

County Durham Surface Water Management Plan

Final Report



Prepared by: Alex Perryman
Consultant

Checked by: Christian Lomax
Principal Consultant

Approved by: Roy Loblely
Associate Director

Rev No	Comments	Checked by	Approved by	Date
0	Draft Final Report	CSL	RAL	June 2011
1	Final Report	CSL	RAL	August 2011

5th Floor, 2 City Walk, Leeds, LS11 9AR
Telephone: 0113 391 6800 Website: <http://www.aecom.com>

Job No 60155102.M012

Reference SWMP

Date Created August 2011

This document has been prepared by AECOM Limited for the sole use of our client (the "Client") and in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM Limited and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM Limited, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM Limited.

Table of Contents

Abbreviations	i
Glossary	iii
1 Introduction	1
1.1 What is a Surface Water Management Plan?	1
1.2 County Durham SWMP Partnership	1
1.3 Scope of the County Durham SWMP	4
1.4 Why Consider Water Quality?	5
1.5 Links with Other Studies	5
1.6 Surface Water Principles	6
2 Summary of SWMP Analysis	9
2.1 Introduction.....	9
2.2 Phase 1: Preparation.....	9
2.3 Phase 2: Risk Assessment	9
2.4 Phase 3: Options	12
2.5 Phase 4: Implementation & Review	14
3 Key Findings	16
3.1 Surface Water Flood Risk.....	16
3.2 Managing the Risk of Surface Water Flooding	17
3.3 Water Quality	18
3.4 Action Plans.....	19
3.5 Key Messages from SWRAs	23
4 Next Steps	28
4.1 Funding for Surface Water Management.....	28
4.2 Requirements of the Flood & Water Management Act.....	30
5 Summary	34
5.1 Surface Water Risk.....	34
5.2 Options	34
5.3 Actions.....	35
List of Appendices	
Appendix A - County Durham’s Strategic Water Environment.....	38
Appendix B - Risk Assessment.....	61
Appendix C – Options.....	112
Appendix D – SWRA Action Plans.....	171
List of Tables	
Table 1.1: Roles & Responsibilities	3
Table 3.1: Development sites that provide opportunities to manage the risk of surface water flooding.....	18
Table 3.2: County Durham Action Plan.....	20
Table 3.3: Key Messages	23
Table 4.1: Example of a Flood Incident Template.....	32
Table 5.1: Preferred Option	35
List of Figures	
Figure 2.1: Prioritised SWRAs	11
Figure 2.2 – Development and Implementation of the County Durham SWMP	13

Capabilities on project:
Water

Abbreviations

AAD	Average Annual Damage
AMP	Asset Management Plan
CFMP	Catchment Flood Management Plan
CSO	Combined Sewer Overflow
Defra	Department Environment, Food and Rural Affairs
ELR	Employment Land Review
FRMP	Flood Risk Management Plan
GES	Good Ecological Status
GI	Green Infrastructure
GIS	Geographical Information System
GQA	General Quality Assessment
IDP	Infrastructure Delivery Plan
LDF	Local Development Framework
MAGIC	Multi-agency geographical information system for the countryside
MCA	Multi Criteria Analysis
NVZ	Nitrate Vulnerable Zone
OFWAT	Economic Regulator for the Water and Sewerage Industry in England & Wales
PPS23	Planning Policy Statement 23–Planning and Development Control
PPS25	Planning Policy Guidance 25-Development & Flood Risk
PFRA	Preliminary Flood Risk Assessments
RBD	River Basin District
RBMP	River Basin Management Plan
SACs	Special Area of Conservation
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest

Capabilities on project:
Water

SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
SWRA	Surface Water Risk Area
WCS	Water Cycle Study
WFD	Water Framework Directive

Capabilities on project:
Water

Glossary

Core Strategy – A Development Plan Document setting out the spatial vision and strategic objectives of the planning framework for an area.

Department for Communities and Local Government - is the government department responsible for policy on local government, housing, urban regeneration, planning and fire and rescue. They have responsibility for all race equality and community cohesion related issues in England and for building regulations, fire safety and some housing issues in England and Wales. (<http://www.communities.gov.uk/corporate/about/>)

Department for Environment, Food and Rural Affairs (Defra) – Department that brings together the interests of farmers and the countryside; the environment and the rural economy; the food we eat, the air we breathe and the water we drink.

Employment Land Review (ELR) - provides an evidence base that will be used to inform the preparation of employment land policies and allocations in the Local Development Framework (LDF). The ELR ensures that sites and buildings that are important to the future prosperity of an area are retained in employment use and to enable the release of sites that could sensibly be used for other purposes.

Environment Agency (EA) – The Environment Agency was established under the Environment Act 1995, and is a Non-Departmental Public Body of Defra. The Environment Agency is the leading public body for protecting and improving the environment in England and Wales today and for future generations. The organisation is responsible for wide ranging matters, including the management of all forms of flood risk, water resources, water quality, waste regulation, pollution control, inland fisheries, recreation, conservation and navigation of inland waterways. It will also have a new strategic overview for all forms of inland flooding

Flood Risk Assessment (FRA) – a FRA is required under PPS25 at the planning application stage for new developments. An FRA will demonstrate how flood risk from all sources to the development itself and flood risk to others will be managed now and in the future (including climate change).

Floods and Water Management Act (2010) – Act of Parliament to clarify the legislative framework for managing surface water flood risk in England.

General Quality Assessment (GQA) Programme – the Environment Agency's method for classifying the water quality of rivers and canals is known as the General Quality Assessment scheme (GQA). It is designed to provide an accurate and consistent assessment of the state of water quality and changes in this state over time.

Green Infrastructure – a concept originating in the United States in the mid-1990s that highlights the importance of the natural environment in decisions about land use planning. In particular there is an emphasis on the "life support" functions provided by a network of natural ecosystems, with an emphasis on interconnectivity to support long term sustainability.

Growth Point – communities that are pursuing large-scale, sustainable housing growth through a partnership between local organisations and central government.

Interim Code of Practice for SuDS – A guidance document produced by CIRIA, which aims to facilitate the implementation of sustainable drainage in developments in England and Wales by providing model maintenance agreements and advice on their use. It provides a set of agreements between those public organisations with statutory or regulatory responsibilities relating to SuDS.

Local Development Framework (LDF) – a folder of local development documents that outlines how planning will be managed in the area.

Local Authority or Local Planning Authority (LA or LPA) – the Local Authority or Council that is empowered by law to exercise planning functions. Often the Local Borough or District Council, National Parks and the Broads Authority are also considered to be local planning authorities. County Councils are the authority for waste and minerals matters.

Capabilities on project:
Water

Main River – Generally main rivers are larger streams or rivers, but can be smaller watercourses. Main Rivers are determined by Defra in England, and the Environment Agency has legal responsibility for them.

Ofwat – The Water Services Regulation Authority (Ofwat) is the body responsible for economic regulation of the privatised water and sewerage industry in England and Wales. Ofwat is primarily responsible for setting limits on the prices charged for water and sewerage services, taking into account proposed capital investment schemes (such as building new wastewater treatment works) and expected operational efficiency gains.

Ordinary watercourse - An ordinary watercourse is any other river, stream, ditch, cut, sluice, dyke or non-public sewer which is not a Main River. The Local Authority or Internal Drainage Board have powers for such watercourses.

Pitt Review - An independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.

Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) – these documents set out the Government's national policies on different aspect of planning. The policies in these statements apply throughout England and focus on procedural policy and the process of preparing local development documents.

Regional Spatial Strategy (RSS) – a broad development strategy for a region for a 15 to 20 year period prepared by the Regional Planning Body. The RSS informs the preparation of Local Development Documents (LDDs) and Local Transport Plans (LTPs).

Strategic Flood Risk Assessment (SFRA) – an assessment of flood risk from all sources which is used to inform the planning process of flood risk and provides information on future risk over a wide spatial area. It is also used as a planning tool to examine the sustainability of the proposed development allocations. SFRAs form the basis of flood risk management in England and are a requirement of PPS25.

Supplementary Planning Documents (SPD) - supplementary planning documents can give further context and detail to local development plan policies. It is not part of the statutory development plan. Therefore, it does not have the same weight when local planning authorities are considering planning applications.

Surface Water Flooding - surface water flooding describes flooding from sewers, drains, groundwater, and runoff from land, small water courses and ditches that occurs as a result of heavy rainfall.

Surface Water Management Plan (SWMP) - is a plan which outlines the preferred surface water management strategy in a given location.

Sustainable Drainage Systems (SuDS) – Sustainable drainage systems (previously referred to as sustainable urban drainage systems): a sequence of source control, management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques (may also be referred to as SuDS or SDS).

Water Cycle Study (WCS) – The purpose of a water cycle strategy is to strategically plan the most sustainable water infrastructure in a timely manner, across all of the water cycle from water supply and water resources, flood risk and surface water drainage, and wastewater and biodiversity.

Water Framework Directive (WFD) – A European Community Directive (2000/60/EC) of the European Parliament and Council designed to integrate the way water bodies are managed across Europe. It requires all inland and coastal waters to reach “good status” by 2015 through a catchment-based system of River Basin Management Plans, incorporating a programme of measures to improve the status of all natural water bodies.

Water Resources - Water which is available for human use.

Water Supply – The provision of water to homes and industry using a pipe network.

Introduction



Capabilities on project:
Water

1 Introduction

1.1 What is a Surface Water Management Plan?

The Surface Water Management Plan (SWMP) Technical Guidance¹ states that a SWMP is:

“a plan which outlines the preferred surface water management strategy in a given location. In this context surface water flooding describes flooding from sewers, drains, groundwater, and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall.”

In addition the guidance stresses the need for local partners with responsibility for surface water and drainage to work together to understand the causes of surface water flooding and agree the most cost effective way of managing the risk of surface water flooding. It further states the need to make surface water management decisions that are evidence based, risk based, future proofed and are inclusive of stakeholder views and preferences. The SWMP can be used to inform Preliminary Flood Risk Assessments under the Flood and Water Management Act (2010) and fulfil the requirement for Flood Risk Management Plans (FRMP) under the Flood Risk Regulations (2009).

Surface water flooding occurs when severe rainfall events generate runoff which exceeds the capacity of surface water conveyance systems including natural watercourses and man-made drainage systems. Surface water flooding may develop quickly especially in urban areas and is often difficult to predict. Current predictions on the impacts of climate change suggest more frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall. This reinforces the need to manage surface water for the present and future situation.

From a planning perspective SWMPs can provide a framework to deal with surface water flooding for new developments, whilst contributing to improving the water quality of our water networks and achieving the requirements of the Water Framework Directive (WFD).

There are four phases to a SWMP:

- Phase 1 – Preparation: identifies Partners and Stakeholders who need to be involved in the study and clarifies their roles and responsibilities.
- Phase 2 – Risk Assessment: reviews the risk of surface water flooding.
- Phase 3 – Options: identifies measures by which the surface water flood risks can be mitigated. The mitigation measures, or options, are prioritised and analysed in terms of their suitability and practicality.
- Phase 4 – Implementation & Review: the preferred options are implemented by the Partners. A review of the SWMP should be periodically carried out to identify areas that have benefited from the study and recommend any areas of improvement or identify gaps in the study.



1.2 County Durham SWMP Partnership

The nature of SWMPs varies from location to location depending on local variables and the type of problem encountered. As a result the organisations who need to be involved with a SWMP will also vary. Three Partners have been identified for the County Durham SWMP; Durham County Council, Northumbrian Water and the Environment Agency. In light of the high level nature of the study it was appropriate to limit the consultation and engagement process. If more detailed analysis is undertaken in the future it may be appropriate to consider additional Stakeholders depending on the nature of the site and works.

¹ Defra (March 2010). Surface Water Management Plan Technical Guidance.

Capabilities on project:
Water

Each of the three Partners has an important role to play concerning flood risk. The following sections outline their roles and responsibilities and summarises how the outputs of the SWMP will be of use to each organisation.

1.2.1 *Durham County Council*

Durham County Council is responsible for planning and controlling development within their district, with due regard to the risk of flooding and has a number of permissive powers under the Land Drainage Act and Public Health Act to undertake drainage works in relation to watercourses. Local Authorities acting in their capacity as a highways authority have powers with regard to the drainage of highways.



Under the Flood and Water Management Act, County Councils or Unitary Authorities have been given the lead in managing all local floods and will become the approving and adopting body for all Sustainable Drainage Systems (SuDS). All drainage systems in new developments and redevelopments that include SuDS schemes will need to be approved by the County Council or Unitary Authority before construction can commence. Should the SuDS scheme serve more than one property, the County Council or Unitary Authority would subsequently adopt and maintain the scheme where constructed as approved. It will be important for schemes to be accompanied by maintenance plans to ensure that the effectiveness of schemes does not decrease over time.

Durham County Council is the Lead Partner and has the responsibility for the SWMP. Outputs from the SWMP will be used by the County Council to carry out other activities such as emergency planning, control drainage, review LDF land allocations, and develop investment programmes, at the same time as satisfying the requirements of the Flood and Water Management Act and contributing to the evidence base supporting the Durham Plan.

1.2.2 *Environment Agency*

The Environment Agency is an Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs (England) and an Assembly Sponsored Public Body responsible to the National Assembly for Wales. The organisation's aims are to protect and improve the environment, and to promote sustainable development. The Environment Agency plays a central role in delivering the environmental priorities of central government and the Welsh Assembly Government through their functions and roles.



The Environment Agency has a general supervisory duty relating to all flood defence related matters under the Environment Act and the Flood and Water Management Act has given the Environment Agency an overview of all flood and coastal erosion risk management. The extent of the Environment Agency's operational role greatly depends upon the designation of a watercourse as Main River. The power of the Environment Agency to maintain and improve existing works and construct new works is a permissive one.

The Environment Agency is an essential Partner in the SWMP. The outputs from the SWMP will be issued to the Environment Agency to review and assess existing and new emergency plans, communicate with local residents on flood risk issues, and finalise asset management plans (investment, operations and maintenance).

1.2.3 *Northumbrian Water*

Northumbrian Water is the supplier of water and sewerage services for County Durham comprising water resources distribution and collection, surface water drainage, wastewater collection and disposal. Having a total customer base of 2.6 million households, the water company has the responsibility (amongst others) for ensuring that its drainage network is maintained and improved to cope with surface water flooding. This is not an absolute responsibility, as sewerage undertaker's funds are not unlimited and investment in sewers must be prioritised. There is broad agreement that this responsibility is limited to flooding arising from the 3.33 AEP (1 in 30 year return period) event. They also



Capabilities on project:
Water

have a duty to receive water from approved SuDS. Northumbrian Water will identify strategies in order to address issues and apply for funding from OFWAT to deliver the schemes.

Asset management and investment in water companies occurs in Asset Management Plan (AMP) periods. Each period has an investment programme to improve and maintain current assets and invest in new development areas. Northumbrian Water has recently commenced their next investment period, AMP5: 2010-2015, therefore the outputs from the SWMP will only be able to influence their priorities to a limited extent. However as the company makes progress during the AMP5 period, their asset improvement plan could be reviewed to include the recommendations of the SWMP.

Northumbrian Water is an essential partner in the SWMP. The outputs from the SWMP will be used by Northumbrian Water to prepare for emergencies, undertake their Drainage Area and Sewerage Management Plans, plan their investment and respond to climate and population change in addition to development pressures.

Table 1.1 sets out what each Partner is required to contribute to the SWMP and the benefits that will arise.

Table 1.1: Roles & Responsibilities

Partner	Role	How they inform the SWMP	What they get out of the SWMP
Durham County Council	Lead partner responsible for future development, surface water and that a partnership approach is adopted.	Provision of information concerning future development; locations, phasing and numbers and surface water drainage data.	<p>The SWMP acts as a vital evidence base to the Durham Plan, showing surface water flooding has been considered during the strategic planning process. The study provides information and assurances that the Council's growth and regeneration aspirations can be supplied with due regard for flood risk. The SWMP will input to the Infrastructure Delivery Plan which will also contribute towards the evidence base.</p> <p>The SWMP will ensure a joined up approach between land owners, water infrastructure providers and planners during strategic growth and regeneration planning.</p> <p>The SWMP will help to ensure that the natural water environment is protected and work with the Green Infrastructure Strategy (GI)² to support the activity, health and well being of local people and wildlife through the provision of green space.</p>
Northumbrian Water	Essential partner responsible for ensuring that its drainage network is maintained and improved to cope with surface water flooding.	Contribute to the identification and assessment of areas at risk of surface water flooding.	<p>An appreciation and understanding of the local authorities growth aspirations, when development will come forward, where and the phasing.</p> <p>The SWMP can inform long term planning, identifying where and when investment is required.</p> <p>An opportunity to comment on the proposed growth to influence the location and timing of future development by supporting proposals or make</p>

² Durham County Council (June 2009). Green Infrastructure Communications Strategy

Capabilities on project:
Water

Partner	Role	How they inform the SWMP	What they get out of the SWMP
			recommendations for changes.
Environment Agency	Essential partner responsible for flood risk, development control and water quality.	Provision of information and data concerning the water environment and its constraints and limitations.	Encourage sustainable development. Participate in and prove partnership working. Achieve efficiencies of working, support growth and ensure growth is sustainable with regard to the environment.

1.3 Scope of the County Durham SWMP

The average annual rainfall for County Durham is approximately 643mm, which is lower than the average rainfall for the north of England however; the varied topography of the area along the River Wear and its tributaries has a major influence on surface water runoff and flow patterns. The impact of development over time has exerted an impact on the runoff patterns, rates and volumes, consequently stressing the drainage infrastructure and its ability to cope with future expansion in some areas. There have been reported cases of surface water flooding and property damage, which further reinforces the need for a SWMP which will provide a more holistic approach to addressing the surface water flood risk to existing and proposed development.

The SWMP covers the entire County and as such is a high level, strategic document which serves as a starting point for the Partners to address surface water flood risk. It should be noted that the SWMP ought to remain a living document, to be updated as further data and information comes to light.

The primary purpose of the SWMP is to contribute robust evidence to support the Core Strategy. However it is much more than simply a planning document given its capacity to provide all three Partners with information concerning surface water risks across County Durham, and in recommending solutions to tackle key risk areas.

At a Partner Workshop the following four objectives were defined for the County Durham SWMP:

1. Guide limited resources to critical drainage areas of greatest need (*existing development*).
2. Ensure the level of *future development* does not exacerbate existing problems and identify opportunities for new development to provide benefits in terms of flood risk management.
3. Inform *emergency planning* and feed into Durham County Council's Flood Plan.
4. Protect and improve *water quality* in accordance with the objectives of the WFD.

The four objectives reflect different aspects of surface water flooding. There will be a risk of surface water flooding facing existing development / communities across County Durham and the SWMP will be able to identify potential options by which this risk might be managed. The Durham Plan will mean that significant levels of new development will occur in the future. To this end the SWMP is able to steer development away from areas at risk of flooding or identify measures by which the new development can help to alleviate or manage the existing surface water flood risk.

The summer floods of 2007, particularly in Hull, enforced the need for emergency planning to take due account of surface water and as part of the brief Durham County Council requested that opportunities for the management of urban water quality be investigated to fulfil improvements and compliance in ecology, water quality and habitats required under the WFD.



Capabilities on project:
Water

The SWMP is intended to be a 'living' document which is adapted to changes in the Council's aspirations regarding site development and regeneration in the future, at the same time improving on experience over time. It should be noted that the SWMP is the starting point in addressing the issues pertaining to surface water flood risk and this document does not end the need to review or address surface water issues in the future.

1.4 Why Consider Water Quality?

Water is essential for life, and is vital for our health and wellbeing (potable supplies, disposal of waste water, recreation and amenity), for agriculture, aquatic environments and fisheries, industry and transportation. The water environment, through wetlands and floodplains, can also provide natural water storage and flood protection. Therefore, it is important that this resource is protected and used sustainably and there are numerous European Directives and National Acts that have legislated to that effect, in addition to national and local planning policy. Annex A1 in Appendix A provides a review of this legislation. Durham County Council is committed to the holistic management of the water environment.



Water quality can be affected by diffuse water pollution as a result of runoff washing pollutants (dissolved and / or particulate) from surfaces into watercourses, directly or via surface water sewers. Pollution can also occur where heavy or prolonged rainfall leads to surface flooding of a contaminated site (e.g. petrochemicals and heavy industry, landfill, a large construction site etc.). Finally, although not the focus of this study, other point source water quality effects can occur from spills from combined sewer overflows. Although strategic planning can assist with the locating of potentially polluting sites/developments, the mitigation of flooding impacts will require a combination of flow management and flood defence.

1.5 Links with Other Studies

In addition to the SWMP, Durham County Council is producing a raft of documents as part of their Local Development Framework (LDF) to ensure a sustainable future for County Durham. Two of these are directly relevant, and integral to, the SWMP. These are the Strategic Flood Risk Assessment (SFRA) and Water Cycle Study (WCS).

A Level 1 and 2 SFRA³ has been completed for County Durham which produced an assessment of surface water flood risk, classifying the risks as high, medium and low. This data-set formed the foundations for the SWMP and was integrated with other data-sets as part of the Risk Assessment phase of the SWMP.

The management of runoff from urban areas is essential if the effects of diffuse urban pollution are to be reduced and prevented, to help achieve the requirements of the WFD. In addition to setting out the strategic risk from flooding, the Level 1 Report also considered ways to mitigate flood risk, which included Sustainable Drainage Systems (SuDS). The SFRA provides a generic overview of the SuDS approach and maintenance requirements, before touching on the possible application of SuDS in County Durham (Annex C2, Appendix C).

The WCS is reviewing the ability of the water environment (including existing infrastructure) to support future development across County Durham. Large parts of County Durham are served by combined sewers which carry wastewater from households and industry, and surface water runoff. These combined sewer systems tend to be located in the older, historic parts of the County, whereas more recent development has implemented separate sewer systems.

The combined sewers and the associate Sewage Treatment Works have been identified as a potential constraint to future development. Northumbrian Water have identified the removal of surface water from these combined sewers as their preferred means of providing additional capacity within the sewers and at the Works to support future growth. It is unlikely that existing developments served by combined sewers are going to be retro-fitted to separate the waste- and surface water, therefore re-development of brownfield land offers a means of providing this capacity.

³ Golder Associates (March 2010). Durham County Council, Strategic Flood Risk Assessment (SFRA) – Level 2.

Capabilities on project:
Water

The surface water removed from the combined sewers will need to be managed to ensure it does not pose a flood risk elsewhere. The SWMP has had due consideration for the need for surface water to avoid going into the sewer systems.

Another document relevant to the SWMP is the Green Infrastructure Strategy which will include a network of multifunctional green space and other relevant land and watercourses, which support the activity, health and well being of local people and wildlife. Future development and growth across County Durham has the potential to play a role in the expansion and reinforcement of the GI networks. The most obvious means of contributing to GI is through the provision of green spaces on the individual development sites and through SuDS which can create water features, although the identification of deficiencies in existing water infrastructure that require intervention may also present opportunities to contribute towards GI.

Durham County Council are also producing a Preliminary Flood Risk Assessment (PFRA) which is a key document informing the preparation of future Local Flood Risk Management Strategies as required by the Flood and Water Management Act 2010. A PFRA aims to locate areas in which the risk of surface water and groundwater flooding is significant and warrants further examination through the production of maps and management plans.

1.6 Surface Water Principles

In light of the work undertaken as part of the SWMP, the following surface water principles are proposed that Durham County Council should bear in mind when considering planning applications and consider the value of incorporating them into planning policies and / or local Supplementary Planning Documents.

As part of development:

- Surface water runoff to be managed at source (avoid disposal to public sewer systems wherever possible).
- Runoff rates should not exceed Greenfield wherever possible.
- Runoff up to and including the 100 year event should be managed on site where possible.
- Measures of source control should be actively encouraged.
- Measures that provide water quality improvements should be actively encouraged.
- Developers should be encouraged to set part of their site aside for surface water management, to contribute to flood risk management in the wider area and supplement green infrastructure networks.
- Surface water should be removed from combined sewer systems.
- Developers should be encouraged to maximise permeable surfaces.

Capabilities on project:
Water

As part of retro-fitting schemes:

- Durham County Council to consider the potential for surface water management when undertaking highways schemes such as regarding roads, to manage excess surface water runoff in the roads or channel it away from high risk areas.
- Encourage green roofs to be retro-fitted wherever possible, with sites using surface water as a resource rather than disposing of it.
- Home owners should be encouraged to reduce impermeable surfaces and implement resilience and resistance measures.

Summary of SWMP Analysis



Capabilities on project:
Water

2 Summary of SWMP Analysis

2.1 Introduction

It was outlined in the previous chapter that there are four phases to the SWMP process. This chapter provides a concise summary of the work that was undertaken for County Durham. The reader is referred to the Appendices where more detailed, technical information can be found.

2.2 Phase 1: Preparation

For the Preparation phase the SWMP Partnership was established. Due to the nature of the study the Partners were restricted to Durham County Council, the Environment Agency and Northumbrian Water. The Partners are outlined in Section 1.2 of this report.

If the County Durham SWMP leads to further work being undertaken in a specific location, it will be appropriate for the Partners to review the local circumstances to determine if additional Stakeholders need to be incorporated into the process through a more specific SWMP for that location.

2.3 Phase 2: Risk Assessment

The principal purpose of the Risk Assessment for County Durham was to strategically identify broad locations considered to be more or less vulnerable to surface water flooding. Given the geographical scale of the strategic assessment, it should be used to flag locations requiring further assessment and to help prioritise more detailed studies. As the strategic assessment operates at a large geographical scale, the SWMP guidance recommends that the analysis should be based on existing information or the use of simple analysis methods to improve existing information and make maximum use of existing data and information. Appendix B presents the Risk Assessment in more detail.

To begin with, all available data was collated together to establish what the strategic water environment looks like for County Durham. This baseline data concerning the water environment can be found in Appendix A. A gap analysis was carried out to identify missing information. The primary gaps in the information base relate to information from Northumbrian Water, who during the project was in the process of establishing a Data Sharing Protocol which would facilitate data sharing.

To gain an understanding of the sewer network, sewer maps were provided in PDF format by Durham County Council which was used to visually assess the network coverage. However, in order to be able to make informed decisions and undertake detailed analysis Northumbrian Water must play a more active role in the SWMP contributing information and ideas to the process.

Durham County Council's dataset concerning known surface water incidents has gaps and inconsistencies within the attribute information. The attribute table looks to be an amalgamation of multiple tables with duplicate columns containing the same information. By restructuring the table and maintaining the accuracy of the information, this would allow easier analysis and presentation of the information. It would be beneficial to add a column that categorises the cause of the incidents so that the data can be thematically mapped.

All GIS datasets should have associated metadata so as to understand what information the data contains and to clarify column headings or explain any information that is coded or graded. Attribute information that may be contained in datasets and useful to a SWMP may not be realised because the metadata was not provided or contained null information. When metadata is provided it should contain enough detail so as not to require any further information or interpretation.

2.3.1 Surface Water Risk Areas

Based on the available data Surface Water Risk Areas (SWRAs) were defined in GIS using cluster analysis. Cluster analysis looks at the distribution of 'priority' datasets to look for correlations and patterns in the data so as to form a cluster, in this case a SWRA.



Capabilities on project:
Water

The following priority datasets were used to define the SWRAs:

1. Known Surface Water Incidents
2. SFRA Surface Water modelling
3. Environment Agency Areas Susceptible to Surface Water Flooding*
4. Potential Development Sites (SHLAA and ELR data)
5. Critical Infrastructure (Schools, railway lines and major roads)
6. Environmental Designations

* The Flood Map for Surface Water was unavailable at the time of the analysis but was later used to verify the assessment.

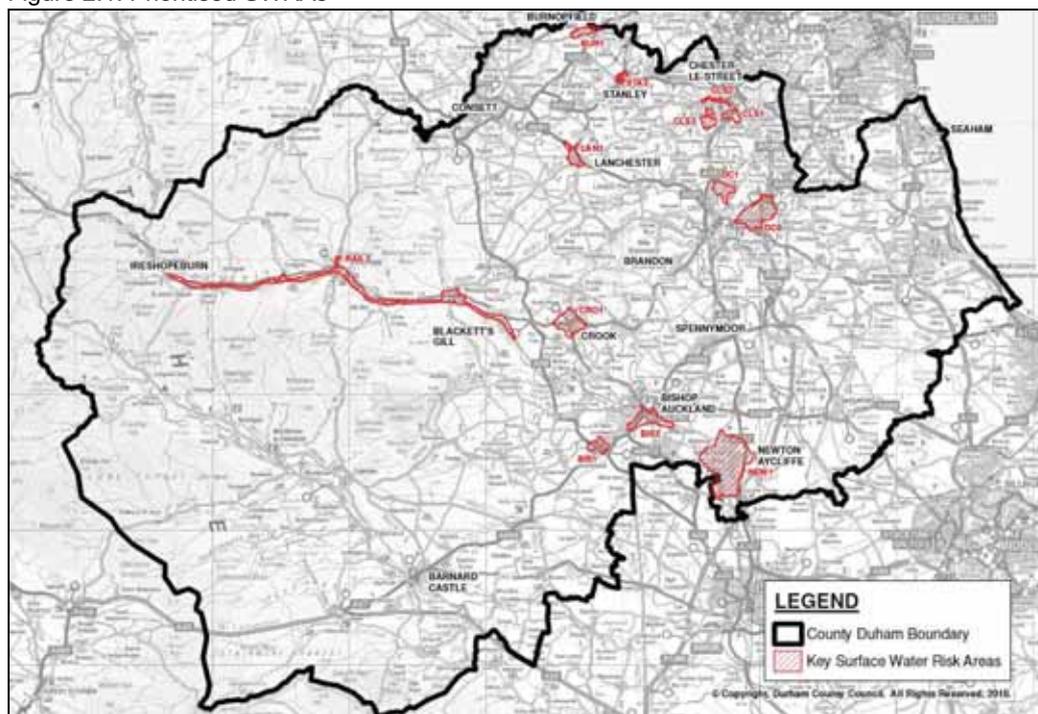
These datasets inform areas where surface water flooding has or could cause a significant risk to people and property, or pose a threat to the degradation of one or more environmental designations. Clusters of known incidents of surface water flooding indicate areas where surface water currently poses a flood risk.

In total 139 SWRAs were created across County Durham the majority of which are located in the eastern part of the county, in or around urban conurbations.

Having identified SWRAs across County Durham it was appropriate to rank them in terms of their importance. The prioritisation process sought to address known surface water problems and the largest numbers of people at risk of surface water flooding so that resources can be targeted in these areas, see Annex B1 of Appendix B. Of the 139 SWRAs identified across County Durham, thirteen sites were assessed in more detail as part of the Risk Assessment. This includes eleven sites that were ranked in the top ten (accounting for equal rankings), plus two additional sites in Chester-le-Street that whilst they fell lower down the priority ranking table are known surface water problem areas according to the Environment Agency's environment priority documents. The thirteen prioritised SWRAs are illustrated in Figure 2.1.

Capabilities on project:
Water

Figure 2.1: Prioritised SWRAs



A summary sheet was prepared for each of the thirteen SWRAs, highlighting areas affected by flooding and the causes for the incidents, Annex B2 of Appendix B. These sheets were circulated to the Partners to communicate the findings of the Risk Assessment, to obtain feedback and further information concerning the SWRAs and to ascertain whether the SWRA should be considered further by the SWMP and carried forward to the Options stage. A Workshop attended by Durham County Council and the Environment Agency subsequently discussed each of the SWRAs to decide how they should be addressed by the SWMP. The key message coming out of the Workshop was that many of the known surface water flood incidents are being addressed by either Durham County Council or Northumbrian Water and the SWMP therefore ought to focus on the residual risks posed by exceedance events, i.e. areas identified by the SFRA modelling or the Environment Agency Areas Susceptible to Surface Water Flooding.

2.3.2 Future Development and the Risk of Surface Water Flooding

One of the objectives for the SWMP is to “Ensure the level of future development does not exacerbate existing problems and identify opportunities for new development to provide benefits in terms of flood risk management”. Durham County Council provided information concerning potential future development in the form of Strategic Housing Land Availability Assessment (SHLAA) and Employment Land Review (ELR) data-sets. As part of the Risk Assessment SWRAs have been identified based on the presence of SHLAA and ELR sites in close proximity to areas at risk of surface water flooding. Many of the potential development sites fall within or in close proximity to areas at risk of flooding. In light of this it will be essential that site specific Flood Risk Assessments (FRAs) are undertaken if the development comes forward to ensure that each development takes due account of the potential flood risk and does not place people at risk of flooding. Another important aspect for the Council to be aware of is where development sites present opportunities to manage and mitigate flood risk beyond the site boundary. Phase 3 of the SWMP identified potential development sites that could play a role in managing the risk of surface water flooding.

Capabilities on project:
Water

2.3.3 *Emergency Planning*

The third objective of the SWMP is to “Inform emergency planning and feed into Durham County Council’s Flood Plan”. The findings of this Risk Assessment should be disseminated within each of the Partner organisations to inform and update (multi-agency) flood plans / severe weather plans and Local Resilience Forum community risk registers. This might include information on high flood risk areas, roads and access routes likely to be impassable, impacts on critical infrastructure or vulnerable people.

2.4 **Phase 3: Options**

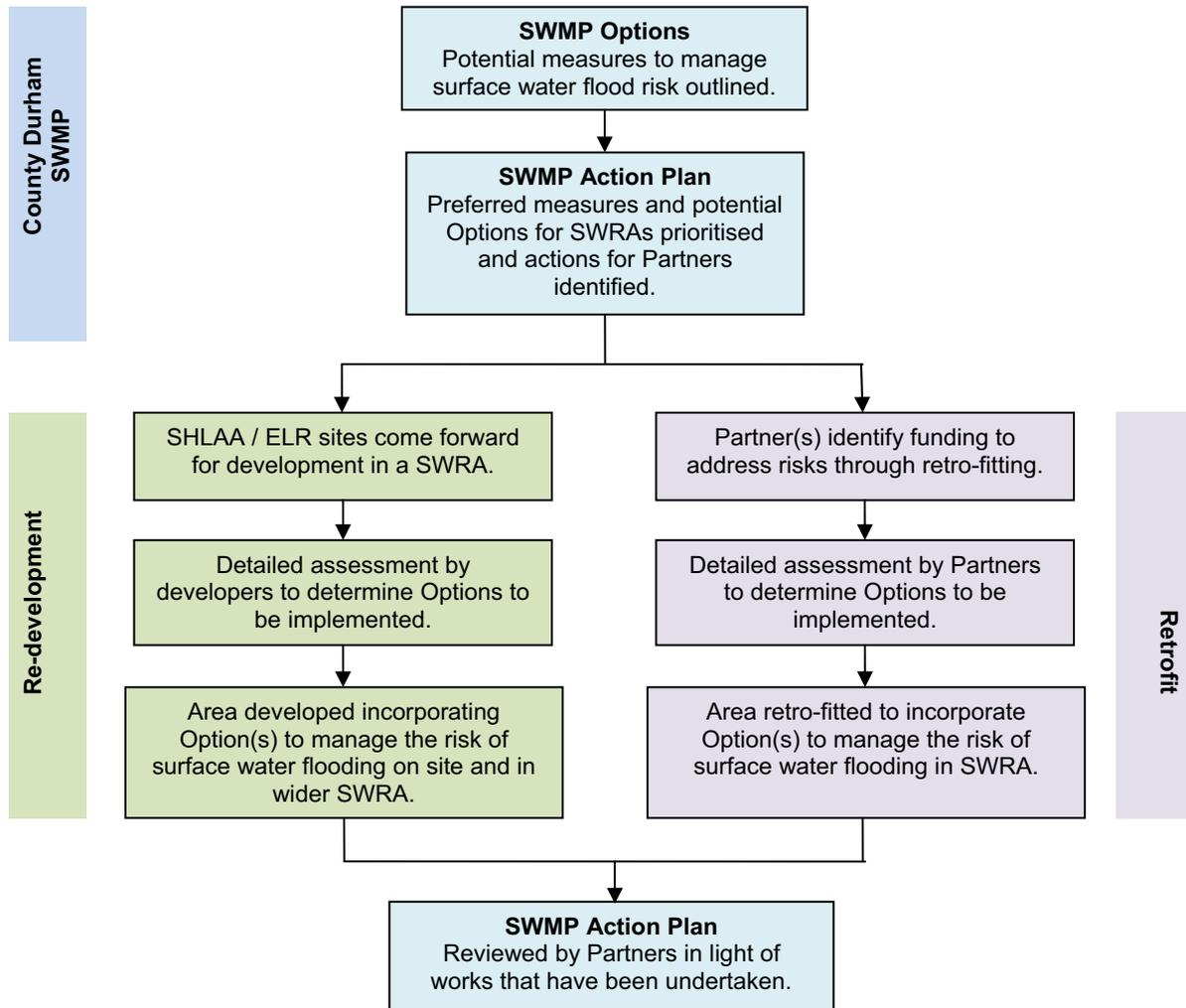
Appendix C presents Phase 3 of the SWMP in greater detail.

The Options phase took nine of the thirteen SWRAs considered by the Risk Assessment to review broad, high-level measures by which the risk of surface water flooding could be managed. It is not appropriate for the SWMP to prescribe specific options as this would only be appropriate after a more detailed examination of the existing situation. Additionally, prescribing specific options could also place constraints on potential development sites making development unviable. As such, the details provided in Appendix C are only intended to indicate the elements of a possible solution that could be implemented to reduce surface water flood risk and provide a starting point for further investigations should the Partners wish to take action to address the surface water flood risk across County Durham. Figure 2.2 presents a flowchart outlining the process that the findings of this report will need to go through.



Capabilities on project:
Water

Figure 2.2 – Development and Implementation of the County Durham SWMP



The assessment process aims to short-list measures that will achieve multiple objectives in the context of site constraints and future development. In accordance with the guidance, a Multi-Criteria Assessment (MCA) screening exercise considered the relative merits of each measure to manage surface water against the following criteria:

- Technical Feasibility – *is it easily implemented?*
- Relative Cost – *how expensive is it in comparison to other measures?*
- Economic Viability – *is it expensive to implement?*
- Social Impact and Acceptability – *how will it impact on residents?*
- Environmental – *how will it impact the environment?*
- Sustainability – *is it a sustainable approach?*

Capabilities on project:
Water

Each management option is scored against each of the criteria set out above using a relative indicator, in line with the guidance:

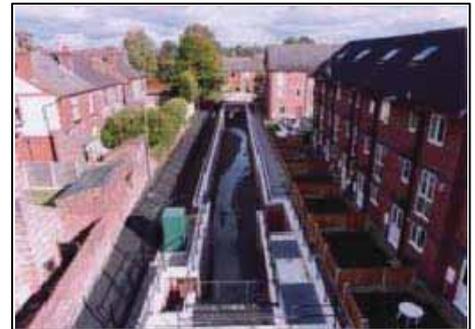
- U** - not applicable or unacceptable outcome
- 2** - severely negative outcome
- 1** - moderately negative outcome
- 0** - neutral outcome
- +1** - moderately positive outcome
- +2** - strongly positive outcome

The measures with the lowest overall combined scores from the MCA were screened out to produce a short list of preferred options. The short-listed mitigation measures provide the starting point for a more detailed economic assessment should the Partners wish to take any of the SWRAs further and implement surface water management measures.

2.5 Phase 4: Implementation & Review

The final stage of the SWMP is the collation of the information from the first three phases and the production of an Action Plan(s) for managing surface water. Chapter 3 of this document sets out the Key Findings of the study and has developed an Action Plan for the Partners to implement as they seek to manage the risk of surface water flooding. Additionally an Action Plan has been developed for each of the nine SWRAs that were considered by the Options phase (Appendix D).

It will subsequently be up to the Partners to implement the Action Plans to manage and mitigate the risk of surface water flooding across County Durham. As lead Partner with will be Durham County Councils responsibility to monitor the implementation of the Action Plans.



The SWMP is a living document and it is recommended that the Partnership continues to work together after the completion of the SWMP to discuss the implementation of the proposed actions. The plans should be reviewed and updated on a regular basis, but there are circumstances which might trigger a review and/or an update sooner. These may include the occurrence of a flood incident or additional data becoming available, which may alter the understanding of risk within the study area or if the outcome of investment decisions by Partners is different to the preferred option, which may require a revision to the Action Plan.

Key Findings



Capabilities on project:
Water

3 Key Findings

In light of the Risk Assessment and Optioneering work that has been undertaken as part of the County Durham SWMP (Appendices B and C), it is possible to identify a number of key findings for further consideration by the Partners, potentially through planning policies and Local Supplementary Documents.

3.1 Surface Water Flood Risk

- Surface water poses a widespread flood risk across County Durham.
- This risk is concentrated in the east of the County and specifically associated with urban areas.
- Known flood incidents regularly corroborate predictions concerning extreme flooding.
- Modelled predictions of extreme flooding often results in small, discrete, highly-localised areas of risk. These will be extremely difficult to holistically manage.
- Maintenance of drainage systems; both natural and man-made, is critical to managing / limiting the impact of surface water flooding. Many known flood incidents are a result of inadequate maintenance. In the current economic climate, maintenance budgets are likely to come under threat, if cuts are unavoidable it is essential that maintenance is targeted at appropriate times of the year, for example autumn when leaves fall off trees and often block road gullies.
- In some areas, such as Carrville, Durham, community associations have been set up by local residents in response to flooding.



Capabilities on project:
Water

3.2 Managing the Risk of Surface Water Flooding

- Development presents the best opportunities to manage the risk of surface water flooding.
- Northumbrian Water wish to limit the volume of surface water entering combined sewer systems. Re-development that manages surface water on site will increase the capacity of the combined sewer networks thereby limiting the risk of sewers surcharging and causing flooding.
- Durham County Council should encourage developers to not only address runoff from their site but the potential benefits that can be achieved for the wider area.
- Several development sites that provide opportunities to manage the risk of surface water flooding have been identified (Table 3.1)
- If development sites, situated in areas with a high risk of surface water flooding, are unlikely to come forward in the planning process, the Partners ought to consider using the sites themselves to provide surface water management, water quality benefits and green infrastructure opportunities, for example through the creation of wetlands.
- There are many areas where development does not offer opportunities to manage the risk of surface water flooding. In such circumstances the Partners will need to take action themselves, through the SWMP process, to manage the risk. This would usually be in the form of retro-fit schemes.
- The Partners can also encourage and support individuals / communities to take action to protect themselves from surface water flooding (see Section 4.1).



Capabilities on project:
Water

Table 3.1: Development sites that provide opportunities to manage the risk of surface water flooding

SHLAA / ELR Reference	SHLAA / ELR	SWRA	Greenfield / Brownfield
ELR48	ELR	BIS3 – Bishop Auckland	Unknown
2/CH/08	SHLAA	CLS3 – Chester-le-Street	Greenfield
2/WA/01	SHLAA	CLS3 – Chester-le-Street	Greenfield
2/WV/02	SHLAA	CLS3 – Chester-le-Street	Mostly Greenfield
ELR10	ELR	DC1 – Durham	Unknown
3/CR/02	SHLAA	CRO1 – Crook	Greenfield
4/DU/107	SHLAA	DC8 – Durham	Greenfield
4/DU/71	SHLAA	DC8 – Durham	Greenfield
ELR121L	ELR	NEW1 – Newton Aycliffe	Unknown
3/SJ/02	SHLAA	RAIL3W – St Johns Chapel	Greenfield
3/SJ/03	SHLAA	RAIL3W – St Johns Chapel	Greenfield
ELR71A	ELR	RAIL3W – St Johns Chapel	Unknown
ELR71B	ELR	RAIL3W – St Johns Chapel	Unknown
3/WE/05	SHLAA	RAIL3W - Westgate	Both
3/WE/04	SHLAA	RAIL3W – Westgate	Brownfield
3/WE/02	SHLAA	RAIL3W – Westgate	Both
3/FR/04	SHLAA	RAIL3C - Frosterley	Greenfield
3/FR/03	SHLAA	RAIL3C – Frosterley	Brownfield
ELR67	ELR	RAIL3C – Frosterley	Brownfield
1/ST/03	SHLAA	STA3 – East Stanley	Greenfield

3.3 Water Quality

- 56% of water bodies are not expected to reach good status or good potential by 2015 but rather 2027.
- Surface water runoff is frequently a source of diffuse and point source pollution to water bodies.
- The implementation of SuDS as part of flood risk management has the potential to offer water quality benefits to receiving water bodies.

Capabilities on project:
Water

3.4 Action Plans

A generic Action Plan has been developed as part of Phase 4 of the SWMP for County Durham (Table 3.2). The Action Plan provides a list of actions by which the Partners (Durham County Council, Environment Agency and Northumbrian Water) can manage and mitigate surface water flooding across the County. IN addition to the county-wide Action Plan an individual Action Plan has been developed for each of the nine SWRAs considered by the Options phase (Appendix D). The high-priority actions which are essential to achieve SWMP objectives are outlined below.

Capabilities on project:
Water

Table 3.2: County Durham Action Plan

Ref	Type of Action	Action	Partners (lead in bold)	Timetable for Implementation
1	Flood & Water Management Act	Durham County Council to improve their GIS data concerning known surface water incidents.	Durham County Council	0-6 months
2	Flood & Water Management Act	Investigate and record flood incidents occurring in the County. Durham County Council to use their data concerning known surface water incidents as a starting point for a formal means of recording flood incidents.	Durham County Council	0-6 months
3	Flood & Water Management Act	Continue to investigate causes of flooding and the standards of service in relation to problems, followed by appropriate remedial works where necessary.	Durham County Council Northumbrian Water Environment Agency	Ongoing
4	Flood & Water Management Act	Durham County Council to maintain their Asset Data Register. Including the identification of third party assets deemed to affect flooding.	Durham County Council	Ongoing
5	Flood & Water Management Act	Establish SuDS Approval Body	Durham County Council	0-6 months
6	Flood & Water Management Act	Partners to consider further studies to review surface water flood risk in areas identified as being at the greatest risk (SWRAs).	Durham County Council Northumbrian Water Environment Agency	0-2 years
7	Partnership	Partners to continue to work together so as to better manage the surface water risk and the effective implementation of the options.	Durham County Council Northumbrian Water Environment Agency	Ongoing
8	Partnership	Northumbrian Water to play a more active role in the SWMP Partnership going forward.	Northumbrian Water Durham County Council Environment Agency	0-6 months
9	Policy	Put in place policies within the Local Development Framework which seek to remove / protect critical infrastructure at risk of surface water flooding. A policy which seeks to relocate this infrastructure at the end of its operational life would improve the area's ability to respond to and deal with flood incidents in	Durham County Council Northumbrian Water Environment Agency	0-10 years

Capabilities on project:
Water

Ref	Type of Action	Action	Partners (lead in bold)	Timetable for Implementation
		the future. Set standards of protection for flood risk to critical infrastructure (i.e. roads, railways lines, electricity installations, schools, GP's).		
10	Policy	Surface water runoff should be managed at source avoiding disposal to a public sewer where possible. Source control measures such as green roofs, permeable paving, storage and rainwater harvesting could all be encouraged.	Durham County Council Northumbrian Water Environment Agency	Pre-development 0-12 months
11	Policy	Development should implement pollution control as appropriate to help improve water quality and work towards achieving WFD requirements.	Durham County Council Northumbrian Water Environment Agency	Pre-development 0-12 months
12	Policy	Runoff rates should not exceed Greenfield wherever possible.	Durham County Council Northumbrian Water Environment Agency	Pre-development 0-12 months
13	Policy	Runoff up to and including the 100 year event should be managed on site where possible.	Durham County Council Northumbrian Water Environment Agency	Pre-development 0-12 months
14	Policy	Developers should be encouraged to set part of their site aside for surface water management and to supplement green infrastructure networks.	Durham County Council Northumbrian Water Environment Agency	Pre-development 0-12 months
15	Policy	Surface water to be removed from combined sewer systems where possible.	Durham County Council Northumbrian Water Environment Agency	Pre-development 0-12 months
16	SWRA - STA3	Investigate the development potential of the SHLAA site at Beamish Moor to provide source control measures to manage surface water.	Developer	Pre-development
17	SWRA - CLS2	Investigate the option of using the roads as storage(incorporating the cost of road re-grading and profiling of the carriageway to provide overland flow paths out of the area to reach Front Street and Cone Terrace) Investigate the potential of the SHLAA and ELR sites to provide storage and	Durham County Council Developer	Pre-development Pre-development

Capabilities on project:
Water

Ref	Type of Action	Action	Partners (lead in bold)	Timetable for Implementation
		contribute to the Green Infrastructure networks		
18	SWRA - CLS3	Undertake a geotechnical investigation into the feasibility of source control measures at the SHLAA site to the west of Waldrige Road	Developer Durham County Council	Pre-development
19	SWRA - DC1	Encourage source control measures such as green roofs and permeable paving, storage ponds and swales for any new developments, notably the ELR site between the Nature Reserve and Rothbury Road. Enforced through planning policy and development control.	Durham County Council	Pre-development
20	SWRA - DC8	No high priority actions		
21	SWRA - BIS3	Conduct a cost benefit analysis, assessing the benefit of creating swales or filter drains above Coundon Grange to intercept flows coming off the hill, or channel overland flows into storage areas.	Developer Durham County Council	Pre-development
22	SWRA - NEW1	No high priority actions		
23	SWRA - CRO1	Investigate the potential of the SHLAA sites to the north west of Crook and north of West Road to provide source control measures to manage surface water risk. Implemented through development control and planning policies (includes formal flow paths to be instated)	Developer Durham County Council	Pre-development
24	SWRA - RAIL3	Investigate the potential of the SHLAA sites in St John's Chapel, Westgate, Frosterley and Wolsingham to provide source control measures to manage surface water risk.	Developer Durham County Council	Pre-development

Capabilities on project:
Water

3.5 Key Messages from SWRAs

Table 3.3 sets out the key messages that came out of the options phase for the nine SWRAs.

Table 3.3: Key Messages

SWRA	Key Messages
STA3	<p>STA3 has experienced 15 known surface water incidences relating to inadequate drainage capacity in the combined sewers. Issues with maintenance have resulted in blocked gullies and collapsed drains. The source of surface water in this area is primarily from the impermeable surfaces throughout the urbanised area. 93 properties fall within the Environment Agency's Flood Map for Surface Water for the 200 year event. Annual Average Damages have been estimated at £95,000.</p> <p>If developed, the SHLAA site to the east, on Beamish Moor provides an opportunity to manage surface water at source to benefit the wider area and prevent sewer systems downstream spilling. It is essential that soakaways, storage ponds or swales are considered on the SHLAA site to manage the runoff and could be combined with green roofs and rainwater harvesting systems.</p> <p>West of Pelaw Avenue, the lack of open space and redevelopment opportunities means measures would need to be retro-fitted. The preferred measures are likely to be improving resilience and resistance or storage of water in the roads. Kerbing could be provided to contain and attenuate surface waters until the combined sewer system has capacity. Retro-fitting permeable pavements may provide some benefit. Similar measures are preferred at Cemetery Road, notably resilience measures and storage in the roads.</p>
CLS2	<p>35 properties fall within the Environment Agency's Flood Map for Surface Water for the 200 year event. Annual Average Damages have been estimated at £45,000. The two key flood risk areas are Market Place and Hopgarth Gardens. Risk areas exist outside the SWRA at Avondale Terrace / Edward Street which links to flooding on Cone Terrace via Front Street.</p> <p>At Avondale Terrace / Edward Street a significant flow path would be required to encourage water to drain onto Front Street and down towards Chester Burn. Road re-grading and landscaping could facilitate this. Interceptor grids could subsequently allow the water to drain into the culvert. Alternatively "street architecture" could be employed to channel surface water away. Redevelopment of SHLAA and ELR sites to the north may present opportunities to store water in ponds/wetlands. There are limited opportunities to implement measures other than local storage in roads or improved resilience and resistance of individual properties.</p> <p>At Hopgarth Gardens, a playing field presents an opportunity to store water. In the Market Place there are several car parks and green areas which could be used for flood storage. Interceptor grids could be used to drain excess runoff into the watercourse.</p>
CLS3	<p>82 properties fall within the Environment Agency's Flood Map for Surface Water for the 200 year event. Average Annual Damages have been estimated at £81,000. SHLAA sites are the preferred measure and it is essential that source control measures are considered if any SHLAA sites are brought forward for development.</p> <p>There appears to be low spots creating overland flow paths through the Embleton Drive, Redesdale Road and Powburn Close areas. Runoff from the fields and the inundated highway drainage are believed to be the cause of several previous surface water incidents. The SHLAA site to the west of Waldrige Road should introduce source control measures such as green roofs, permeable paving, attenuation storage and rainwater harvesting. It may be possible to provide an overland flow route across the existing pavement surface. Alternatively storage of this water could be provided in Millennium Green.</p> <p>At Cedar Street, source control methods such as green roofs and permeable paving, storage ponds and swales could capture runoff draining north, or the runoff could be diverted towards the allotments to the east of the residential area</p>

Capabilities on project:
Water

SWRA	Key Messages
	and the tributary of Southburn Dene. Similar measures can be employed along West Drive.
DC1	<p>97 properties fall within the Environment Agency's Flood Map for Surface Water for the 200 year event. Average Annual Damages have been estimated at £108,000. Surface water tends to be the result of runoff from impermeable surfaces.</p> <p>Rothbury Road is a low point where surface water is likely to collect. Works could be undertaken at the nature reserve to increase its ability to hold water. If the ELR site between the nature reserve and Rothbury Road is re-developed, it is essential that steps are considered to be taken to limit runoff from the site through the provision of storage, infiltration, soakaways and potentially green roofs and rainwater harvesting. The public footpath presents opportunities for the creation of a swale to manage any overland flows.</p> <p>At Raby Road the preferred action would be to lower the parkland to provide additional storage capacity for the surface water to drain into. At Rochester Road storage of water in the road or provide an overland flow route to the open land to the east. At Canterbury Road, Lindifarme Road solutions would need to be retro-fitted. Open land is available for storage and road regrading and kerbing could be used to hold the water in the roads rather than properties. The same situation is found at Bek Road where storage in roads, kerbing, creating an overland flow path to a storage area are the preferable measures.</p>
DC8	<p>DC8 includes 57 known flood incidents within the Belmont, Carrville and Gilesgate areas, associated to inadequate surface water sewer network, highways drainage and blockages. Northumbrian Water is in the process of completing a flood alleviation scheme involving oversized pipes to provide additional storage in the Belmont and Gilesgate systems, and Durham County Council has created additional gullies and de-silting blocked highways drains.</p> <p>The area occupies high ground therefore the source of the surface water risk is rain falling across DC8 rather than flowing into the area from elsewhere. The transport corridors (A1, A690 and railway) prevent overland flow leaving the area. 585 properties fall within the Environment Agency's Flood Map for Surface Water for the 200 year event. Average Annual Damages have been estimated at £610,000.</p> <p>Topographic lows have been identified that form overland flow paths which could be formalised to channel flood water out of Devonshire Road and Damson Way and into the SHLAA site on Sherburn Grange which could provide storage. It is essential source control measures are considered if this site is developed on. If the surface water can be managed in situ, there are a number of small park areas or the industrial estate car park off Damson Way could provide storage. Alternatively the flat roofs at the industrial estate may present opportunities to retro-fit green roofs.</p>
BIS3	<p>296 properties fall within the Environment Agency's Flood Map for Surface Water for the 200 year event. Average Annual Damages have been estimated at £365,000.</p> <p>Surface water in the Coundon Grange area will be a result of rainfall running off Grange Hill to the north. The SHLAA sites on Grange Hill present opportunities in the form of ponds, wetlands, swales and rainwater harvesting but would not directly solve the problems at Coundon Grange. Swales or filter drains could be used above the residential area to intercept flows coming off the hill or channel overland flows into storage areas in the SHLAA sites.</p> <p>Brooklands is heavily urbanised therefore measures would likely be implemented through retro-fit schemes. The most preferable measure would be improving resilience and resistance or storage of water in the roads. Kerbing could be provided to contain and attenuate surface waters until the combined sewer system has capacity. Retro-fitting permeable pavements may provide some benefit and it may be possible to provide an overland flow route to the River Gaunless.</p> <p>The ELR site at Dovecot Hill, if developed, presents opportunities to implement source control measures such as green roofs and storage. It is essential source control measures are considered as there are no alternative options in</p>

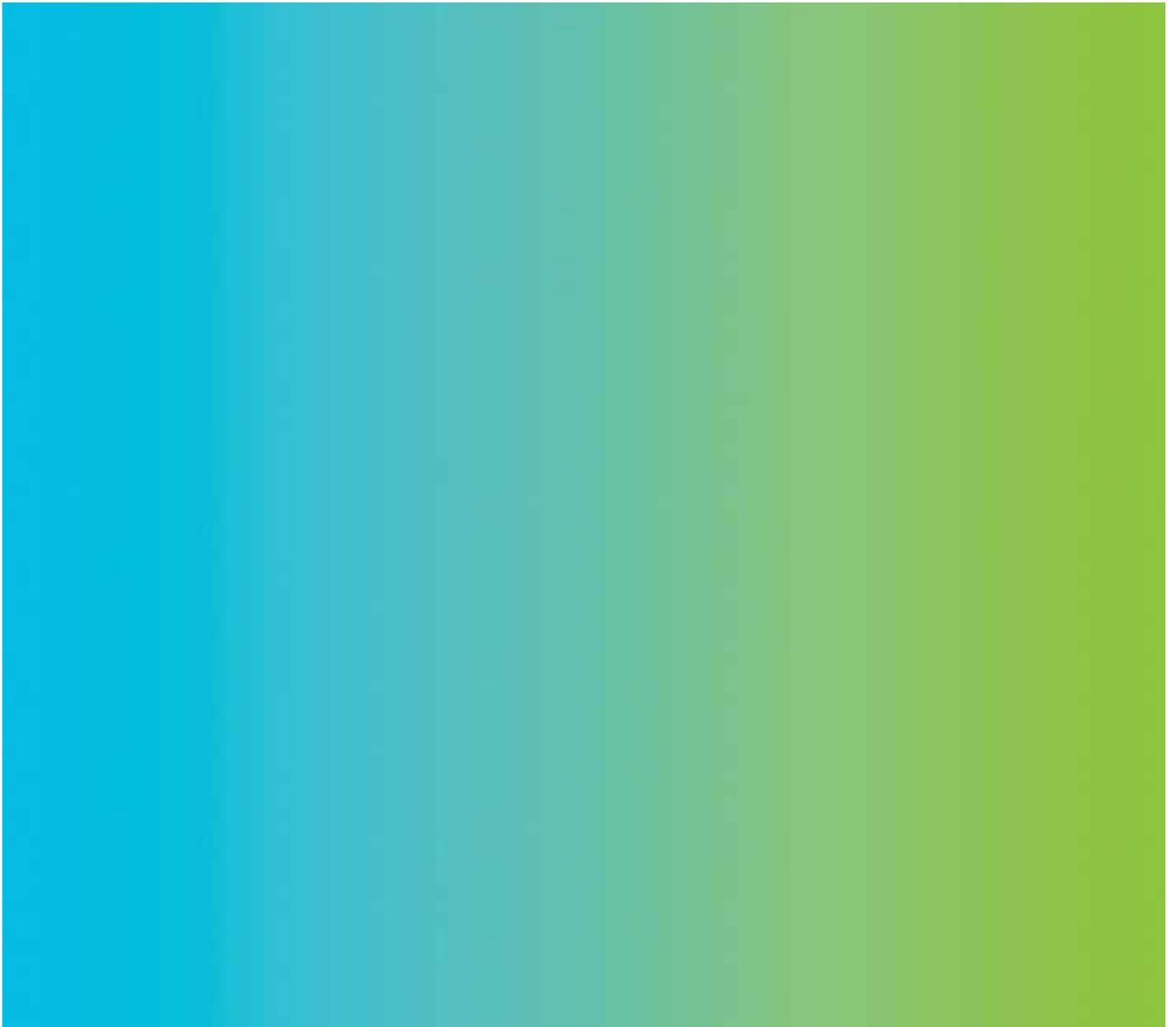
Capabilities on project:
Water

SWRA	Key Messages
	this area.
NEW1	<p>The Burnhill Way area is a hotspot for surface water. The playing fields immediately to the north of Burnhill Way could be used for storage. Alternatively, creating storage in the roads is an option to prevent surface water flooding to properties. Kerbing could be provided to contain and attenuate surface waters until the sewer system has capacity. Given the highly urbanised setting, storage in roads can be implemented for the area immediately south of Woodham Burn. There is open floodplain alongside Woodham Burn which can be used to provide storage, if the water can be transferred from the urban setting to the river setting. This would require the formal overland flow paths to be instated.</p> <p>The flat roof buildings on the industrial estate could retro-fit green roofs, however this is unlikely to be cost effective measure. It is essential that the ELR site, if developed, should implement source control measures wherever possible.</p>
CRO1	<p>560 properties fall within the Environment Agency's Flood Map for Surface Water for the 200 year event. Average Annual Damages have been estimated at £626,000.</p> <p>It is essential that the SHLAA site on Low and Middle Mown Meadows, if developed, should consider source control measures such as green roofs, storage basins and swales to provide benefits downstream. Similarly the SHLAA sites to the north of West Road also present opportunities to manage surface water runoff. This would likely require formal overland flow paths being created along the roads to facilitate drainage away from residential areas.</p> <p>South End Villas is at surface water risk and it is proposed that the open green space at South End Villas is landscaped so as to provide storage during extreme events to limit water affecting properties. Additional potential opportunities would be to provide upstream storage in the playing fields to the north.</p> <p>Due to a lack of open space at Whitfield Street, the only viable option would be to store water in the roads.</p>
RAIL3	<p>RAIL3 has experienced 26 known flood incidents the cause of which is a mix of highway issues, overland flow from local fields and overland flow after heavy rainfall from upland areas. Durham County Council engineers advised that Northumbrian Water has undertaken upsizing of the sewer system and removed Combined Sewer Overflows to alleviate the problems. The railway and the A689, B6278 and B6296 are at risk from flooding. 384 properties fall within the Environment Agency's Flood Map for Surface Water for the 200 year event. Average Annual Damages have been estimated at £368,000.</p> <p>If developed, it is essential that the SHLAA and ELR sites in St John's Chapel and Westgate should consider implementing source control measures such as storage areas, swales, green roofs to help manage the risks of surface water flooding. Alternatively, the development proposed for north of Hood Street (St John's Chapel) could be developed to accommodate a formal overland flow path on the western side or storage along the road near the caravan park. Removing a section of dismantled railway may reduce surface water ponding in the area. In Westgate there is the potential for storage along Front Street or formalising a flow path around the caravan park.</p> <p>If developed, it is essential the three SHLAA sites in Frosterley or the SHLAA site to the south of the railway consider implementing source control measures. Storage along Front Street is a possibility and a culvert may be required under the active railway to alleviate the surface water risk in the area.</p> <p>In Wolsingham it may be possible to channel overland flows from the risk area into SHLAA sites (storage). An alternative is to improve resilience and resistance or storage of water in roads along Leaze's Lane, High Street, The Causeway and Riverdale. Kerbing could be used to contain and attenuate surface waters in these areas until the combined sewer system has capacity. There is also the ability to provide storage between Leaze's Lane and the High Street to alleviate risk. There is an overland flow path running along the B6296. Two options would include</p>

Capabilities on project:
Water

SWRA	Key Messages
	<p>storage of water along the roadway until it feeds into the River Wear, or to utilise the SHLAA site to the east as storage in the form of a pond or wetland. The railway along Wolsingham is an active line and there is shallow flooding affecting the railway line. One measure could be the provision of a formal overland pathway in the form of a swale or filter drain to the River Wear.</p>

Next Steps



Capabilities on project:
Water

4 Next Steps

4.1 Funding for Surface Water Management

The Environment Agency has calculated that one million people are vulnerable to surface water flooding with a further 2.8 million properties susceptible to surface water flooding alone. Average flood damage costs are currently in the region of £1 billion per year, but these costs could rise to as much as £27 billion by 2080. At a time when the Government is calling for budget reductions, national government is unlikely to be a primary source of funding for measures by which the risk of surface water flooding can be managed. Given the national spending constraints, and due to the large and growing flood management problem, it is likely that local sources of funding will become increasingly important. The Pitt Review said that those that will benefit from flood defence might wish to contribute to costs: *“The Review does not believe that it is unreasonable, therefore, for funding to come from sources other than Government, such as a local authorities, business, environmental organisations or local community groups”*.

The following section provides a discussion of potential means by which measures identified in the SWMP could be funded.

4.1.1 Local Authorities

Currently, local authorities receive an allocation from central government through the Revenue Support Grant, but this is not ring-fenced and does not have to be spent on flood risk. Alternatively, local authorities can use their own funds to tackle flood risk, choosing to follow the example of Gloucestershire County Council in raising additional council tax specifically to manage flood risk.

Sources of local funding could include:

- Local authority spending (either from the revenue support grant or through a council tax levy);
- Voluntary contributions from local businesses or individuals; and,
- Community funding (such as through Business Improvement Districts or the Private Streetworks code)

Local authorities can apply for grant for capital investment from the Environment Agency to create new or improved flood risk and coastal erosion management infrastructure.

Revenue and non-grant eligible expenditure by local authorities is supported by formula grant from Communities and Local Government (CLG), but it is not ringfenced for flood and coastal risk management. Individual authorities can decide how much to spend, subject to limits on overall budgets and the need for investment on other priorities.

Additional income can also be secured through the planning system and from contributions secured from major beneficiaries.

Local authorities and communities already have a range of options available to them to help pay for local schemes that do not meet national priorities but nevertheless deliver significant benefits to local communities. Such local funding mechanisms could range from the use of existing local authority prudential borrowing and wellbeing powers, the business improvement district (BID) model or even increases in council tax precepts, where these are affordable and in the best interest of local communities.

Other, new and alternative, funding sources are available from a range of organisations and beneficiaries. These include:

- Section 106 agreements (s106), local tariffs, supplementary planning documents and any future community infrastructure levy (CIL), subject to its introduction
- Local business rates including 'business rate supplements' and council taxes including specific precepts and 'special expenses', plus fees and charges, where appropriate and affordable
- Local activities that can achieve flooding and coastal erosion benefits as a secondary outcome to their primary purpose of securing community benefit and facilitating economic growth and sustainability. These activities would include those associated with the local environment, land management, highways management, community infrastructure management, recreation, tourism, wealth creation and regeneration plans.

Capabilities on project:
Water

4.1.2 *Alternative Funding Sources – Business*

In Hereford; the supermarket chain Asda contributed £2m as part of the planning conditions for a supermarket in the town, in addition to constructing 440m of flood defences. The total cost of the scheme was £7.5m and it provides protection to 196 properties including 25 listed buildings.

The Leeds City Flood Alleviation project will increase the level of protection to Leeds City centre but makes a relatively low contribution to reducing flood risk for households. However, the proposed project is likely to enable significant economic and financial benefits for the local and regional business, commercial and development/regeneration sectors. The Environment Agency considers that these benefits are sufficient to justify a contribution of at least £50m towards the £178m scheme's total cost. Discussions, consultations and negotiations are on-going between the Environment Agency and the City Council on how this value of contribution can be realised to secure the proposed benefits to the city.

4.1.3 *Alternative Funding Sources – Community Self Help*

The Hanneys Flood Group

Source: <http://www.thehanneysfloodgroup.org.uk/>

The villages of East and West Hanney, Oxfordshire were affected by flooding during 2007. Many residents felt that despite the unusual weather actions could have been taken to reduce the consequences of such flood events. The Hanneys Flood Group was set up to improve the ability of the community to accommodate similar events in the future. The Hanneys Flood Group consists of volunteers working for the benefit of the community and has members from the East Hanney and West Hanney Parish Council and Oxfordshire County Council and works closely with the Environment Agency, Oxfordshire Highways, Local Landowners, Vale of White horse District Council Emergency Response Officer and the Vale of White Horse District Council Land Drainage Engineer.

Volunteers cleared weeds from a local brook, increasing the brook's capacity, and also constructed a flood defence bank and footpath. The Environment Agency provided soil, the hire of two mini-excavators and two dump trucks. The local authority paid for coir rolls used to help stabilise the new bank.

Bucklebury Flood Alleviation Scheme

Source: www.floodalleviation.co.uk

A community-led partnership formed by Bucklebury residents, the Environment Agency and West Berkshire Council is the driving force behind a flood alleviation scheme for the village of Bucklebury, Berkshire. The villagers set up a Community Interest Company (CIC) after the floods of 2007, and took an active part in looking into how future flooding could be prevented.

Funded by the Regional Flood Defence Committee with contributions from the villagers and West Berkshire Council, the scheme will protect 25 homes and the village hall from future flooding. The overall cost of the scheme is £600,000; of which £65,000 had been raised from residents alone, while grants from West Berkshire Council, Bucklebury Parish Council and the Thames Regional Flood Defence Committee would make up a further £550,000 towards the alleviation works. The flood alleviation scheme includes building flood bunds, digging a bypass channel and developing a new ford to divert flood flows around the village. It also includes works to ensure the flood risk is not increased downstream in Stanford Dingley. The CIC approached the Environment Agency and West Berkshire Council to discuss various strategies, and just over three years later, a new flood alleviation scheme was proposed for the village.

Appleby

Source: <http://www.edenvalleymessenger.com/news/2009/november/appleby-flood-prevention-scheme-hailed-success>

This scheme (and another in Sandside, South Lakeland) was jointly conceived and administrated by the Environment Agency and Eden District Council (South Lakeland District Council for Sandside). It formed part of the national Defra £500,000 Pilot

Capabilities on project:
Water

Flood Resilience project where local authorities and the Environment Agency were encouraged to work together in different ways to promote a resilience scheme. £90,000 and £80,000 of grant money was received by Eden and South Lakeland Councils respectively, directly from Defra. This arrangement meant that the Councils could use their grant distribution powers to fund individual property protection schemes.

The average amount of grant issued to the 46 properties that took part was approximately £1,300. The property owners were expected to fund any work in excess of the grant available for their particular property.

Approximately 26 of the properties that took part in the Appleby scheme benefited from their defences in the November 2009 flooding. They would have flooded if their resilience scheme funded defences had not been in place.

Bawdsey

Source: <http://www.suffolkcoastal.gov.uk/news/thorpeness0211.htm>

In 1997 a major storm led to the already vulnerable coastline at East Lane, Bawdsey in Suffolk to erode severely. This retreating coastline posed an immediate threat to three coastal properties, including a Grade I listed Martello Tower. Due to insufficient priority, Suffolk Coastal District Council struggled to justify grant aid to fund a complete scheme at East Lane. This led to a series of emergency works along the District Council and Environment Agency frontages to limit the damage caused primarily from winter storms.

In 2007 a group of local landowners and residents formed East Lane Trust, a “not-for-profit” charitable organisation to raise £2.2m to implement a coastal protection and flood defence scheme for the 250m section of coast. The money was raised by selling plots of land in nearby villages. In 2007, the government granted special permission to allow 26 homes to be built on the plots which were not in the Local Plan as being available for residential development. The money raised was given to the District Council to commission a sustainable coast protection scheme which was completed in summer 2009. It is thought to be the first privately funded coastal protection scheme since the enactment of the Coast Protection Act in 1949. The scheme highlights that, through effective co-operation between local communities and the responsible authorities, common goals can be achieved.

4.2 Requirements of the Flood & Water Management Act

The following describes two requirements of the Flood & Water Management Act that have been incorporated into the Action Plan.

4.2.1 Data Asset Register

The Flood and Water Management Act 2010, states that all Lead Local Flood Authorities must establish and maintain:

- a register of structures or features which, in the opinion of the authority, are likely to have a significant effect on flood risk in its area, and
- a record of information about each of those structures or features, including information about ownership and state of repair.

At this time it is not known what level of detail, or content, is required for an Asset Register since there is no guidance as to what constitutes a register and what needs to be included.

As part of the SWMP data collection exercise it is apparent that Durham County Council has several datasets that could form the basis of an Asset Register although there are many areas where information concerning drainage is missing. It is expected that a great deal of relevant information is held within the Council and the experience of its staff that has not been formally documented.

Durham County Council have started production of an Asset Register and it has been suggested that it starts with the available data and initially seeks to expand it based on internal input whilst working towards gathering additional information from third parties before finally investing in going out to collect key data-sets relating to specific flood problems where these are not already known.

Capabilities on project:
Water

Durham County Council has already provided spreadsheets detailing culverts, bridges and other structures for County Durham. The culvert spreadsheet details 59 culverts and contains information on the culvert size, date built and name. The culvert spreadsheet also contains co-ordinates allowing the data to be plotted in GIS. The disadvantage is that it is a single co-ordinate, presumably for the culvert entrance/exit, therefore in the case of long culverts the exact route of the culvert is not known, although in many cases this will be easily plotted based on local engineering knowledge. The bridge dataset contains the bridge name, area and material; however no co-ordinates have been provided and therefore they cannot be plotted in GIS at present. Again for someone familiar with the dataset it would be a relatively quick exercise to spatially plot these bridges in GIS.

Whilst these are two extremely valuable datasets crucially they do not contain any information concerning the risk that the structure poses in terms of flood risk, the ownership and state of repair which is required as part of the Flood and Water Management Act.

Durham County Council have provided a gully dataset, however the data does not contain areas of known blockages, maintenance issues or works undertaken or required that would be useful for the SWMP. Metadata would be useful so as to understand what the information is showing, e.g. the IIT_DESCRI and IIT_X_SECT columns contain quantitative information that could be thematically mapped. However what the information represents is not clear and therefore cannot be accurately assessed.

Sewer asset data has presently not been supplied by Northumbrian Water. As a result no analysis of the data can be undertaken, or included as part of an Asset Register. It would be recommended that the sewer data be in a format compatible with GIS, and contain information regarding capacity issues or known drainage incidents so that the information can be analysed with the priorities in this Scoping Report.

4.2.2 Investigate Flood Incidents

The Flood and Water Management Act also states that Lead Local Flood Authorities will; investigate flooding incidents in its area (where appropriate or necessary) to identify which authorities have relevant flood risk management functions and what they have done or intend to do. The Lead Local Flood Authority will then be required to publish the results of any investigation, and notify any relevant authorities.

In order to do so, Durham County Council, in its capacity as Lead Local Flood Authority, will initially need to be made aware of any reported flood incidents. Flooding could be reported to Durham County Council by members of the public, private organisations, the Environment Agency or Northumbrian Water. As such it would be appropriate for the County Council to maintain a register of flood incidents. It would also be practical for this to be integrated with the Asset Register so that assets responsible for flooding could be linked to the events.

In many instances, the flooding will not fall under the jurisdiction of the Environment Agency or Northumbrian Water therefore it will fall to Durham County Council to investigate the matter. In such circumstances a quick response will be essential to ensure that details of the flood extent are accurately recorded (through site photographs and survey if appropriate) and eye witness accounts are documented before the passage of time has the effect of over- or under-exaggerating the events. Table 4.1 provides an example of how the information could be recorded.

Capabilities on project:
Water

Table 4.1: Example of a Flood Incident Template

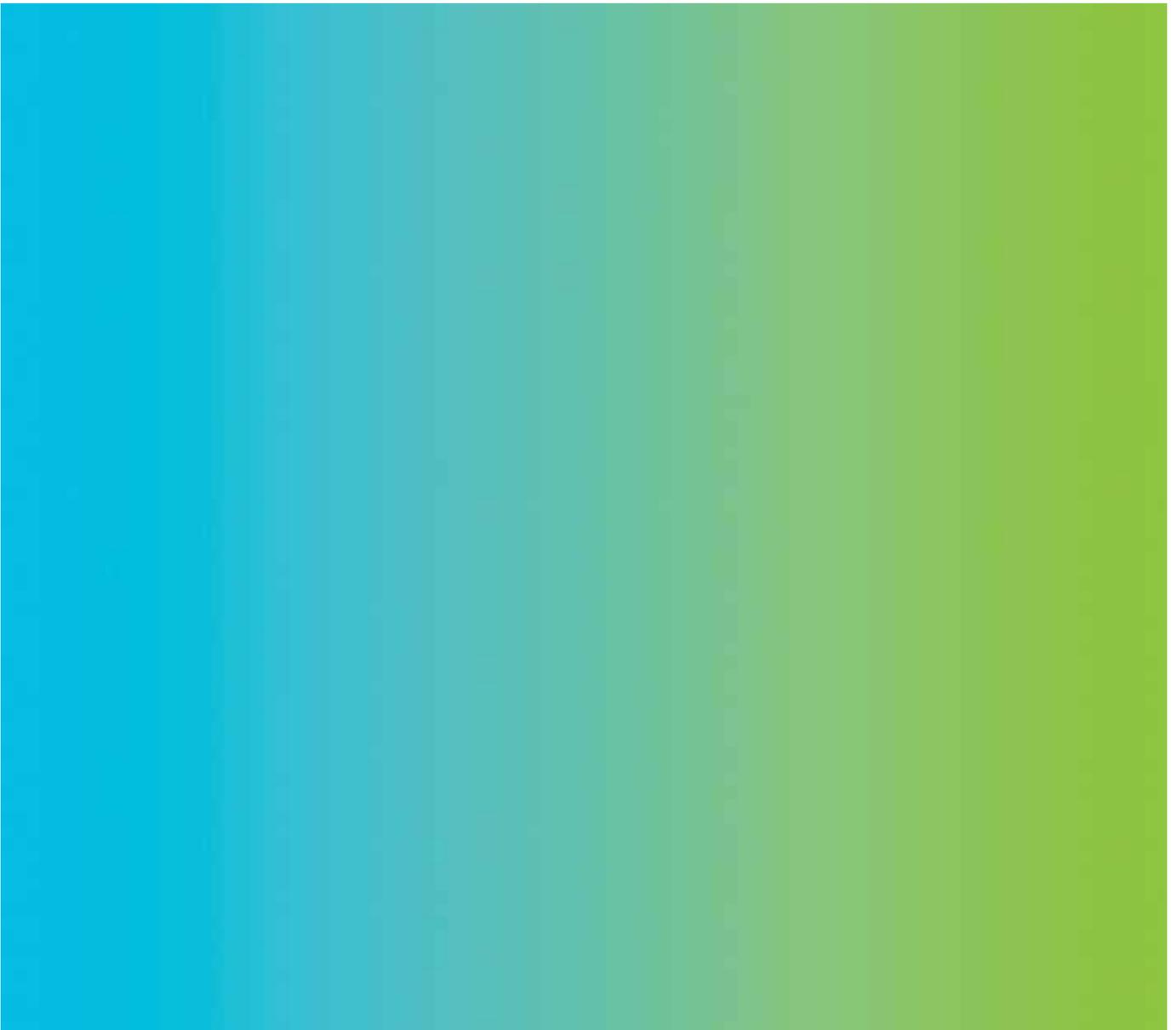
Event ID <i>Unique Ref</i>	Location <i>General</i>	Date	Extent <i>Specific description of the area affected</i>	Cause <i>Drop down menu of causal mechanisms</i>	Total no. of properties affected	Description <i>Additional Information</i>	Previous Events (Date)	Previous Works	X	Y	Risk Band <i>Red Amber Green</i>	Photo	
001	Crook	May 2011	Heather Lane and Metalink Factory affected	Surface Water Artificial Drainage Canal Highways Sewer Groundwater Other Unknown	25	Sandbagging used to protect properties	June 2007	None			Easting & Northing for entry into GIS	Define level of risk	Photo ID or Hyper-link

Note: Information does not reflect an actual flood event

In addition to details of the flooding itself it is extremely valuable to have information concerning the causative mechanisms of flooding. Rain data can easily be obtained from the Environment Agency, or potentially Northumbrian Water, and details of the rainfall causing the flooding analysed. It is a quick procedure to use the Flood Estimation Handbook CD-ROM to estimate the rarity, or probability, of a rainfall event, which can subsequently be used to evaluate whether or not the local drainage systems could be expected to accommodate the event without flooding occurring. The proximity of a rain gauge to the flood event may influence the reliability of the rarity calculated.

Durham County Council should establish a county-wide reporting procedure using a standard template. Data from each flooding incident should be recorded and passed, to a central record system administered by Durham County Council. All Partners will need to be involved in these arrangements, so as to ensure that the flooding information is both comprehensive and suitable for supporting county-wide judgements such as the identification of priority in any flood risk reduction schemes to be implemented.

Summary



Capabilities on project:
Water

5 Summary

The SWMP is a high level, strategic document which serves as a starting point for the Partners to address surface water flood risk across County Durham and contribute robust evidence to support the Core Strategy. A holistic approach has been undertaken to address the surface water flood risk to existing and proposed development, assessing surface water flooding from sewers, drains, groundwater, and runoff from land and small watercourses that occur as a direct result of heavy rainfall.

The objectives of this SWMP are:

1. Guide limited resources to critical drainage areas of greatest need (*existing development*),
2. Ensure the level of *future development* does not exacerbate existing problems and identify opportunities for new development to provide benefits in terms of flood risk management,
3. Inform *emergency planning* and feed into Durham County Council's Flood Plan and
4. Protect and improve *water quality* in accordance with the objectives of the WFD.

'Guide limited resources to critical drainage areas of greatest need (*existing development*)' and 'Ensure the level of *future development* does not exacerbate existing problems and identify opportunities for new development to provide benefits in terms of flood risk management'

The Risk Assessment identified 139 SWRAs across the County, and prioritised the risk. As part of the Options phase, nine SWRAs were deemed the areas of greatest need, with measures identified by which the surface water risk can be mitigated, and analysed in terms of their suitability and practicality. Actions Plans have been developed by which the Partners can work together to manage the risks broadly on a county-wide basis and within the nine SWRAs.

Inform *emergency planning* and feed into Durham County Council's Flood Plan

The findings of this Risk Assessment should be disseminated within each of the Partner organisations to inform and update (multi-agency) flood plans / severe weather plans and Local Resilience Forum community risk registers. This might include information on high flood risk areas, roads and access routes likely to be impassable, impacts on critical infrastructure or vulnerable people.

Protect and improve *water quality* in accordance with the objectives of the WFD

The SWMP is an opportunity to bring about co-ordinated improvements in water quality and has been considered as an integral part of this study. An overview of the strategic water environment in County Durham has been detailed so as to be able to understand the current water quality status and the role that the SWMP could potentially play to work towards achieving the WFD targets.

5.1 Surface Water Risk

Surface water poses a widespread risk across County Durham, concentrated in the urban areas to the east of the County. There are a number of known incidents which correlate well with the modelled Flood Map for Surface Water and Areas Susceptible to Surface Water Flooding. In some instances, associations have been set up by local communities in response to flooding.

Maintenance of man-made and natural drainage systems is critical to mitigating the surface water risk as many known incidents are due to inadequate maintenance.

5.2 Options

Preferred options have been identified for each SWRA, Table 5.1. Source control measures go hand-in-hand with planning polices and development control measures; please refer to C.4 of Appendix C for the shortlisted measures for each SWRA.

Capabilities on project:
Water

Table 5.1: Preferred Option

SWRA	Preferred Option
STA3	Green Roofs Soakaways/Infiltration Planning Policies / Development Control
CLS2	Planning Policies / Development Control Improve Resilience and Resistance
CLS3	Planning Policies / Development Control
DC1	Planning Policies / Development Control
DC8	Planning Policies / Development Control
BIS3	Attenuation Storage Swales/Filter Drain Planning Policies / Development Control
NEW1	Flow/Storage on Roadway Improve Floodplain Storage Planning Policies / Development Control Improve Resilience and Resistance
CRO1	Planning Policies / Development Control
RAIL3	Planning Policies / Development Control

Development presents the best opportunities to manage the risk of surface water flooding. For the development sites that come forward to the planning process, Durham County Council should encourage developers to not only address surface water runoff from their site, typically by implementing source control measures, but to realise the potential benefits that can be achieved for the wider area. These measures can be implemented through planning policies and development control. If development sites, situated in areas with a high risk of surface water flooding, are unlikely to come forward in the planning process, the Partners ought to consider using the sites themselves to provide surface water management, water quality benefits and green infrastructure opportunities, for example through the creation of wetlands. Where development sites do not offer opportunities to manage the surface water risk, Partners will need to take action themselves to manage the risk, such as retro-fit schemes. The Partners can also encourage and support individuals / communities to take action themselves.

Northumbrian Water wishes to limit the volume of surface water entering combined sewer systems. Re-development that manages surface water on site will increase the capacity of the combined sewer networks thereby limiting the risk of sewers surcharging and causing flooding.

5.3 Actions

An Action Plan has been produced at a county-wide scale and for each SWRA (Appendix D). The actions from the SWMP should be implemented by the Partners to manage surface water flooding, inform emergency planning, control drainage, review LDF land allocations, and develop investment programmes, at the same time as satisfying the requirements of the Flood and Water Management Act and contributing to the evidence base supporting the Durham Plan.

The SWMP is a 'living' document and it is vital the Partners to continue to work together after the completion of the SWMP to discuss the implementation of the proposed actions and to discuss progress of any further work or follow up actions which were identified in the preparation of the plans. Durham County Council should review the plans on a regular basis, but there are

Capabilities on project:
Water

circumstances which might trigger a review and/or an update sooner. These may include the occurrence of a flood incident or additional data becoming available, which may alter the understanding of risk within the study area or the outcome of investment decisions by Partners that is different to the preferred option, which may require a revision to the Action Plan.