
IA	26	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Oban Avenue	Foggy Furze				Optioneering Investigation		x	HBC
IA	27	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Haswell Avenue	Foggy Furze				Optioneering Investigation		x	HBC
IA	28	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Tynebrook Avenue	Foggy Furze and Manor House				Optioneering Investigation		x	HBC
IA	29	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Tanfield Road	Foggy Furze				Optioneering Investigation		x	HBC
IA	30	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Monkton Road	Manor House and Rural West				Optioneering Investigation		x	HBC
IA	31	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Torquay Avenue	Fens and Rossmere, and Seaton	The Stell near Seaton			Detailed Investigation		x	HBC
IA	32	13.Proportionate risk based approaches to local flood risk management duties as Lead Local Flood Authority	The Stell - Brenda Road/Seaton Lane	Seaton	The Stell near Seaton		The Stell	Quick win investigation		x	HBC
IA	33	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Ruswarp Grove/Elizabeth Way	Seaton				Detailed Investigation		x	HBC
IA	34	2.Appraise and adopt full range of whole life cost measures available to manage local flood risks	Tees Road/South End	Seaton		7 - Seaton Carew		Detailed Investigation		x	HBC
IA	35	2.Proportionate risk based approaches to local flood risk management duties as Lead Local Flood Authority	Tees Road/Zinc Road	Seaton				Quick win investigation	x		HBC
IA	36	2. Appraise and adopt full range of whole life cost measures available to manage local flood risks.	Tees Road/Brenda Road Roundabout	Seaton				Optioneering Investigation		x	HBC
IA	37	2.Proportionate risk based approaches to local flood risk management duties as Lead Local Flood Authority	Thorn Tree Lane	Seaton, and Rural West				Quick win investigation	x		HBC

7 Funding the LFRMS

This section provides an overview of key funding sources that may provide resources to support the delivery of the LFRMS and its Action Plan.

7.1 Flood and Coastal Resilience Partnership Funding

In 2012/13, a new approach to funding of flood alleviation schemes was introduced, based on the outcomes of the proposed schemes. Flood and Coastal Resilience Partnership funding, was designed to allow more schemes to proceed, by supplementing funding from Central Government with additional contributions from the private and public sectors.

A cost-benefit analysis is carried out on the schemes and outcome measures calculated to ascertain the amount of funding a scheme can receive. For most schemes, additional funding is required which needs to be secured through other sources to enable a scheme to proceed.

Local Authorities have the opportunity to bid for FCERM funding; all proposals are assessed and if successful, they are allocated to the Medium Term Plan for funding in a given year.

7.2 Local Levy

Regional Flood and Coastal Committees (RFCCs) have responsibility for allocating the local levy which can be used to supplement Grant in Aid. An annual levy is charged to each local authority based on the numbers of properties in its area, within a Council Tax banding. The total sum raised from all North East Local Authorities is open to bids from the Councils, Environment Agency or Northumbrian Water. The amount of levy allocated to projects is discussed by the Programme and Investment sub group of the RFCC. The final programme for funding is decided at the RFCC meeting on an annual basis and changes need to be agreed at the committee.

7.3 Surface Water Disposal Charge

Since April 2015, all new major developments (10 properties or more) are required to incorporate a means of surface water disposal, by using sustainable drainage systems. Such systems will need to be maintained for the lifetime of the development and there are various options for this maintenance, through the local authority, a management company appointed by the developer or the local water and sewerage company (Northumbrian Water).

A surface water disposal charge is levied on all properties served by a sustainable drainage system regardless of who maintains the system and the monies raised from the charge fund the maintenance of that system. The level of charge is specific to a development and is determined by the cost of maintenance over the lifetime of the system. All properties on a development, using the same system will pay the same charge however, charges may vary from development to development, as drainage systems can be very different and are specific to a development. Northumbrian Water will not currently maintain SuDs.

7.4 Private Funding

Recent changes to Grant in Aid allow private contributions; to supplement central government funding. Local businesses, commercial organisations, private individuals, in fact anyone who may benefit from a flood defence scheme can contribute towards the resourcing of these schemes.

7.5 Section 106 Contributions

The Town and Country Planning Act 1990, Section 106; allows a local planning authority to enter into an agreement with a landowner/ developer when granting planning permission. The agreement is used to address issues and secure funding to support the development through service or infrastructure improvement.

7.6 Community Infrastructure Levy

The Community Infrastructure Levy came into force in April 2010. It allows local authorities in England and Wales to raise funds from developers undertaking new building projects in their area. The money can be used to fund a wide range of infrastructure that is needed because of development. This includes new or safer road schemes, flood defences, schools, hospitals and other health and social care facilities, park improvements, green spaces and leisure centres.

7.7 Local Authority Funding

The Council actively seeks grant funding for schemes, all opportunities are considered and where appropriate the Council will submit a bid. Sometimes grants are available purely for flood risk but often the council will look to resource flood risk improvements alongside other proposals such as highways improvements.

8 Monitoring and Review

The LFRMS is a 'living' document which will be monitored and updated to monitor and update the strategy moving forward.

8.1 Monitoring Measures

Monitoring indicators linked to the proposed measures will need to be drawn up and used in the Corporate Strategy and Risk Register to monitor implementation and actions, effectively.

8.2 Review cycle

In order for the strategy to remain fit for purpose and effectively manage flood risk, it will act as a living document which is continually updated on an annual basis. This will ensure that it informs the corporate strategy, service plans, and plans and strategies drawn up with other risk management authorities.

The monitoring and updating will ensure that any review of the strategy will be simplified and follow the review of the preliminary flood risk assessments in 2017.

The cyclical nature of the preliminary flood risk assessments and the continual updating of the strategy will facilitate an increased understanding of risk and provide the framework for a risk based approach to flood risk management.

8.3 Limitations

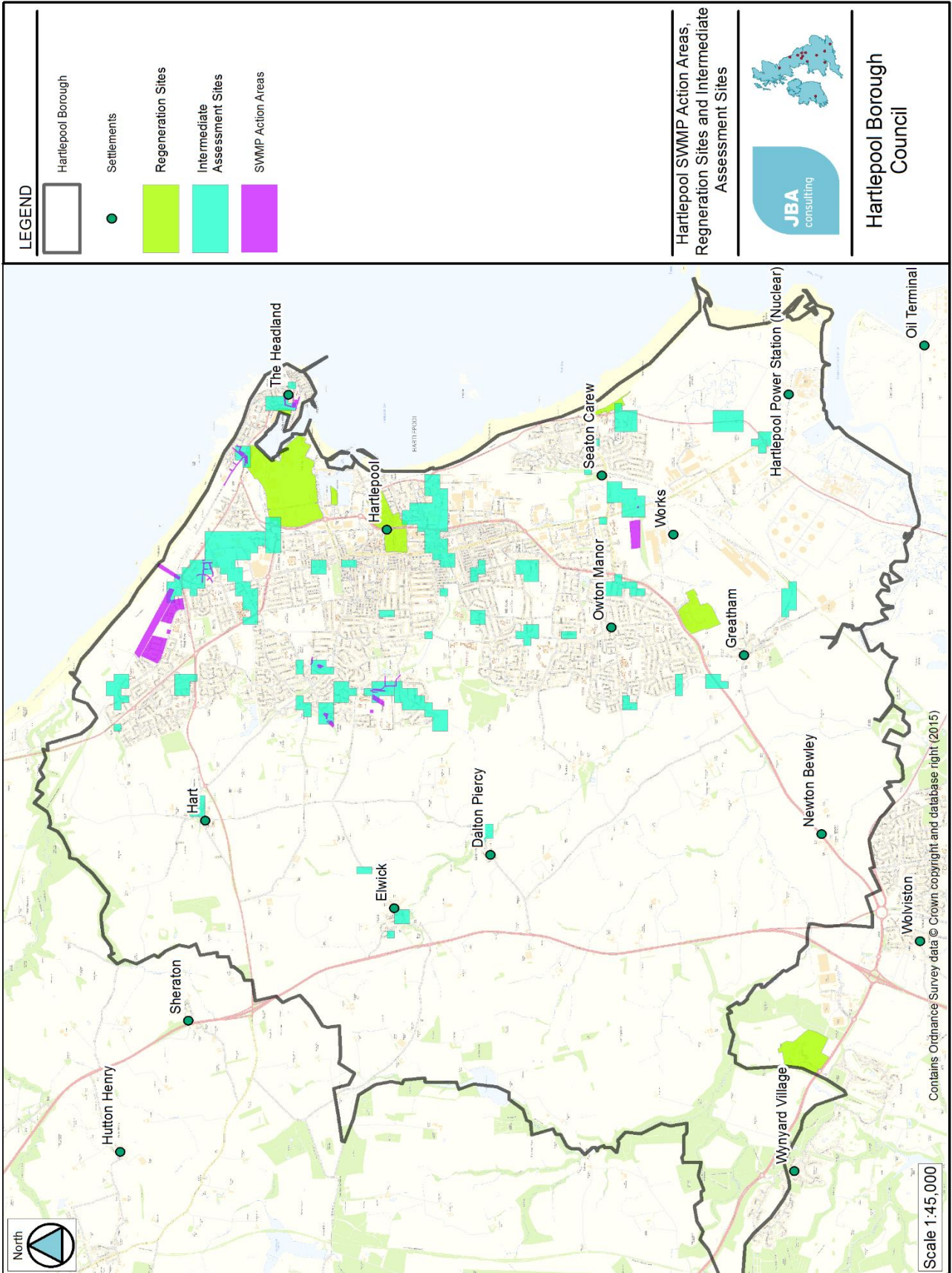
This strategy was drafted ahead of the flooding events of December 2015 and is based on current and available information at the time. Any significant changes to national or local policy or flood risk information could initiate a review of the strategy.

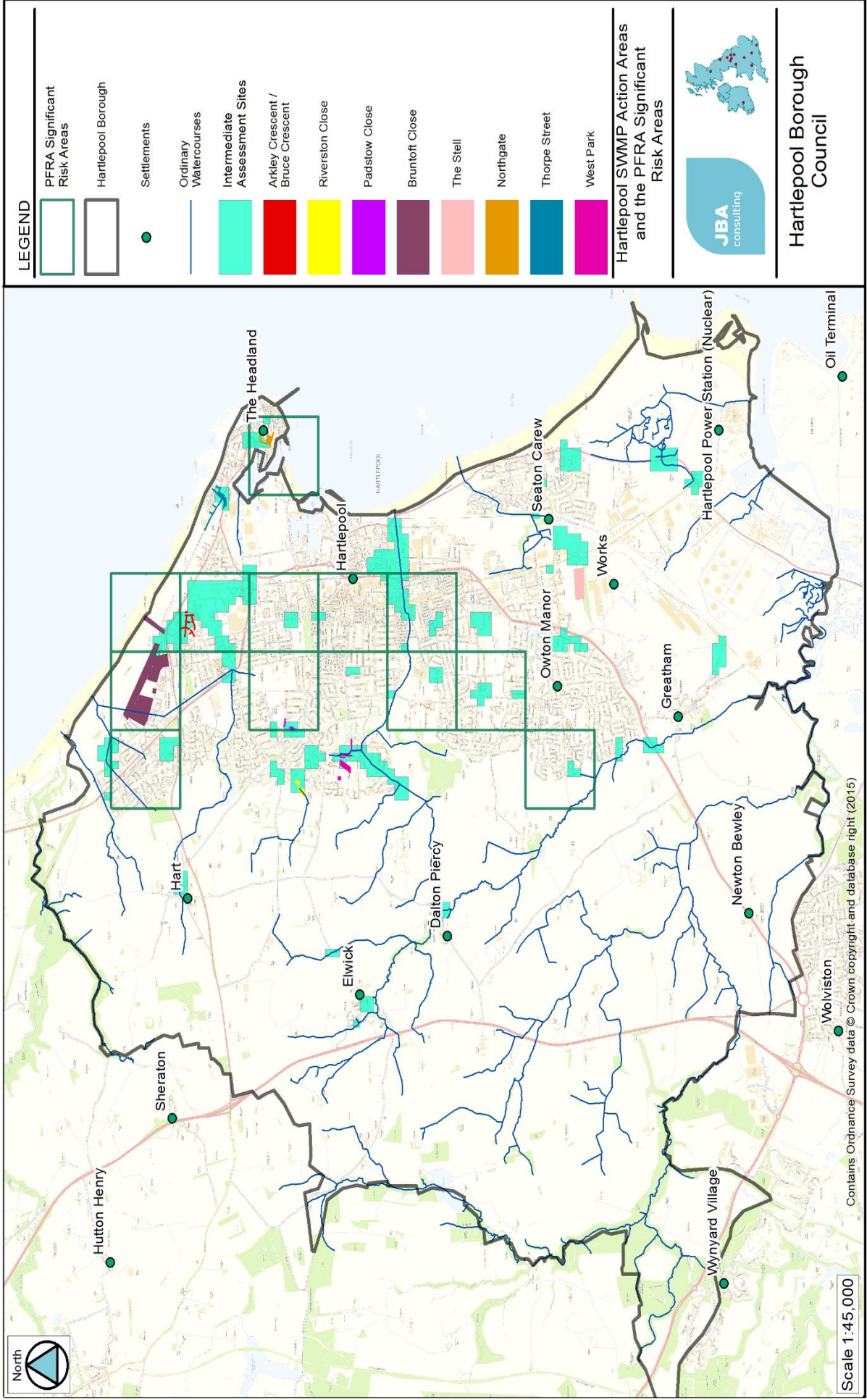
It is a shared vision of Hartlepool BC to continue to strengthen existing partnerships and work towards an integrated plan system between now and next cycle of the Flood Risk Regulations due to begin in 2021.

9 References

- Environment Agency. (2009a). *River Basin Management Plan, Northumbria River Basin District*. Bristol: Environment Agency.
- Environment Agency. (2011). *Seaton Carew Coastal Strategy Study*. Newcastle: Hartlepool BC.
- Environment Agency. (2012). *Tees Catchment Flood Management Plan Update*. Newcastle: Environment Agency.
- Environment Agency. (2013, April). *Groundwater Map*. Retrieved November 17, 2015, from Environment Agency Interactive Map: <http://maps.environment-agency.gov.uk/wiyby>
- Environment Agency. (2014b). *The Tees Management Catchment - A summary of information about the water environment in the Tees management catchment*. Bristol: Environment Agency.
- Hartlepool BC. (2006). *Hartlepool Local Plan - including Mineral and Waste Policies: Adopted Plan*. Hartlepool: Hartlepool BC.
- Hartlepool BC. (2011). *Preliminary Flood Risk Assessment Report*. Hartlepool: Hartlepool BC.
- Hartlepool BC. (2012). *Seaton Carew Northern Management Unit Phase 2*. Environment Agency.
- Hartlepool BC. (2013). *Hartlepool Surface Water Management Plan*. Hartlepool: JBA Consulting.
- JBA Consulting. (2010). *Strategic Flood Risk Assessment Level 1*. Skipton: JBA Consulting.
- JBA Consulting. (2010a). *Hartlepool BC Level 2 Strategic Flood Risk Assessment*. Skipton: JBA Consulting.
- JBA Consulting. (2015). *Hartlepool Local Flood Risk Management Strategy - Strategic Environmental Assessment. Environmental Report*. Skipton: JBA Consulting.
- Met Office. (2014). *UK Climate Projections*. Retrieved October 16, 2015, from Maps and key findings: <http://ukclimateprojections.metoffice.gov.uk/21708>
- North East Coastal Authorities Group. (2007). *Shoreline Management Plan 2: River Tyne to Flamborough Head*. Bretton: Royal Haskoning.
- Tees Valley Unlimited. (2015a). *Interactive area profile*. Retrieved October 22, 2015, from https://www.teesvalleyunlimited.gov.uk/InstantAtlas/area_profile/atlas.html
- Weather2. (2015). *Hartlepool Climate Profile*. Retrieved October 16, 2015, from My Weather 2: <http://www.myweather2.com/City-Town/United-Kingdom/Hartlepool/climate-profile.aspx>

Appendix A: Local Flood Risk Priority Areas





JBA
consulting

Offices at

Coleshill

Doncaster

Dublin

Edinburgh

Exeter

Glasgow

Haywards Heath

Isle of Man

Leeds

Limerick

Newcastle upon Tyne

Newport

Peterborough

Saltaire

Skipton

Tadcaster

Thirsk

Wallingford

Warrington

Registered Office

South Barn

Broughton Hall

SKIPTON

North Yorkshire

BD23 3AE

t:+44(0)1756 799919

e:info@jbaconsulting.com

Jeremy Benn Associates
Ltd

Registered in England

3246693



Visit our website

www.jbaconsulting.com